MAY 2025

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# A New National Purpose: Biosecurity as the Foundation for Growth and Global Leadership

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***A New National Purpose: Biosecurity as the Foundation for Growth and Global Leadership* is a joint report by Tony Blair and William Hague.**

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# Foreword

The world is currently undergoing the fastest technological and scientific revolution in human history, creating new opportunities to grow our economy and reform our public services, as well as new challenges for security and technological sovereignty. That is why the two of us have argued consistently since 2023, through a series of joint policy papers, that responding to this new revolution in technology must become our country's New National Purpose.

The benefits and dangers of this new age of accelerating innovation are exemplified by the world's response to the Covid pandemic five years ago. We saw the opportunities of innovation through the rapid development and deployment of effective therapeutics, including the Oxford-AstraZeneca vaccine which saved 6 million lives in its first year of rollout. Through vaccine nationalism and unreliable supply chains, we also saw the risks of depending too much on the capabilities of other countries – even those of our closest allies.

All of us hope that Covid-19 was the kind of once-in-a-century event that none of us will have to live through again. Yet accelerating trends in deforestation, population growth and farming make the natural emergence of new viruses more likely, while advances in artificial intelligence could enable the proliferation of biological weapons.

In this new age of profound geopolitical uncertainty, we need to take steps to protect the UK from the threat of engineered attacks from potentially hostile states. Russia, Iran and North Korea all have either a proven or alleged interest in biological weapons and could feasibly use biology as the new warfare.

Advances in technology can help us mitigate these risks. New vaccine technologies can help us treat emerging diseases faster, as we saw during Covid. Gene editing can help breed farm animals that are more resilient to viruses and prevent the spread of dangerous pathogens to humans. Progress in metagenomic sequencing and surveillance can enable us to spot viruses early, giving us more time to limit their spread. Microbial forensics can help us distinguish engineered viruses from naturally occurring ones, helping deter hostile states from developing and deploying bioweapons against us.

Harnessing such innovations here in the UK to protect ourselves, our allies and the wider international community from biological threats must become a central aspect of our country's efforts on science and technology. To their credit, both parties recognise the importance of this endeavour, with Rishi Sunak's administration publishing an important Biological Security Strategy in 2023 and Sir Keir Starmer's government stepping up its delivery over recent months.

While this strategy has the right ambitions, its delivery must be urgently accelerated and complemented by action in other areas. In an age of renewed geopolitical competition, tariffs and export controls, much more will need to be done to ensure Britain has the sovereign capabilities it needs to detect, respond to and withstand future biosecurity threats.

Ministers must urgently invest in new wastewater-surveillance systems to monitor for new pathogens emerging at UK airports, introduce robust safeguards around DNA synthesis and secure the lab infrastructure necessary to respond quickly to new threats. The government can also go further on international cooperation by working to enhance the coordination of Europe's biosecurity through NATO and engaging with the United States to ensure its withdrawal from the World Health Organization does not damage information sharing on emerging pathogens.

The prime minister has shown with the drive he is bringing to the delivery of the AI Opportunities Action Plan that he recognises the importance of securing British leadership in science and technology. By bringing the same zeal to the task of improving Britain's biosecurity, he can realise the growth

opportunities that emerging biosecurity technologies afford our life-sciences sector, and ensure that when faced with the next pandemic, we are less likely to need lockdowns to curb the spread of pathogens.

Five years ago, our country was caught unprepared by the Covid pandemic. It would be a tragedy if in so short a time span we forgot the lessons of that unfortunate period, and failed to do enough to ensure we are sufficiently prepared for the next one. Biosecurity is now an essential aspect of national security and growth.

**Tony Blair and William Hague**

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# Executive Summary

The United Kingdom is entering a new era where biosecurity is not just a matter of public health – it is central to economic growth, technological leadership and national security. Five years ago the world was turned upside down by the emergence of Covid-19 in China. Since then the risks have not diminished; they are intensifying. Pandemics that severely impact life in the UK will no longer be rare, once-in-a-century events. The root causes of the emergence of natural pandemic-capable pathogens – deforestation, population growth, global travel, wildlife consumption and growing livestock numbers – are all increasing, raising the prospect of more regular and severe pandemics. For example, experts are warning that the rapid spread and mutation of H5N1, a deadly bird-flu virus, within the United States warrants urgent global action to prepare for another pandemic.[1]

At the same time, rapid developments in engineering biology and technological diffusion risk making it much easier for hostile states and terrorists to create bioweapons at scale. These could range from engineered viruses that could cause another pandemic to new weaponised toxins (poisonous substances such as ricin produced by living organisms). At the same time, new artificial-intelligence-enabled biological tools such as those facilitating protein design could make engineered viruses more deadly or transmissible, raising the ceiling of harm.

Despite these growing risks and the lessons from the last pandemic, the UK has not yet established the comprehensive response needed to meet the scale of the threat. While the UK's 2023 Biological Security Strategy is world-leading, its implementation in the first year was slower than anticipated, and the new government is now seeking to get its delivery back on track. Furthermore, some departments' work on biosecurity has to date largely focused on chronic risks. Without a renewed effort on preparedness for acute risks such as a severe pandemic or engineered threats, the country risks being caught unprepared, just as it was at the start of 2020.

Biosecurity is also an essential aspect of national security. This is a new age of profound geopolitical uncertainty. Russia, Iran and North Korea – all of whom have either a proven or alleged interest in biological weapons – are increasingly testing the West's red lines through hybrid-warfare attacks in domains such as cyber. Just as the UK and Europe are now seeking to secure sovereign defence capabilities, so too must they develop sovereign biosecurity capabilities to deter attacks and ensure an effective response to threats.

At the same time, President Donald Trump is creating new challenges and opportunities with regards to biosecurity. Some of the Trump administration's recent decisions – such as the withdrawal of the United States from the World Health Organization (WHO) and its pathogen-sample-sharing networks, and changes at the US Centers for Disease Control and Prevention (CDC),[2] – are creating complexities. However, President Trump's concern about engineered viruses[3] and his new executive order on ending federal gain-of-function research and encouraging DNA synthesis screening[4] also offer potential for greater US-UK cooperation on biosecurity.

Taking urgent action to address these growing risks is not only the government's responsibility; it is also an economic opportunity. Many of the emerging technologies required for keeping Britain secure from bio risks have significant potential for economic growth, from metagenomic sequencing to gene-editing. The metagenomic surveillance required for rapid pathogen-detection capabilities can drive efficiencies in the NHS.

To mitigate growing biosecurity risks and seize opportunities for growth, the government needs to reorganise Whitehall's structures and accelerate the delivery of its Biological Security Strategy; prevent the next biosecurity threat by tackling the root causes of natural pandemics and fostering responsible innovation within bioengineering; cultivate pandemic resilience in the UK's pharmaceutical industry and wider society; and develop pathogen-surveillance capabilities at scale.

# Key Recommendations

**STRATEGY**

Ministers should reorganise Whitehall to drive a centralised approach to biosecurity focused on acute risks, across all relevant departments, including by:

- **Appointing a Biosecurity Taskforce**, a small team of biotechnology experts from industry, within the Cabinet Office, led by a national biosecurity advisor.

**PREVENTION**

Ministers should aim to address the root causes of natural pandemics, and leverage non-proliferation guardrails and deterrence to block the development of bioweapons by hostile actors by:

- **Bringing forward secondary legislation to enable gene-editing in animals** as a matter of urgency.
- **Creating a new Precision-Bred Livestock-Resilience Challenge Fund** to fund research programmes into reducing the risks of zoonotic-disease spillovers from livestock.
- **Strengthening deterrence against biological weapons** through a new DIANA challenge and a NATO Innovation Fund (NIF) programme focused on biosecurity to invest in microbial forensic techniques; and working with Western allies to agree a broad outline of coordinated measures to respond to different bioweapon-release scenarios, with the threat of collective response acting as a NATO-style “Article 5 for Biosecurity” deterrent.
- **Deterring Russian biological attacks on post-war Ukraine by** deploying NATO’s Combined Joint Chemical, Biological, Radiological and Nuclear (CBRN) Defence Task Force to train Ukrainians, and exploring the expansion of the SIGMA+ sensor trial to include post-war Ukraine.

- **Introducing strong domestic safeguards for DNA synthesis**, including making it a legal requirement that all UK-based research and commercial activity procuring synthesised DNA use synthesis firms that have their orders screened for suspicious activity.

**RESILIENCE**

Atrophying lab capacity and insufficient biosecurity R&D risk leaving the UK without the resilience required to respond effectively to the next pandemic. Ministers should address these issues by:

- **Establishing a Biosecurity Research, Innovation and Ventures Accelerator (BRIVA)**, modelled on existing initiatives such as BARDA DRIVe and HERA Invest, to fund biosecurity R&D and accelerate the development of medical countermeasures.
- **Creating a series of lab hotels – modular production facilities** that are kept warm through regular manufacturing but can pivot and scale to respond to an emerging threat.

**SURVEILLANCE**

Identifying the next pandemic early will require broader, pathogen-agnostic detection capabilities, as well as greater international cooperation over data-sharing. Ministers can deliver this by:

- **Establishing metagenomic surveillance at airports and seaports**, using wastewater sampling to detect pathogens early and strengthen outbreak response. The programme could be piloted at three airports, costing around £6 million per annum and providing 30,000 samples each year.
- **Piloting a National Health Forecast system**, using wastewater samples from sewers across the country to provide near-real-time infectious-disease tracking.
- **Pushing for a NATO-wide pathogen-agnostic surveillance programme**, modelled on the US's CDC Traveler-based Genomic Surveillance (TGS) programme, and partnering with allies at greater risk of bioterrorism, such as South Korea and Israel, to improve their surveillance capabilities.

- **Launching a rapid review of the impacts of the US suspending the sharing of samples and data relating to pathogens of pandemic potential** with the WHO, and immediately seeking a priority bilateral agreement with the US to facilitate sample-sharing relating to influenza viruses with pandemic potential.
- **Partnering with leading wearable health-tech companies to pilot AI-driven infection detection**, integrating biometric data into early-warning systems for rapid testing and response.

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# Introduction

The world is entering an era where biosecurity is no longer just a defensive necessity – it is critical for economic growth, investment and national security. Advances in biotechnology, artificial intelligence and precision medicine are shaping the industries of the future, and the UK has a unique opportunity to lead. As highlighted in a recent report by the Tony Blair Institute for Global Change (TBI), *A New National Purpose: Leading the Biotech Revolution*, breakthroughs in synthetic biology, AI-driven drug discovery and genomic medicine could unlock trillions in global value over the next decade.

Past failures have shown the price of inaction. Covid-19 cost the UK at least £310 billion, exposed deep vulnerabilities in health care, supply chains and pandemic preparedness, and underlined that prevention is far cheaper and less damaging than crisis management.[5] The impact was not just financial – it weakened public services, disrupted industries and stalled economic progress.

As the WHO has noted, many countries adopt a cycle of panic and neglect on biosecurity, "throwing money and resources at the problem when a serious outbreak occurs, then neglecting to fund preparedness when the news headlines move on".[6] Without a proactive biosecurity strategy, the UK risks repeating these mistakes, falling behind in global competitiveness and leaving itself unprepared for future threats. Given that Covid-19 itself was a relatively mild pandemic compared to historic examples such as Spanish influenza or the Black Death, and given the new risk of engineered viruses, the UK must take preparedness far more seriously.

With world-class biotech institutions, a thriving life-sciences sector and access to unparalleled NHS health data, Britain has all the ingredients to become a global hub for biosecurity-driven innovation. To seize this opportunity, biosecurity must not be a reactive measure but an active enabler of economic growth, fostering technological leadership, commercial investment and long-term global influence. With much of the progress in

biotech being driven by the private sector, maintaining an attractive investment ecosystem through the country's R&D tax reliefs and British Patient Capital's Life Sciences Investment Programme will be key.

A strong biosecurity strategy is a direct economic driver, accelerating growth in biotech, life sciences and AI-powered diagnostics – some of the fastest-growing industries of the next decade. The global biopharmaceuticals market is expected to grow from $397 billion to $655 billion by 2030, while the precision-medicine subsector is forecast to more than double in value from $91 billion to $208 billion by 2032.[7] Given that the UK is home to leading pharmaceutical companies, including GSK and AstraZeneca, it is well-placed to benefit from global growth in this sector.

Metagenomic sequencing, an emerging technology that underpins pathogen surveillance and human-genome research, is projected to grow fivefold – from $3 billion in 2024 to $15 billion by 2033 – as it becomes increasingly commercially sustainable and widespread in its use.[8] Home to world-class firms like Oxford Nanopore Technologies, the UK has contributed the second-largest volume of Covid-19 sequences to the Global Initiative on Sharing All Influenza Data (GISAID) after the US, making biosecurity-linked genomics a major driver of exports and investment.[9]

FIGURE 1

# Number of viral genome sequences from human cases of Covid-19 shared with GISAID: top ten countries

| Top 10 countries | Sequences shared | Proportion of world total |
|---|---|---|
| United States | 5,187,154 | 31% |
| United Kingdom | 3,055,738 | 18% |
| Germany | 951,290 | 6% |
| Japan | 689,733 | 4% |
| France | 680,347 | 4% |
| Denmark | 678,773 | 4% |
| Canada | 666,594 | 4% |
| Spain | 294,396 | 2% |
| Sweden | 284,837 | 2% |
| India | 280,590 | 2% |
| **World** | **16,843,380** | **100%** |

Source: GISAID

Agriculture is another sector in which biotech can drive innovation, boost productivity and enhance food security. Endemic livestock diseases cost UK farmers between £290 million and £710 million annually;[10] losses that the widespread introduction of gene-edited, disease-resistant livestock could significantly reduce.[11] The UK ranks behind only China and the US in producing highly cited agricultural-science research, and is home to world-leading specialists such as the Roslin Institute, Rothamsted Research and Genus plc, positioning it to lead in next-generation agricultural biotech.[12] Investing in biotechnology protects supply chains, stabilises food prices and ensures a more resilient farming sector.

A modern biosecurity strategy makes public services more efficient and cost-effective and better-prepared for future challenges. Metagenomic sequencing will allow faster identification of the pathogens underpinning infectious disease, which could save lives while easing pressure on hospitals.[13] Beyond hospitals, real-time wastewater surveillance is starting to provide early-warning systems for disease outbreaks, allowing faster interventions that prevent local outbreaks from escalating into national crises. These technologies help allocate resources more effectively, protect public health and reduce long-term costs.

Biosecurity is not just about health and economic resilience – it is a core component of national security. Advances in dual-use bioengineering – where advances in the field have both civilian and potential military applications – are blurring the lines between defence, technology and global stability. The ability to rapidly detect, assess and neutralise biological threats – whether from pandemics, bioterrorism, or hostile state actors – will define Britain's role within NATO and its standing as a global-security leader.

The geopolitical landscape is shifting, presenting a moment for realignment. With the US withdrawing from the WHO and other key global health efforts, there is an emerging vacuum in global biosecurity governance. The UK must step up and shape new bilateral and multilateral frameworks for pandemic prevention, pathogen surveillance and health-data-sharing. Failing to act will inevitably mean ceding influence to other powers, including China, which is rapidly advancing its biotech and biosecurity infrastructure.

As the US looks to Europe to strengthen its own defence capabilities, Britain must position itself as a biosecurity leader within NATO, reinforcing its global standing while securing investment in next-generation health-security infrastructure. Leadership in biomanufacturing, genetic screening and early-warning systems will set the standards for global health security and economic resilience.

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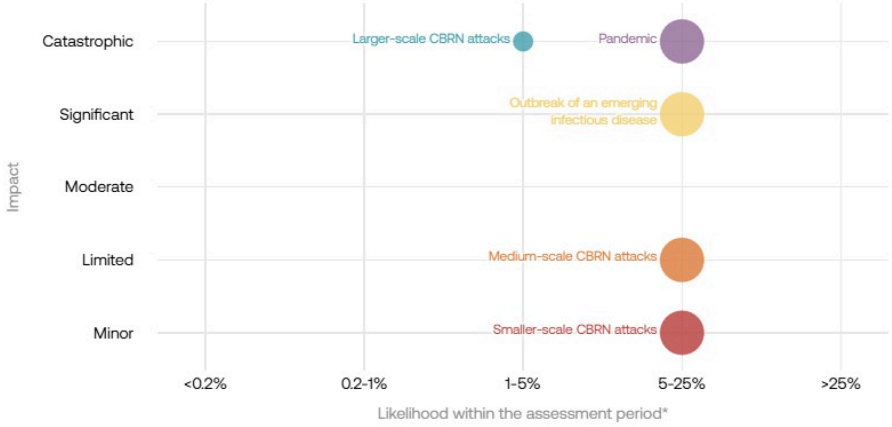
# Addressing Threats to Unlock Opportunities

Realising the opportunities of biosecurity requires addressing the acute risks that could destabilise them. The UK faces two primary challenges: increasingly frequent zoonotic spillovers, which increase the likelihood of severe pandemics, and the growing risk of engineered biological threats, where advances in biotechnology could be misused by hostile states or terrorist groups. The latest National Risk Register from the government puts the likelihood of a "catastrophic" pandemic emerging within the next five years at between 5 and 25 per cent. The same register puts the risk of CBRN attacks on the UK in the next two years at between 1 and 25 per cent, depending on the size of the incident.[14]

FIGURE 2

## Biological threats on the National Risk Register 2025




*Five years for non-malicious risks and two years for malicious risks

Source: Cabinet Office, National Risk Register 2025

These risks are accelerating due to global trends: deforestation, population growth, industrial farming and wildlife trade are driving more frequent spillover events,[15] while rapid progress in synthetic biology, AI-driven bioengineering and DNA synthesis is lowering barriers to the creation of dangerous pathogens. Tackling these threats is fundamental for a secure and competitive bioeconomy.

## Zoonotic Spillovers

Most pandemics originate from zoonotic spillovers, where pathogens jump from animals to humans. These events account for 60 to 75 per cent of emerging infectious diseases,[16] with most pandemics caused by viruses, though some stem from bacteria (as was the case with the Black Death). The severity of pandemics caused by these pathogens can also vary. The most dangerous pathogens – typified by high fatality rates, difficult diagnosis and the ability to spread rapidly – are defined as high-consequence infectious diseases (HCIDs).[17]

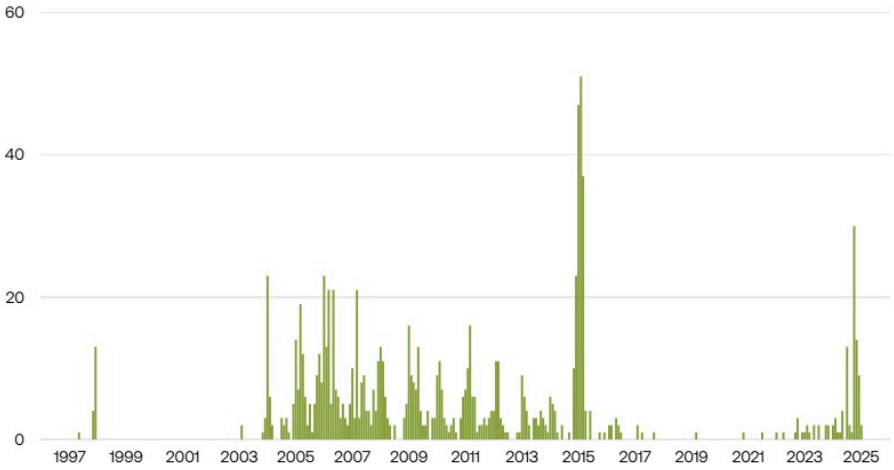
Spillovers occur through direct contact, ingestion or inhalation of infected material.[18] Usually, a zoonotic pathogen cannot be transmitted from one human to another, but pathogens can mutate to develop the ability to make this kind of transmission. Intermediate hosts such as domesticated animals can act as viral "mixing vessels", enabling genetic reassortment that creates new, more transmissible strains. This can happen when two viruses infect the same cell and swap gene segments with each other – a process known as "reassortment".[19]

While few zoonotic pathogens are pandemic-capable, they are appearing with increasing frequency. Zoonotic spillover events increased by 5 per cent annually between 1963 and 2019, with deaths rising by 9 per cent, according to analysis by Ginkgo Bioworks.[20] The American biotech company warns that pathogens it has analysed[21] have the potential to cause four times the number of spillover events and 12 times the number of deaths in 2050 than in 2020. More recent analysis by Ginkgo concludes there is an 18 to 26 per cent chance of an event as severe as or worse than Covid occurring over the next decade, rising to 40 to 53 per cent.[22,23]

Multiple key factors are increasing spillover risk: expanding human-wildlife contact due to deforestation, population growth and land-use change,[24] increasing wildlife trade and consumption (linked to Ebola, HIV and SARS),[25] and the growth of global livestock populations.[26] The 2009 H1N1 influenza pandemic is believed to have arisen from infected swine in Mexico. There have been a number of recent cases where dairy and poultry workers have been infected with H5N1, but so far with no human-to-human transmission. And with international travel becoming more frequent, dangerous pathogens can spread much further and much faster.

FIGURE 3

## Monthly reported human cases of H5N1 influenza across the world




Source: Our World in Data, World Health Organization

# Engineered Threats

The risk of engineered biological threats is rising, ranging from small-scale attacks using toxins to engineered viruses that could result in a severe pandemic. As warned in *A New National Purpose: Leading the Biotech Revolution*, three key technological shifts are making these engineered threats more likely to cause harm, whether by accident or with intent.

First, riskier research by scientists is raising the likelihood of biothreats emerging. Lab leaks are common, with 309 lab-acquired infections and 16 known pathogen escapes documented between 2000 and 2021. High-risk pathogen labs continue to be built in countries with poor biosecurity standards.[27] The extent to which scientists are openly publishing pathogen data, which could be misused by terrorists, is another growing concern. Novel kinds of high-risk, low-reward research in areas like "mirror life" microbes – synthetic organisms built in the mirror image of natural organisms – also pose a threat. A group of Nobel laureates recently warned that such microbes "would likely evade many immune mechanisms" and potentially cause "pervasive lethal infections" in humans and nature, while yielding limited foreseeable benefits.[28]

Second, technological advances risk enabling the deliberate engineering of pathogens and bioweapons. Improvements in nucleotide-editing technology, such as CRISPR, are making precision-editing of DNA sequences easier, while advances in DNA synthesis are making it easier to produce high-quality sequences cheaply. At present, most DNA synthesis is performed by large commercial actors, the majority of whom screen orders for suspicious activity through the International Gene Synthesis Consortium. However, benchtop devices for DNA synthesis are becoming more reliable, and experts have warned that within two to five years, these devices will be able to print sequences long enough to create viruses; a possibility with important implications for existing screening methods.[29] Furthermore, the global proliferation of sophisticated chemicals manufacturing, and biotech advances in areas such as micro-encapsulation, micro-milling and improved dermal absorption, might reduce barriers to developing and successfully deploying small-scale biological weapons.[30]

Finally, AI-enabled biological tools and protein-language models are increasing the potential impact of engineered pandemics.[31] While transformative for life sciences, models predicting protein structure or permitting protein design could be misused to engineer viruses for enhanced transmissibility or vaccine resistance. Many AI-enabled biological tools are open source and have already been widely adopted, raising the possibility they could in future be exploited by rogue actors. De novo protein-design tools could also be misused to create completely novel toxins.[32]

Falling access barriers and rising harm ceilings risk equipping countries hostile to the West with the means to inflict significant damage. Russia's long-held interest in bioweapons can be traced back to the Cold War; the Soviet Union's Biopreparat initiative was the largest known biological-weapons programme in history.[33] As part of the programme, the Kremlin developed a smallpox-based weapon, as well as weaponising anthrax and ricin.[34] More recently, satellite imagery shows a significant expansion of Russia's Sergiev Posad-6 bioweapons site since its invasion of Ukraine.[35] While there is currently no evidence that China is engaged in the development of bioweapons, the US government has warned that China now considers biology a "new domain of war".[36] North Korea now "has the capability to genetically engineer biological products with technologies such as CRISPR".[37] Iran has also conducted offensive-bioweapons research in the past, although it is unclear whether that has continued.[38]

While non-state actors may currently lack the means to engineer pandemic-capable viruses, this may not be the case for much longer. Small-scale biological weapons have already been used for terrorism, such as the 2001 anthrax attacks in the US and the failed attempt by Japanese death cult Aum Shinrikyo to deploy botulinum in the 1990s.[39] Given the historic interest of terrorist groups such as ISIS and al-Qaeda in biological weapons,[40] the proliferation of these technologies to such groups would pose profound risks to Western countries.

Alongside the direct threat to humans, synthetic pathogens could also target agriculture and livestock, disrupting food supplies. Experts warn that this may be a more accessible route for terrorist groups than direct attacks

on human populations. Furthermore, advances in bioengineering and the use of gene drives to edit the genes of a species population, such as the genes that allow mosquitos to carry malaria, could result in accidental or deliberate damage by collapsing key species in an ecosystem.[41]

## Other Threats

Zoonotic spillovers and engineered threats are not the only biosecurity risks. Antimicrobial resistance (AMR) is a growing global threat, projected to cause 8.2 million deaths annually by 2050, up from 4.7 million in 2021.[42] Climate change is expanding the range of vector-borne diseases such as malaria, increasing the risk of non-native mosquito and tick populations in Europe.[43] Invasive fungal infections, which can be deadly for immunocompromised people, are already responsible for 2.5 million global deaths a year, and this number could grow if climate change helps fungi adapt to higher temperatures.[44]

Overall, zoonotic spillovers and engineered threats towards humans represent the biological risks most capable of causing massive societal disruption and harm in the UK. The spillover of a new pandemic-capable pathogen or the development and deployment of an engineered pathogen would raise the risks of significant loss of life in the UK and around the world, far in excess of these other threats. Preventing such an outcome, if either of these threats were to manifest, would demand a rapid and effective response by the state – which, judging by the UK's response to the Covid pandemic, it is not currently capable of providing.

The government's National Risk Register explicitly differentiates between "acute risks", such as a severe pandemic or bioterrorism, and "chronic risks" that "manifest over a longer timeframe" such as AMR, because it recognises that preparing for an acute risk is very different to preparing for chronic, long-term issues.[45] While both chronic and acute risks merit action, some of the work of government on biosecurity is largely focused on chronic risks. The growing risk of zoonotic pandemics and engineered threats demand

urgent attention and a rebalancing of ministerial focus, to supplement existing initiatives on slow-burning chronic threats such as AMR and diseases related to climate change.

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# Strategy

The UK's Biological Security Strategy 2023 acknowledged the increasing risk of serious Covid-19-style pandemics and engineered threats and set out a number of broad aims. These include preventing threats from arising by shaping international standards on responsible biotech use and reducing the risk from the spread of infectious diseases in the UK and overseas, as well as detecting threats early through a national biosurveillance network, and enhancing the UK's capability to respond to crises by rapidly scaling testing and therapeutics.

While these are all the right ambitions, not enough progress was made on delivery in the first year of the strategy. For example, the Centre for Long-Term Resilience's first-year review noted that while strong progress was made in some areas, especially two outcomes relating to responsible innovation and AMR mitigation, there had been less progress in other areas.[46] In recent months there have been promising developments, including new DNA-screening guidance, a metagenomics surveillance programme in NHS hospitals, plans for a large-scale biosecurity exercise, funding to spur advances in microbial forensics and a new diagnostic accelerator to speed up new tests for emerging pathogens.

This flurry of new announcements suggests renewed ministerial interest in biosecurity within the Cabinet Office. Furthermore, the Chancellor of the Duchy of Lancaster has made clear in his response to the Covid Inquiry's findings that boosting the UK's resilience is one of his key priorities.[47] It is vital that the government continues to grip this issue and get the delivery of the strategy back on track, given the increasing risk of biosecurity threats and the deteriorating geopolitical and security landscape globally.

## A Refocus of Governance and Leadership on National Biosecurity

If Whitehall is to refocus on the threats and opportunities of biosecurity, three significant hurdles must be overcome.

First, responsibility for biosecurity across government is fractured. A wide array of organisations is contributing to the delivery of the strategy and other initiatives linked to UK biosecurity. Alongside the role of key departments and agencies such as the Cabinet Office and the UK Health Security Agency (UKHSA),[48] the Department for Science, Innovation and Technology (DSIT) is responsible for shaping norms around responsible biotech use, while the Department of Health and Social Care (DHSC), the Department for Environment, Food and Rural Affairs (DEFRA) and the Foreign, Commonwealth and Development Office (FCDO) are all jointly responsible for reducing the risk from the spread of infectious diseases.

The Counter Proliferation and Arms Control Centre (CPACC), a unit of civil servants from the Ministry of Defence (MOD), FCDO and Department for Business and Trade, is responsible for preventing hostile states and groups developing and deploying biological weapons.[49] The Home Office is responsible for biosecurity at the border and maintains a national network of laboratories to screen suspected chemical and biological materials. Meanwhile, UK Research and Innovation (UKRI) is providing grant funding for R&D programmes targeted towards infection research.[50]

The difficulty in coordinating the delivery of the strategy across these varied departments is further complicated by the fact that some departments are not allowing sufficient bandwidth for preparedness for acute national biosecurity threats, and are largely focused on chronic risks.

Despite being founded to ensure the UK's biosecurity, UKHSA's strategic plan has a broad remit, encompassing all infectious diseases.[51] Much of its activity is focused on smaller-scale threats, such as the decision to focus its National Biosurveillance Network pilot towards vector-borne diseases rather than high-impact human-to-human transmitted pathogens.[52] Likewise, its recent priority-pathogen list includes 24 viral and bacterial families for which it is keen to target R&D, but only four of these not only have medium-to-high pandemic potential but are also severe enough to be classed as a high-consequence infectious disease.[53]

UKHSA also recently dissolved the New Variant Assessment Platform, which supported 18 countries across the world to strengthen their sequencing capabilities to identify and track new viruses and variants.[54] This has left the Fleming Fund as the UK's main international aid programme supporting health surveillance overseas, but this fund is specific to AMR rather than acute risks that require urgent prioritisation, such as H5N1. And finally, while UKRI designated infection research as a "strategic theme" for 2023 to 2029, much of its funding is directed at vector-borne diseases, which pose chronic, lower-impact risks to the UK compared with severe pandemics and engineered threats.[55]

This failure to prioritise acute biosecurity risks could indicate misplaced trust in the UK's level of preparedness for another pandemic and the reliability of international initiatives. As venture-capital company Air Street Capital has noted, many officials tend to "view biosecurity as something the World Health Organization should sort out".[56] But vaccine experts recently warned Parliament that the Coalition for Epidemic Preparedness Innovation's (CEPI) 100 Days Mission focuses on the creation of global medical countermeasures to support developing countries, and does not enhance the UK's ability to respond rapidly to an acute biosecurity threat. Professor Sandy Douglas of the University of Oxford said he was "not aware of any joined-up plan from government … to prepare and to make sure that we had the capability to respond within 100 days".[57]

Supporting global health efforts and tackling chronic biosecurity risks to the UK are important, but overreliance on WHO-led initiatives for pandemic preparedness weakens the UK. Britain must do more to enhance its national resilience and prepare for acute, high-impact biosecurity threats such as a serious pandemic or engineered threat.

The second hurdle to overcome is a lack of expertise in biotechnology advances and the risks they engender within the centre of government. While the government has access to civil servants with experience in national-security issues through the CPACC, the Chemical, Biological and Radiological (CBR) security team at the Cabinet Office and the National Security Secretariat, it lacks expertise from the biotech industry, whose experts can provide unique insights into the opportunities available for

biosecurity by advancing technology and preparedness for pandemics and engineered threats. Given that the UK Covid-19 Inquiry has highlighted civil-servant "groupthink" as a serious hindrance, outside expertise from industry is critical.[58] While the Engineering Biology Responsible Innovation Advisory Panel, an expert advisory group of leading academics and industry figures in biotech, is an important step in the right direction,[59] more expertise is needed within government itself in order to drive implementation.

To deal with these two challenges, Whitehall needs a centralised, data-driven approach to biosecurity. A dedicated Biosecurity Taskforce, led by a National Biosecurity Advisor within the Cabinet Office, would ensure strategic coordination across all relevant departments. Staffed by biotech-industry specialists, the Taskforce would provide expertise, coordinate the government's strategy and ensure acute biosecurity risks are prioritised across departments and agencies.[60] The Biosecurity Taskforce would also support the work of the CDL in chairing a new regular subcommittee of the National Security Council focused on biosecurity, in order to drive the government's priorities across the work of the MOD, the Home Office, DSIT, DHSC, DEFRA and the FCDO, and maintain a focus on acute biosecurity threats.

**Recommendation:** Reorganise Whitehall's biosecurity efforts into a centralised approach, focused on acute threats to the UK, across all departments by:

- Appointing a Biosecurity Taskforce – a small team of biotech-industry experts within the Cabinet Office, led by a National Biosecurity Advisor.
- Creating a National Security Council (Biosecurity) Subcommittee to consider matters relating to future pandemics and bioweapon attacks, chaired by the CDL.

Finally, organisations lack the resources required to deliver on the objectives of the 2023 Biological Security Strategy. UKHSA faces structural problems. Post-pandemic, its budget was slashed by 75 per cent, forcing cuts to two-thirds of its workforce and weakening its response capacity.[61] Key labs at Porton Down and Colindale are ageing, while development of new facilities at a site in Harlow, announced in 2015, remains delayed until 2036.[62]

Similarly, the Animal and Plant Health Agency's (APHA) laboratories at Weybridge, responsible for testing for zoonotic diseases such as avian influenza, have also, in the words of the Public Accounts Committee, "been left to deteriorate to an alarming extent". Weybridge's redevelopment programme is estimated to cost £2.8 billion over 15 years, but so far only around half of this funding has been released.[63] Much of the UK's expertise in research into treating livestock diseases in the UK comes from the Pirbright Institute, a national capability laboratory, which is dependent on continued grants from UKRI and other research funders.[64]

While the UKHSA is staffed with talented people and delivers some promising programmes, including work on a National Biosurveillance Network, it does not have adequate funding to prepare the UK for acute biosecurity threats. Funding for the modernisation of laboratory infrastructure and any additional personnel required to staff these laboratories should be prioritised.

One particularly important resource for the UKHSA and other teams involved in biosecurity response is sufficient compute capacity. Analysing vast amounts of biosurveillance data and running computational analysis on pathogen data and potential medical countermeasures requires access to supercomputers. For example, the US Department of Defense has recently announced CASSIE, a new exascale computer for biosecurity surveillance and response; the UK must take similar action to secure its sovereign biosecurity capabilities.[65] Ministers should ensure that a sufficient proportion of the new compute capacity pledged in the AI Opportunities Action Plan is reserved for UKHSA and biosecurity activities. Alongside this, investing in cloud-based infrastructure for holding these kinds of data would ease integration with other data sets and facilitate cross-border data-sharing.

**Recommendation:** Expand the operations of the UKHSA and other biosecurity agencies by:

- Increasing resource funding for UKHSA's day-to-day operations.
- Immediately releasing sufficient capital funding for UKHSA's new Harlow site and the APHA redevelopment at Weybridge.

- Reserving a sufficient proportion of the compute capacity pledged in the AI Opportunities Action Plan for UKHSA and biosecurity activities.

## A Tiered Plan for Rapid Threat Response

One of the key priorities for the government and the proposed Biosecurity Taskforce should be fulfilling the 2023 Biological Security Strategy's commitment to produce "a comprehensive set of tested response plans which are ready to guide UK responses to a spectrum of biological threats".[66] This should be informed by real-time surveillance data with predefined intervention thresholds, which then triggers action by the state. This would cut through some of the bureaucratic inertia that exemplified the UK's early response to the Covid pandemic.

To achieve this, ministers should agree in advance a tiered threat-response plan, written in collaboration with the proposed Biosecurity Taskforce, setting out the broad measures the government will take as emerging high-risk pathogens meet certain objective thresholds. Being linked to real-world indicators, this plan would reduce the degree to which arbitrary timelines or political considerations might interact with critical decisions made in the context of an evolving pandemic. This would speed up early decision-making and reduce the risk of having to impose society-wide restrictions including lockdowns, which caused demonstrable damage to the UK's economy, health and society.

**Recommendation:** The UK should develop a tiered biosecurity-response plan, informed by surveillance data from multiple settings with clear intervention thresholds, which would then trigger action by the state.

While exact indicators and criteria would be set by the proposed Biosecurity Taskforce and other expert advisors such as the Scientific Advisory Group for Emergencies (SAGE) and the New and Emerging Respiratory Virus Threats Advisory Group (NERVTAG), Figure 4 shows examples of what the tier system could look like for an emerging virus threat.

FIGURE 4

# Potential tiered biosecurity-response plan for viral outbreaks

| Threat level | Number of cases | Surveillance data | Outbreak status | Circulating in humans | Case fatality rate | Transmissibility | Hospital capacity | Treatment available |
|---|---|---|---|---|---|---|---|---|
| 5.00 | 1-10 | Sequence of uncertain significance identified | Isolated reports | Circulating in animal hosts | <0.01% | Unlikely to be widely transmissible | | Treatment already available |
| 4.00 | 10-100 | Sequence of uncertain significance increasing exponentially | Confirmed outbreak | Confirmed animal-to-human transmission | 0.01-0.1% | | | Treatment exists, but not widely available |
| 3.00 | 100-10,000 | Harmful sequence increasing exponentially | Multiple foci of outbreak | Confirmed human-to-human transmission | 0.1-1% | | Evidence of hospital transmission; widespread hospital admissions | Treatments in clinical trials, with evidence of benefit, but not yet approved |
| 2.00 | 10,000-1,000,000 | | International outbreaks | Widespread human-to-human transmission | 1-10% | Widely transmissible | Disruption of non-emergency hospital care | No treatment available, but predicted to be possible to generate one |
| 1.00 | 1,000,000> | | Pandemic | | 10%> | Widely transmissible with possibility of significant asymptomatic / latent phase | Hospital capacity for all routine intensive care overwhelmed | No treatment available, and predicted to be very difficult to generate one |

Source: TBI, James Black

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# Prevention

In parallel with establishing the right strategy, the UK must also focus on prevention – tackling the root causes of zoonotic spillovers and ensuring the proper regulation of bioengineering technologies with dual-use risks.

## Gene-Editing Technology

Gene-editing livestock can reduce zoonotic spillovers. A recent study found that bioengineered pigs were far less likely to transmit influenza A, reducing the risk of viruses mixing among livestock, becoming more transmissible to humans and resulting in potential pandemics. Similarly, British scientists have used gene editing to breed chickens that are partially resistant to bird flu. Wider adoption could also cut farmer losses from livestock disease.[67]

The Genetic Technology (Precision Breeding) Act 2023 legalised gene-editing for precision breeding, but full implementation requires secondary legislation.[68] So far, the government has only implemented this for plants, leaving uncertainty over gene-editing of animals. Experts have warned that this failure to proceed with implementation will damage the UK's ability to reduce diseases in livestock, and risk losing gene-editing funding and talent to countries such as Brazil and the US where precision-bred livestock are legal.[69]

The government should bring forward secondary legislation to legalise gene-editing in animals, therefore enabling precision breeding, as a matter of urgency. Ministers should establish a Precision-Bred Livestock Resilience Fund, redirecting funding from UKRI's Biotechnology and Biological Sciences Research Council to support research into spillover risk reduction.

**Recommendation:** Bring forward secondary legislation to enable gene-editing in animals as a matter of urgency.

**Recommendation:** Create a new Precision-Bred Livestock Resilience Challenge Fund to fund research programmes into reducing the risks of zoonotic spillovers from livestock, by reallocating funding away from the UKRI's Biotechnology and Biological Sciences Research Council.

Stronger livestock resilience not only reduces spillover risks but also cuts antibiotic use, helping combat antimicrobial resistance.

## Risky Research

The UK must help prevent engineered biological threats by strengthening global research safeguards and biosecurity norms. While such threats may originate abroad, UK action can help reduce risks from both accidental leaks and deliberate misuse by states or terrorist groups.

Reducing risky scientific research is key to preventing engineered threats. There is growing international recognition of the threat from risky scientific research, with the Office of Science and Technology Policy in the US publishing a framework in 2024 for managing research into pathogens with potential dual-use risks.[70] As highlighted in *A New National Purpose: Leading the Biotech Revolution*, the UK should work with its scientists and journals to develop a voluntary code of best practice for publishing information on pandemic-capable pathogens – a risk also highlighted in the Biological Security Strategy but on which no clear progress has been made.

The UK should lead efforts to establish an international panel on bioengineering safety, focused on setting research guardrails for high-risk emerging fields such as "mirror life" and other forms of synthetic biology. Composed of scientists and policymakers, the panel would assess risks, evaluate potential research restrictions and establish global norms to prevent synthetic biology research with the potential to cause significant loss of life. Cooperation between the US and China would be key to its success, given these countries are world leaders in research into engineering biology and life sciences. The Trump administration's concerns around gain-of-function research suggest that the US could be open to working with other countries on risks from synthetic biology.

**Recommendation:** Establish an International Bioengineering Safety Panel to set global research standards and risk controls for high-risk fields like “mirror life” and other forms of synthetic biology.

## Deliberate Engineered Threats

Stopping hostile states and terrorist groups from developing engineered biological threats requires strong non-proliferation and deterrence measures. While the UK’s International Biological Security Programme helps counter bioweapons development abroad, rapid technological advances demand more aggressive action.[71]

Preventing the spread of dual-use biotechnology requires robust safeguards, especially against terrorist groups that cannot be deterred through traditional means.

Stronger DNA-synthesis guardrails are among the most effective non-proliferation measures. Former US President Joe Biden’s executive order mandated screening for federally funded research. While President Trump has since revoked this, he has recently published an executive order instructing his administration to create a new framework that encourages DNA-synthesis providers to use screening mechanisms and requires federal agencies to use suppliers that adhere to the forthcoming framework, suggesting a degree of continuity. [72] Despite the rollback, bipartisan US efforts are pushing for stricter DNA-synthesis screening, including mandatory compliance for providers and a new federal oversight body.[73] Progress has also been made on screening in the UK, with the government recently publishing voluntary guidance for DNA-synthesis screening, including for benchtop devices.[74]

The UK must mandate DNA-synthesis screening and strengthen oversight of benchtop synthesisers. A strong domestic framework will also strengthen the UK’s ability to encourage the US to reinstate its own safeguards. Ministers could also explore potential incentives for researchers and companies to use DNA synthesis firms based in the UK in order to enhance our sovereign capabilities.

**Recommendation:** The UK should introduce mandatory DNA-synthesis screening and oversight, including by:

- Making it a legal requirement for all UK-based research and commercial activity procuring synthesised DNA to use synthesis firms that have their orders screened for suspicious activity through an existing screening scheme such as the International Gene Synthesis Consortium. As a minimum first step, this requirement should be introduced for all UK government-funded research.
- Introducing licensing requirements for all benchtop synthesisers used in the UK.
- Working with the US and other Western countries to agree an international framework introducing mandatory screening requirements on DNA synthesis covering all research and commercial activities. This should include requiring manufacturers of benchtop synthesisers to monitor, screen and approve DNA synthesis against a regularly updated cloud-based database of sequences before synthesis can begin, and banning foreign benchtop synthesisers that do not comply with these standards.

Non-proliferation measures for AI-enabled biological tools will be much harder to introduce, given that many such tools have been made open-source in order to maximise their benefits for society. Important work is already being undertaken by the Centre for Long-Term Resilience and RAND to develop a new risk index that assesses biosecurity risks from AI-tool capability, evolution and maturity.[75,76] Likewise, the Nuclear Threat Initiative has highlighted the potential role of built-in guardrails and managed-access paradigms,[77] which the AI Security Institute could explore.

The UK must strengthen international deterrence against biological weapons. Holding hostile states and non-state actors accountable for bioweapons programmes makes their use less attractive.[78] Stronger attribution capabilities and clear consequences for violations are essential, as the Biological Weapons Convention lacks effective verification measures. Given current geopolitical constraints, deterrence must be enhanced through intelligence, forensic capabilities and international coordination.[79]

Strengthening attribution capabilities is key to deterrence. Advances in microbial forensics allow investigators to trace biological agents to their origin – natural or synthetic – making it harder for perpetrators to act without consequence. Continued investment in these technologies is essential.[80]

The government is working to strengthen sovereign attribution capabilities through the new United Kingdom Microbial Forensics Consortium, which works to trace biothreat origins and deter misuse.[81] A £1 million Defence and Security Accelerator (DASA) grant is funding computational tools to improve anomaly detection in genome sequencing – although the relatively small size of individual grants (£100,000 to £250,000 each) could limit their impact.[82] To further strengthen attribution, the UK and its allies should expand pooled research grants through platforms such as NATO's DIANA programme and funding through NIF to scale and commercialise any advances made.

Beyond attribution, clear consequences must be established for bioweapons use. The UK, NATO and their allies should develop a coordinated response framework, outlining actions in scenarios where bioweapons attributed to a state are used. This would form the basis of an "Article 5 for Biosecurity"-style deterrent, meaning that an attack on one member state is considered an attack on all, therefore ensuring swift, coordinated and proportionate retaliation against violators.

The UK could also explore making greater use of its international sanctions regime to target individuals and organisations linked to foreign biological-weapons programmes or reckless biological research abroad. The government already has broad powers to levy sanctions linked to national security via the 2018 Sanctions and Anti-Money Laundering Act and specific secondary legislation allowing sanctions on those linked to chemical weapons, with sanctions in place on Russian and Syrian nationals linked to chemical-weapons crimes.[83]

**Recommendation:** Strengthen deterrence against biological weapons by:

- Setting up a new DIANA challenge and expanding NIF funding for biosecurity, with an initial focus on attribution capabilities, to invest in the development and scaling of emerging microbial forensic techniques.
- Working with Western allies to agree a broad outline of coordinated measures to respond to different bioweapon-release scenarios, to form the basis of an "Article 5 for Biosecurity"-style deterrent.
- Exploring the use of sanctions against individuals and companies linked to international biological-weapons programmes and reckless biological research, potentially through bespoke secondary legislation linked to the 2018 Sanctions and Anti-Money Laundering Act.

"Deterrence by denial" reduces the likelihood of biological attacks by making them ineffective.[84] In 2003, the US, UK and Canada publicly highlighted smallpox-vaccine stockpiles to deter potential bioterrorist threats.[85] Strengthening and publicising rapid remediation capabilities can deter biological attacks. The UK Home Office and the US Defense Advanced Research Projects Agency are already testing sensors for real-time CBRN detection in urban environments under the SIGMA+ programme.[86]

The 2023 Biological Security Strategy committed to ensuring that the UK has in place "effective and proportionate capabilities to remediate a scene or area within the UK that has been contaminated by hazardous biological material in a small- or medium-scale incident".[87] However, the government's recent progress report on implementing the strategy did not mention this commitment and it is unclear whether such progress has been made. Given Russia's long-held interest in biological weapons and reported expansions to its Sergiev Posad-6 bioweapons site, as well as the Kremlin's increasing willingness to cross red lines, the UK and Europe should prepare for the possibility that Putin could deploy biological weapons in Ukraine, even in the event that a peace deal is agreed. As part of any post-war security guarantee, the UK and NATO should ensure that Kyiv has the appropriate rapid-remediation capabilities required to respond to and deter such attacks.

**Recommendation:** Deter biological attacks on the UK by:

- Considering strategic disclosure of biological defences as part of intelligence operations.
- Delivering on the Biological Security Strategy commitment to secure rapid-remediation capabilities and publicising this clearly.

**Recommendation:** Deter Russian biological attacks on post-war Ukraine by committing to enhancing Ukrainian rapid-remediation capabilities as part of any post-war security guarantee, including by:

- Deploying NATO's Combined Joint CBRN Defence Task Force to train Ukrainian forces in responding to CBRN incidents.[88]
- Exploring whether the UK and US could expand the SIGMA+ sensor trial to include post-war Ukraine.

Effective deterrence requires well-resourced intelligence agencies. MI5's understandable decision to shift focus away from counter-terrorism due to growing threats from rogue states like Russia raises concerns about its capacity to track biological threats from both state and non-state actors.[89] Given the potential resurgence in Syria of ISIS, a terrorist group with a history of interest in biological weapons,[90] it is particularly important that the government ensures intelligence services have sufficient resources to counter challenges from both rogue states and terrorist groups, rather than being forced to choose between risks.

07

# Resilience

While preventing biological threats is critical, resilience ensures the UK can respond effectively when they arise. Strengthening innovation and biomanufacturing capacity will not only protect public health but also secure the UK's position as a leader in life sciences, safeguarding economic and national security.

## Research and Development

A clear biosecurity R&D strategy is essential for ensuring rapid responses to emerging threats, driving innovation and strengthening supply chains. Prioritised investment will accelerate the development of diagnostics, therapeutics and vaccines, securing the UK's leadership in biotech. UKHSA's new priority-pathogen list is an important step in this direction, setting out the 24 viral and bacterial families it recommends should be the focus of the UK's R&D efforts.[91]

Another way to stimulate innovation in biosecurity R&D is through dedicated funding programmes, but the UK's efforts in this area have been lacklustre. As noted above, much of UKRI's funding for infectious diseases has been directed at vector-borne diseases, which pose less acute risks to the UK compared to pandemic-capable pathogens and engineered threats.[92] While DASA can play a role in supporting biosecurity R&D, much of its funding is rightly focused on technology that can directly benefit the UK's defence capabilities, and should remain so, given the deteriorating geopolitical situation. At the same time, there is little late-stage capital to support clinical trials and manufacturing beyond the British Business Bank's Life Sciences Investment Programme. VDEC facilities at Porton Down support industry's capacity to develop medical countermeasures with labs and scientists but do not come with funding attached to help these efforts progress to late-stage trials or manufacturing.

By contrast, the European Union's HERA Invest programme incentivises private-sector investment through loans with partial risk protection, encouraging companies to commit to biosecurity-related R&D. As a result, it supports the development and production of medical countermeasures, including vaccines, therapeutics, diagnostics and platform technologies. HERA (Health Emergency Preparedness and Response Authority) is operating with a substantial €6 billion budget for 2022 to 2027, with €1.3 billion allocated to HERA Invest specifically for supporting late-stage development and manufacturing capacity.[93] Within this broader framework, HERA focuses on procurement and stockpiling, while HERA Invest specifically targets private-sector co-investment to bridge funding gaps that commercial markets alone cannot address.

In the US, the Biomedical Advanced Research and Development Authority's (BARDA) Division of Research, Innovation and Ventures (DRIVe) focuses on early-stage biosecurity innovation, investing in advanced diagnostics, novel therapeutics, wearable health-monitoring devices and platform technologies. DRIVe employs a venture capital-style approach, providing non-dilutive seed funding and expertise to biotech startups, academic labs and private-sector partners, helping de-risk high-impact biosecurity projects. BARDA operates with an annual budget of $2.6 billion (£2.24 billion), managing the full spectrum of biosecurity from R&D through to procurement and stockpiling.[94] DRIVe receives $76 million of this funding specifically to address early-stage innovation through venture-style investments. This targeted approach has proven remarkably effective – BARDA's work has led to 95 FDA-approved medical countermeasures since its inception in 2006, including the Moderna mRNA vaccine that was so pivotal in the global response to Covid-19.[95] BARDA played a central role in Operation Warp Speed as the key interface between the US government and the biomedical industry. The $18 billion invested prevented an estimated $1.6 trillion in economic losses, demonstrating how strategic biosecurity investment creates both health security and extraordinary economic value.[96],[97]

The UK should learn from these models and explore new approaches to investing in leading biopharmaceutical R&D programmes that can strengthen national biosecurity. One option is to seek participation in HERA through a funding contribution of approximately £100 to £150 million annually. This figure represents a proportionate contribution relative to the UK's economic size compared to the EU, equating to roughly 10 to 15 per cent of HERA's annual €1.2 billion budget and aligning with similar third-country participation arrangements in EU programmes. Alternatively, if the government prefers to retain control over domestic innovation, the UK should establish a dedicated biosecurity R&D body, similar to BARDA DRIVe or HERA Invest, to accelerate the development of medical countermeasures by stimulating private investment in areas underserved by commercial markets.

This could be modelled on the Advanced Research and Invention Agency (ARIA), which is already driving world-leading research in various fields, with an £800 million budget for its first four years, and has recently announced that it considers the early detection and prevention of emerging biological threats as an emerging area on which a future research programme could be based.[98] A Biosecurity Research, Innovation and Ventures Accelerator (BRIVA) would build upon this, bringing the benefits of the ARIA model to the rest of the biosecurity ecosystem and ensuring targeted, long-term investment in research on diagnostics, therapeutics and vaccines for future biosecurity threats.

BRIVA would unlock Britain's biotech potential to strengthen national biosecurity. The UK industry raised £3.7 billion in equity financing in 2024, including £2.25 billion in venture capital –a respective 106 per cent and 79.5 per cent increase from 2023.[99] Yet investment skews towards high-return areas like oncology, while biosecurity innovations – such as broad-spectrum antivirals, rapid diagnostics and vaccine platforms – struggle for late-stage funding. Many of these dual-use technologies benefit both routine health care and pandemic preparedness, as seen with mRNA vaccines. But UK biosecurity innovations face a "valley of death", where breakthroughs stall

before clinical validation and manufacturing. BRIVA would bridge this gap, ensuring critical countermeasures advance from early development to real-world deployment.

BRIVA would focus specifically on the investment mechanisms of BARDA DRIVe and HERA Invest rather than replicating the full scope of these parent agencies. This targeted approach offers three key advantages. First, it addresses the UK's most critical biosecurity gap – insufficient financing for innovative countermeasures – without duplicating existing UKHSA functions such as stockpiling and procurement. Second, it maximises impact with a more modest budget, leveraging the UK's strong private-investment ecosystem rather than requiring the multi-billion-pound commitments of full-scale agencies. Third, it enables faster implementation, allowing the UK to rapidly strengthen its biosecurity-innovation ecosystem while broader structural reforms to UKHSA and other agencies continue in parallel.

A five-year, £500-million investment would give BRIVA the scale needed to drive meaningful biosecurity innovation while ensuring project stability. This funding level is both strategic and proportionate when compared to similar initiatives globally: HERA Invest allocates €100 million (£86 million) over five years – about £17 million per year;[100] BARDA DRIVe operates on $76 million (£60 million) annually within BARDA's broader $970 million budget proposed for 2025;[101] and ARIA has £800 million over four years across multiple sectors. At £100 million per year, BRIVA would sit between these programmes in scale but with a more defined focus on translational biosecurity R&D – bridging the critical gap between early discovery and large-scale manufacturing.

This investment would provide sufficient scale to attract leading biotech companies, as BARDA's experience shows that inadequate funding fails to engage industry leaders. It would enable support for ten to 15 significant projects at £30 to 40 million each, advancing promising countermeasures through early development and initial clinical validation – a well-documented bottleneck in biosecurity innovation. Additionally, it should include £60 million for an emergency-response fund, allowing BRIVA to pivot immediately

to address emerging biothreats without waiting for supplemental appropriations. A five-year timeframe would provide both predictability and flexibility for industry to respond to evolving threats.

**Recommendation:** Pursue participation in the EU's HERA programme through a funding contribution of £100 million to £150 million annually, securing access to European biosecurity R&D programmes while influencing their direction.

**Recommendation:** Establish a Biosecurity Research, Innovation & Ventures Accelerator (BRIVA), modelled on BARDA DRIVe and HERA Invest, to fund biosecurity R&D and accelerate the development of medical countermeasures. BRIVA could be backed by £500 million over five years and funded by reallocating resources from UKRI's £9 billion annual budget.

Combined with the new list of priority-pathogen families and accompanying funding, a dedicated biosecurity R&D agency should support the ecosystem to diversify the platforms researched to tackle priority diseases. The Covid-19 pandemic saw the benefit of mRNA come to the fore. As a recent TBI paper outlined, this is an area where the UK can capitalise. However, we cannot afford to over-index on a single platform that may not be the appropriate platform for the next pathogen.

**Recommendation:** The UK should establish a dedicated innovation fund and strengthen public-private partnerships to advance diverse vaccine-platform technologies and bolster manufacturing resilience.

Without clear market incentives, private companies are unlikely to invest in pandemic countermeasures at speed. Overcoming this market failure requires advance purchase agreements (APAs) as part of late-stage funding for medical countermeasures (MCMs), alongside fast-tracking regulatory approvals for platform-based MCMs – allowing faster validation of adaptable bioplatforms – and dedicated public-sector funding.

The UK has historically limited APAs to influenza, but their success during Covid-19 – where BARDA's guaranteed demand accelerated vaccine production, spurred innovation and expanded capacity – demonstrates their

broader value. Expanding APAs beyond influenza to cover priority pathogens will ensure production capacity, price stability and a guaranteed supply chain in future crises. With platform technologies reducing development risks, APAs now offer even greater efficiency by supporting shared infrastructure across multiple vaccine types, making them cost-effective and adaptable to evolving threats.

The Biosecurity Taskforce should coordinate industry partnerships and regulatory processes to ensure the rapid deployment of vaccines and therapeutics, while BRIVA would provide sustained investment in R&D, ensuring a pipeline of high-priority medical countermeasures.

**Recommendation:** While BRIVA should provide sustained funding for early-stage R&D in diagnostics, therapeutics and vaccines, the Biosecurity Taskforce should oversee the rapid development, licensing and deployment of medical countermeasures by:

- Expanding APAs beyond influenza to cover priority pathogens, ensuring stable production capacity and supply-chain resilience.
- Liaising with industry to signal demand for vaccine candidates at the earliest stages of threat identification.
- Coordinating public-private partnerships to accelerate development and regulatory approvals.
- Pre-negotiating agreements for fast-track approvals and strategic stockpiling of medical countermeasures.

The RECOVERY trial, the world's largest clinical trial into treatments for Covid-19, demonstrated the power of adaptive clinical trials, saving an estimated one million lives with dexamethasone. By allowing multiple therapeutic candidates to be trialled under the same ethical approval and using routine clinical data for patient outcomes, RECOVERY provided rapid, high-impact results. However, these best practices have not been institutionalised, leaving the UK unprepared to replicate this success in future pandemics.

The Covid-19 pandemic demonstrated the need for faster vaccine and therapeutic development, with vaccines ultimately lifting lockdowns and reducing fatality rates. To prevent long delays before countermeasures become available, initiatives like the 100 Days Mission aim to compress vaccine-development timelines, but success depends on regulatory agility and early-stage investment in pandemic candidates. Without streamlined approvals and pre-approved trial protocols, the UK risks falling behind in responding to future biological threats.

Beyond vaccines, effective treatments such as dexamethasone were critical in reducing Covid-19 mortality. For bacterial pandemics and other emerging threats, therapeutics may be even more crucial. The RECOVERY trial set a global benchmark, proving that adaptive trial designs, real-time data integration and regulatory streamlining can radically accelerate drug development.

Despite this success, regulatory infrastructure remains slow and fragmented. Cutting unnecessary red tape should be a top priority, ensuring that pre-approved adaptive clinical-trial frameworks are in place before a crisis emerges. The prime minister has recognised this, setting out an ambition to cut the time it takes to get a clinical trial set up to 150 days by March 2026, down from more than 250 days in 2022.[102]

The Biosecurity Taskforce must work with clinical-trial experts to establish frameworks that allow multiple interventions to be tested simultaneously, with regular interim analyses enabling rapid expansion or pausing of trials based on results.

**Recommendation:** The Biosecurity Taskforce should:

- Embed pre-approved adaptive clinical-trial frameworks into the UK's biosecurity strategy to enable rapid testing and deployment of new vaccines and treatments.
- Ensure real-time data integration from electronic patient records to streamline trial enrolment and enhance discovery research.
- Streamline regulatory processes and cut red tape, ensuring trial protocols are ready to activate immediately in response to novel threats.

## Biomanufacturing Capacity

The UK has a strong foundation in vaccine manufacturing, with major pharmaceutical firms and contract manufacturers supporting large-scale production. Moderna's new facility, set to produce 250 million mRNA vaccines annually from 2025, strengthens the UK's biomanufacturing potential. However, scaling domestic production across a diversity of platforms during crises remains a challenge, requiring urgent investment.

A diverse vaccine portfolio – mRNA, viral vectors and protein subunits – enhances adaptability to emerging threats and strengthens supply-chain resilience. Over-reliance on a single platform creates vulnerabilities, as seen in the Covid-19 pandemic. Investing in multiple technologies ensures faster, more flexible responses to future pandemics while also advancing non-pathogen applications such as cancer vaccines. mRNA and viral-vector platforms, initially developed for infectious diseases, are now being adapted for oncology with major potential to revolutionise cancer treatment.

Despite all its strengths in biotech, the UK's vaccine-manufacturing capacity remains underdeveloped. The Vaccine Manufacturing and Innovation Centre was sold to US company Catalent before its construction was completed, while Sir John Bell and other experts have warned that the centre has now been "mothballed".[103] Meanwhile, AstraZeneca recently scrapped its £450 million plans for a Liverpool vaccine lab due to government funding cuts.[104] The UK's failure to secure this investment reflects a lack of long-term vision, inconsistent industrial policy, a failure to leverage the NHS's buying power to secure investment in manufacturing, weak government support and increasing reliance on foreign supply chains.

Compared to global leaders like the US and India, the UK's capacity remains too limited to meet domestic and global demand in a high-stakes health crisis. The House of Lords Science and Technology Committee has warned that the UK cannot assume it will produce vaccines at speed again without renewed, sustained investment.[105]

The Covid-19 pandemic exposed the risks of last-minute procurement, leading to inefficiencies, delays and increased costs. Vaccine production was disrupted by export restrictions on critical inputs like clinical-grade DNA and lipid nanoparticles, highlighting the fragility of global supply chains. To ensure resilience in future crises, the UK must strengthen domestic manufacturing infrastructure and secure key inputs in advance.

A published strategic stockpile of vaccines, therapeutics and critical ingredients, similar to the US – supported by APAs – would enable the rapid deployment of effective treatments and reduce reliance on external suppliers, as well as fostering accountability, parliamentary scrutiny and oversight. Alongside finished medical countermeasures, critical vaccine inputs such as lipid nanoparticles and cell-culture media must be stockpiled and subjected to regular quality testing to prevent production bottlenecks that could delay the rollout of life-saving treatments.

**Recommendation:** UKHSA should establish and maintain a strategic stockpile of vaccines, therapeutics and critical ingredients, including lipid nanoparticles and cell-culture media, with regular supply testing to ensure emergency readiness. It should, where able, publish the contents of its stockpile to encourage a more substantive public debate on UK preparedness for biothreats.

To reduce reliance on foreign markets, the UK must localise supply chains, expand domestic production and strengthen strategic partnerships with international manufacturers. Contract development and manufacturing organisations (CDMOs) play a critical role in scaling vaccine and therapeutic production during emergencies. To ensure priority manufacturing capacity, the UK should establish long-term framework agreements specifying the conditions under which CDMOs would prioritise UK production during a crisis, subsidising investment in high-end manufacturing such as cell and gene therapies where capacity constraints and global competition pose risks to national supply chains. Maintaining strong partnerships with both domestic and international CDMOs will provide flexibility and surge capacity while reducing reliance on any single source.

The UK's forthcoming industrial strategy should formally integrate CDMOs into the life-sciences sector, ensuring they are part of a cohesive national manufacturing strategy. This would enable regular simulations and drills to test surge capacity, ensuring CDMOs can seamlessly transition into emergency production when needed. The government should also incentivise investment in modular manufacturing and rapid-response platforms, aligning industry capabilities with national biosecurity objectives.

**Recommendation:** The UK should develop long-term agreements with CDMOs to secure priority production capacity for emergency vaccine and therapeutic manufacturing. DSIT should integrate CDMOs into the UK's industrial strategy, ensuring their manufacturing capacity can be leveraged for pandemic response and incentivising investments in modular and rapid-response manufacturing technologies.

Investment in modular and surge manufacturing facilities will allow rapid production scale-up during crises, reducing reliance on last-minute interventions. Modular plants, which can quickly adapt to produce different vaccine and therapeutic types, ensure scalability and flexibility. This reduces downtime, shortens lead times and enables a faster, more coordinated pandemic response.

"Lab hotels" – modular production facilities – allow rapid switching between vaccine and therapeutic manufacturing in response to emerging threats.[106] A nationwide network would distribute capacity, reduce bottlenecks and ensure resilience in case of local disruptions.

**Recommendation:** DSIT should establish a network of modular "lab hotels" to maintain warm manufacturing capacity, ensuring rapid scale-up in a crisis.

Alongside vaccines and other drugs, the UK must ensure sufficient antibody-manufacturing capacity by leveraging the NHS's buying power in both antibody manufacturing and other technologies it might need. Covid-19 antibody treatments were not procured, leaving immunocompromised individuals unprotected, despite other countries securing AstraZeneca's Evusheld antibody treatment. Failure to act in the next pandemic would repeat this mistake.

The Vaccine Taskforce estimated that flexible production bioreactors would be required to produce Covid-19 antibodies, but government investment was not forthcoming. While 30 countries purchased Evusheld to protect high-risk groups, the UK did not.[107]

**Recommendation:** Invest in antibody-manufacturing capabilities to ensure immunocompromised individuals are protected in future pandemics.

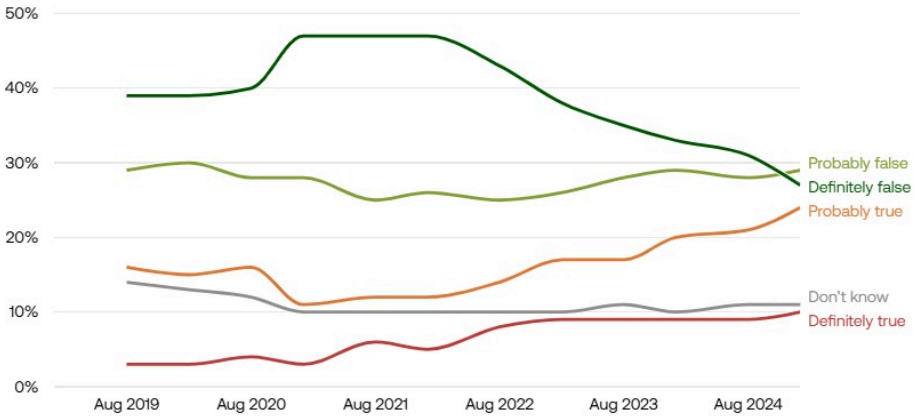
## Society-Wide Resilience

Society-wide resilience against biological threats is a critical component of the UK's biosecurity strategy, reducing the severity of outbreaks and easing pressure on the NHS. Chronic conditions like obesity, diabetes and cancer increase vulnerability to pandemics, worsening patient outcomes and straining the NHS.[108] Preventive health care and early treatment can reduce mortality and ease system pressures.[109],[110] Reducing the prevalence of common diseases by 20 per cent could increase GDP by 0.74 per cent over five years, underscoring the economic benefits of health resilience.[111]

Resilience to health disinformation will also be key to the success of future pandemic responses. Covid-19 vaccine hesitancy was low overall but higher among young people, ethnic minorities and deprived communities.[112] Since 2021, distrust has risen sharply, with belief in undisclosed vaccine harms increasing from 18 to 34 per cent as of 2025.[113]

FIGURE 5

# Belief in undisclosed vaccine harms




*Q: Do you think the following statement is true, or false? "Vaccines have harmful effects which are not being disclosed to the public."*

Source: YouGov

Combatting health disinformation is essential to ensuring public trust in future pandemic responses. Stronger online safeguards are needed. Russia and other hostile states spread vaccine disinformation during the pandemic, undermining public trust.[114] Social-media platforms cooperated in combatting disinformation during Covid-19 but may not in future.[115]

The Online Safety Act's original provisions on legal but harmful content for adults sought to introduce duties around "harmful health content that was demonstrably false", including "some vaccine misinformation and disinformation".[116] However, the 2022 decision to remove these provisions before the act was passed reduced its ability to safeguard against the spread of harmful health disinformation.[117] Social-media companies should be prevented from algorithmically promoting false health claims while preserving free speech for those who actively seek such content.

**Recommendation:** Amend the Online Safety Act to prevent social-media companies from promoting harmful health-disinformation content within their algorithms. This would preserve freedom of speech by allowing adults

to post and read disinformation, but without this content being actively presented to people through their newsfeeds. Existing fines and penalties in the Act would be extended to non-compliant platforms.

Community preparedness is key to resilience. The government's national pandemic exercise and the new UK Resilience Academy, which trains more than 4,000 people annually in emergency response, are positive steps.[118]

08

# Surveillance

Surveillance is the first line of defence against biosecurity threats. A robust detection system enables faster containment, accelerates medical countermeasures, and strengthens national security and economic stability. The UK must move beyond its current reactive approach to adopt a more proactive, data-driven system that identifies emerging risks before they escalate.

Current systems focus too much on known threats rather than identifying emerging risks. UK surveillance must shift from a narrow focus on known threats to a balanced approach that includes pathogen-agnostic detection, ensuring emerging risks are identified early and allowing time to secure mass targeted test-and-trace systems for new threats before outbreaks escalate.

Metagenomics, an emerging technology that will become increasingly prevalent in the next decade, offers a cost-effective way to improve pathogen-agnostic surveillance. Unlike traditional methods such as PCR and lateral-flow tests, metagenomic sequencing reads all genetic material in a sample, enabling the detection of known and unknown pathogens. The 2023 Biological Security Strategy stated a long-term ambition to "incorporate unbiased metagenomic approaches that could identify emerging pathogens in real time" into the UK's surveillance efforts,[119] but little progress has been made in this area. Critical gaps remain in the UK's ability to integrate surveillance, testing and real-time data analysis. The Covid-19 response exposed serious weaknesses in testing and tracing infrastructure, which quickly became overwhelmed and failed to contain the virus in its early stages. Although the UK was among the first to develop a PCR test, testing for travellers and contact tracing were rapidly outpaced by rising case numbers. Mass testing was scaled too late and implemented reactively, reducing its effectiveness as a containment tool.

The UK must therefore strengthen surveillance in four key areas: early threat detection at borders, international cooperation on outbreak monitoring, rapid data-sharing on pandemic-capable pathogens, and scalable test-and-trace systems.

## Early Detection of Novel Threats in the UK

The UK conducts a broad range of biosecurity-surveillance activities, monitoring trends in several different diseases. For example, UKHSA monitors cases of diseases like measles and respiratory viruses, as well as tracking developments in antimicrobial resistance and symptomatic avian influenza, while APHA conducts biosurveillance in livestock and wild animals.[120]

The 2023 Biological Security Strategy introduced the Biothreats Radar and the National Biosurveillance Network to centralise data and expand monitoring, but as of October 2024 these initiatives were still only in prototype and pilot stages and it is unclear when they will be fully operational.[121] These initiatives are steps in the right direction but fall short of providing the pathogen-agnostic surveillance set out in the Biological Security Strategy. The Radar component of the strategy repurposes existing data rather than expanding capabilities, while the National Biosurveillance Network's initial focus on known threats limits its impact.[122]

The government has recently made progress in improving pathogen-agnostic surveillance by deploying the emerging technology of metagenomics. In November, ministers announced plans to expand NHS England's Respiratory Metagenomics programme from ten to 30 hospitals. The programme uses technology provided by Oxford Nanopore to sample patients with severe respiratory infections, and to rapidly diagnose and treat the infections. These data are shared with UKHSA as part of its mSCAPE programme to support quicker detection of emerging infectious diseases.[123] The Medicines and Healthcare products Regulatory Agency and Barts Health NHS Trust have also recently designed a sequencing programme to identify bacterial infections faster and more accurately, which could be integrated into UKHSA's surveillance efforts.[124]

Metagenomics is also increasingly showing promise in detecting pathogens within the environment. A recent study showed that metagenomic sequencing of wastewater in communities across Oregon by the US CDC allowed researchers to detect the presence of H5N1 in 2022 six weeks before the virus was detected in poultry and seven weeks before it was discovered in wild bird populations.[125] Furthermore, UKHSA has piloted the use of metagenomic sequencing to detect AMR in the natural environment, while APHA has participated in a European programme to pilot the use of Oxford Nanopore's metagenomic technology outside laboratory settings.[126]

To further enhance biosecurity surveillance and early threat detection, the UK must expand metagenomic monitoring beyond hospitals to critical entry points. Airports and seaports serve as key transmission hubs for infectious diseases, making them a priority for metagenomic surveillance. Monitoring inbound pathogens at borders would provide early-warning information, allowing the government to make informed decisions on containment and travel restrictions before outbreaks escalate.

The UKHSA has prior experience with wastewater monitoring, having implemented a Covid-19 surveillance programme during the pandemic.[127] Applying this expertise to airports, seaports and high-traffic transport hubs would create a pathogen-agnostic detection system, avoiding privacy concerns and sampling biases associated with individual testing.

The CDC already has such a programme in place. Its TGS programme uses a mix of nasal swabs from participating travellers and aeroplane-wastewater monitoring to provide an early-warning system for detecting emerging infectious threats in near real-time. During the pandemic, the programme was the first to detect Omicron variants, up to six weeks before these variants were reported elsewhere in the US. The programme currently operates at eight major US airports and is creating partnerships to test in airports across the world.[128]

**Recommendation:** The UK should establish metagenomic surveillance at airports and seaports, using wastewater sampling to detect pathogens early and strengthen outbreak response, as well as inform government decisions on containment and travel restrictions. This should be modelled on the US

CDC TGS programme and take the form of a public-private partnership that can leverage expertise from the private sector. The programme could be piloted at three airports, focusing on those with the greatest number of international flights, costing about £6 million per year and providing 30,000 samples each year.[129]

Routine wastewater surveillance across the UK should also be implemented to track infectious-disease prevalence in real-time, improving pandemic preparedness and public-health response. AI-powered analysis of daily sewage samples would provide an early warning of emerging outbreaks, allowing proactive containment strategies.

Beyond pandemics, a National Health Forecast system could provide real-time insights into community disease prevalence, helping the government manage seasonal outbreaks including flu and respiratory infections. This would allow the public to make informed health decisions, easing pressure on the NHS.

**Recommendation:** The UK should pilot a National Health Forecast system, using wastewater samples from sewers across the country to provide near-real-time infectious-disease tracking. A one-year pilot would cost £10 million, with the potential for scaling to full national coverage over two years for an additional £20 million.

To establish an effective National Health Forecast, patient clinical data must be fully integrated with existing monitoring efforts, including wastewater analysis and metagenomic sequencing in emergency departments, as part of the Cabinet Office's Biothreats Radar. However, bureaucratic barriers such as the Control of Patient Information (COPI) notices hinder the seamless sharing of these data. Outside of public health emergencies, accessing patient data often requires navigating complex, overlapping approval processes, delaying research and slowing down response efforts.

These rich and valuable data must be more readily available for research and real-time outbreak tracking. By linking clinical data with surveillance networks and AI-driven analytics, the UK can identify hotspots for targeted interventions and predict which hospitals will need additional resources,

ultimately improving national biosecurity preparedness. Ministers could also explore the potential for integrating anonymised data from wider society, such as supermarket purchases of over-the-counter drugs to monitor for early warning signs of increasing infections.

**Recommendation:** To establish an effective National Health Forecast, the UK should reform patient data-sharing regulations, easing restrictions like COPI to enable secure, real-time integration of clinical data with surveillance systems within the Biothreats Radar, ensuring faster outbreak detection and improved biosecurity innovation.

## Early Detection of Novel Threats Internationally

Strengthening international pathogen surveillance enhances UK biosecurity, reducing the risk of undetected outbreaks spreading globally. While spending constraints have led to UKHSA's New Variant Assessment Platform being dissolved, the UK still supports surveillance in developing countries through the WHO's International Pathogen Surveillance Network. This supports partner institutions from low- and middle-income countries to build their capacities in pathogen genomic analysis.[130] Alongside this, the EU has launched a Global Consortium for Wastewater and Environmental Surveillance (GLOWACON), which seeks to create an early-warning system for outbreaks.[131]

An under-appreciated aspect of surveillance is the need to look beyond developing countries and help strengthen pathogen surveillance and collective defence in allied countries to protect national security. NATO currently lacks adequate biosurveillance capabilities to detect engineered viruses from hostile states and terrorist groups. Although NATO published a new strategy on biotechnology last year, which acknowledged the "risks of new types of bioweapons created from accessible biotechnology research, including as fuelled by generative AI", the alliance has been slow to take action.[132] Some progress is being made by the EU via its recently announced project RApid Next Generation Sequencing for Effective Medical Response (RANGER), which will seek to use metagenomic sequencing to rapidly diagnose viruses in hospitals but does not focus on ports of entry.[133]

A NATO-wide metagenomic surveillance network, modelled on the US CDC's TGS programme, would provide early detection of biothreats at NATO borders. This first line of defence would strengthen biosecurity, prevent hostile use of pandemic-capable pathogens and encourage further investment in metagenomic sequencing, benefitting both security and the UK's biotech sector.

Given that creating new NATO-wide initiatives takes time, and NATO is now rightly focused on increasing its conventional security commitments, one option would be for the UK to pilot how an allied surveillance network could operate in practice through the Joint Expeditionary Force (JEF). This group of ten Northern European countries has a great deal of expertise in genomic sequencing – the UK, Denmark and Sweden are among the countries that have provided the most Covid sequences to GISAID, and together the JEF countries account for more than a quarter of global sequences.[134] JEF also includes some of those countries most at risk from hybrid-warfare attacks from Russia, including Finland and the Baltics.

**Recommendation:** Push for a NATO-wide pathogen-agnostic surveillance programme, modelled on the US CDC TGS programme. As a first step, the UK should seek to lead a pilot network across the ten JEF countries.

Finally, the UK should strengthen biosurveillance partnerships with allies such as South Korea and Israel, which face a high risk of increasing bioterrorism threats from hostile states like North Korea and Iran as well as terrorists.[135] Britain and other allied countries with advanced metagenomics-sequencing technology should explore the merits of biosurveillance partnerships with one or both countries.

**Recommendation:** Explore the potential for a metagenomics-biosurveillance partnership between the UK and countries most at risk of a bioterrorist attack, such as South Korea and Israel. This partnership should potentially involve other leading allied countries, such as the US, Germany and Japan.

## Rapid Information-Sharing

Surveillance alone is not enough – governments must rapidly share pathogen data to enable swift responses to biosecurity threats. Effective data-sharing ensures faster vaccine development, coordinated containment efforts and better global preparedness.

The WHO's proposed Pathogen Access and Benefit Sharing System (PABS) aims to standardise pathogen data-sharing for global pandemic preparedness. Member states would contribute pathogen samples to a WHO-led network, while participating manufacturers would provide a set percentage of vaccines and treatments in exchange for access.

The current draft of the treaty, agreed in Geneva in April 2025 and due to be ratified at the forthcoming meeting of the World Health Assembly, would require manufacturers to provide 20 per cent of vaccines and therapeutics to the WHO in a pandemic, with 10 per cent free of charge.

However, President Trump's decision to withdraw the US from the WHO risks severing key pathogen data-sharing frameworks such as PABS and the Pandemic Influenza Preparedness (PIP) Framework, limiting global access to critical surveillance data.[136] Ahead of its departure from the WHO next year, the US has already ceased the sharing of influenza data with the organisation.[137]

As the US's exit approaches, the UK and Europe must secure alternative pathogen data-sharing agreements, particularly for H5N1 surveillance. President Trump's commitment to identifying alternative partners provides a pathway for continued cooperation.[138]

The UK should urgently pursue a bilateral US agreement on influenza sample-sharing to ensure continued collaboration on H5N1 vaccine and treatment development. This could be built upon with similar agreements across other priority-pathogen families. Longer-term, the UK should work with NATO and Western allies to establish a multilateral pathogen data-sharing framework, ensuring continued collaboration with the US and other key partners.

**Recommendation:** Launch a rapid review of the impacts of the US suspending the sharing of samples and data relating to pathogens of pandemic potential with the WHO. Immediately seek a priority bilateral agreement with the US to facilitate sample-sharing relating to influenza viruses with pandemic potential.

## Mass Test-and-Trace Capabilities

A scalable, responsive testing system is critical for pandemic preparedness, yet the UK's Covid-19 response was hindered by slow implementation, limited capacity and poor infrastructure. During critical stages of the pandemic, testing capacity was inadequate, preventing accurate monitoring and delaying containment measures.

On 12 March 2020, when the UK switched from the "containment" phase of its response to the "delay" phase, only 4.1 tests were being conducted per confirmed Covid-19 case. This compares to 28.9 in South Korea, which rapidly scaled up capacity (using local testing centres, drive-throughs and walk-in clinics) and thereby enabled early containment and contact tracing.

The UK's limited laboratory infrastructure, combined with poor operational decisions and shortages of reagents and testing kits, delayed mass-testing capacity and hindered outbreak control.[139]

While UKHSA's new Diagnostic Accelerator should help improve the speed at which new tests can be made ready at rapid scale for a wider range of different pathogens, more must be done to avoid the repetition of past mistakes and ensure testing infrastructure is ready to scale at the onset of a pandemic.[140] AI and robotics can significantly enhance surge testing capacity. A 2022 pilot found that automated labs could process RT-LAMP Covid tests four times faster than traditional methods, demonstrating the potential for rapid scale-up in future pandemics.[141] Deploying automated testing facilities across the UK would reduce turnaround times and increase resilience during health crises.

**Recommendation:** The Biosecurity Taskforce should prepare to scale up UK testing by:

- Securing advance agreements for PCR-based testing scale-up, ensuring laboratories have contracts in place before a crisis.
- Expanding decentralised testing capacity, allowing rapid deployment of mobile and stand-up testing sites.
- Pre-negotiating procurement of point-of-care tests with private manufacturers, ensuring immediate availability.
- Integrating testing results seamlessly with contact-tracing systems, improving outbreak monitoring and response.
- Working with companies previously employed for Covid-19 testing to ensure that they have plans in place for immediate deployment of testing staff.

Contact-tracing apps are a crucial tool for early outbreak containment, yet the UK's rollout during Covid-19 was slow and ineffective. Germany launched its app in June 2020, while the UK delayed its version until September due to poor decision-making and a failure to collaborate with Google and Apple.[142] Despite the delayed start, the app did eventually prevent around one million Covid cases, 44,000 hospitalisations and around 10,000 deaths in its first year of use.[143]

However, contact tracing is most important immediately after a pandemic-capable pathogen has emerged. Detecting the first few people infected with a new virus, and those who have been in contact with them, presents the opportunity to prevent the pathogen from gaining a foothold.

**Recommendation:** The UK should pre-develop a contact-tracing app that is ready to deploy as soon as a pandemic-capable pathogen reaches high-risk thresholds. This proactive approach would prevent the delays seen during Covid-19, allowing rapid identification and isolation of early cases to contain outbreaks before they spread.

Wearable health technology offers an additional layer of early detection, providing real-time biometric data that can help identify infections before symptoms appear. AI-powered analysis of Fitbit and smartwatch data has

been shown to predict infections accurately, enabling faster testing and isolation.[144] Applied in the real world during pandemics, this could enable health-tech providers to give users an early warning that they may have contracted a pathogen and should seek a test as soon as possible.[145] More than one-third of UK adults already use wearable health technology,[146] and the health secretary is keen to support wearable technology through the government's 10-Year Plan for Health. Given their growing prevalence, wearables could significantly improve the UK's test-and-trace operations in a future pandemic.

**Recommendation:** The UK should partner with leading wearable health-tech companies to pilot AI-driven infection detection, integrating biometric data into early-warning systems for rapid testing and response. If successful, the Regulatory Horizons Council should assess and address any regulatory barriers preventing the use of wearable technology for early infection detection, and advise on robust privacy and data safeguards.

09

# Conclusion

Biosecurity means growth. To lead, the UK must think bigger and smarter about biosecurity – not as a constraint or a reactive measure, but as the foundation for innovation, investment and global influence.

Biosecurity means national security. The UK must ensure it can deter and respond effectively to potential bioweapon attacks, and work with allies to strengthen its collective defence.

Past failures – a slow pandemic response, weak industrial strategy and underinvestment – have been costly. Now the UK must act with urgency. That means securing supply chains, accelerating R&D, and making biosecurity central to economic and national-security planning.

The UK has the chance to lead – but only if it acts now. It can't afford to wait until the next crisis.

The UK has the talent and the technology. What it is missing is the focus and the execution. The countries that get biosecurity right will shape the industries of the future. The UK needs to be one of them.

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# Full List of Recommendations

## Strategy

- Reorganise Whitehall to drive a centralised approach to biosecurity, focused on acute threats to the UK, across all departments, by:
  - Appointing a Biosecurity Taskforce – a small team of biotech-industry experts within the Cabinet Office, led by a National Biosecurity Advisor.
  - Creating a National Security Council (Biosecurity) Subcommittee to consider matters relating to future pandemics and bioweapon attacks, chaired by the CDL.
- Expand the operations of the UKHSA and other biosecurity agencies by:
  - Increasing resource funding for UKHSA's day-to-day operations.
  - Immediately releasing sufficient capital funding for UKHSA's new Harlow site and the APHA redevelopment at Weybridge.
  - Reserving a sufficient proportion of the compute capacity pledged in the AI Opportunities Action Plan for UKHSA and biosecurity activities.
- The UK should develop a tiered biosecurity-response plan, informed by surveillance data from multiple settings with clear intervention thresholds, which then trigger action by the state.

## Prevention

- Bring forward secondary legislation to enable gene-editing in animals as a matter of urgency.
- Create a new Precision-Bred Livestock Resilience Challenge Fund to fund research programmes into reducing the risks of zoonotic spillovers from livestock, by reallocating funding away from the UKRI's Biotechnology and Biological Sciences Research Council.
- Establish an International Bioengineering Safety Panel to set global research standards and risk controls for high-risk fields like "mirror life" and other forms of synthetic biology.
- Introduce mandatory DNA-synthesis screening and oversight, including by:

    - Making it a legal requirement that all UK-based research and commercial activity procuring synthesised DNA use synthesis firms that have their orders screened for suspicious activity through an existing screening scheme such as the International Gene Synthesis Consortium. As a minimum first step, introduce this requirement for all UK government-funded research.
    - Introducing licensing requirements for all benchtop synthesisers used in the UK.
    - Working with the US and other Western countries to agree an international framework introducing mandatory screening requirements on DNA synthesis covering all research and commercial activities. This should include requiring manufacturers of benchtop synthesisers to monitor, screen and approve DNA synthesis against a regularly updated cloud-based database of sequences before synthesis can begin, and banning foreign benchtop synthesisers that do not comply with these standards.
- Strengthen deterrence against biological weapons by:
    - Setting up a new DIANA challenge and expanding NIF funding for biosecurity, with an initial focus on attribution capabilities, to invest in the development and scaling of emerging microbial forensic techniques.
    - Working with Western allies to agree a broad outline of coordinated measures to respond to different bioweapon-release scenarios, to form the basis of an “Article 5 for Biosecurity”-style deterrent.
    - Exploring the use of sanctions against individuals and companies linked to international biological-weapons programmes and reckless biological research, potentially through bespoke secondary legislation linked to the 2018 Sanctions and Anti-Money Laundering Act.
- Deter biological attacks on the UK by:
    - Considering strategic disclosure of biological defences as part of intelligence operations.
    - Delivering on the Biological Security Strategy commitment to secure rapid remediation capabilities and publicising this clearly.
- Deter Russian biological attacks on post-war Ukraine by committing to enhancing Ukrainian rapid remediation capabilities as part of any post-war security guarantee, including by:

- Deploying NATO's Combined Joint CBRN Defence Task Force to train Ukrainian forces in responding to CBRN incidents.
- Exploring whether the UK and US could expand the SIGMA+ sensor trial to include post-war Ukraine.

## Resilience

- Pursue participation in the EU's HERA programme through a funding contribution of £100 million to £150 million annually, securing access to European biosecurity R&D programmes while influencing their direction.
- Establish a Biosecurity Research, Innovation & Ventures Accelerator (BRIVA), modelled on BARDA DRIVe and HERA Invest, to fund biosecurity R&D and accelerate the development of medical countermeasures. BRIVA could be backed by £500 million over five years and funded by reallocating resources from UKRI's £9 billion annual budget.
- Establish a dedicated innovation fund and strengthen public-private partnerships to advance diverse vaccine platform technologies and bolster manufacturing resilience.
- The Biosecurity Taskforce should oversee the rapid development, licensing and deployment of medical countermeasures by:
  - Expanding APAs beyond influenza to cover priority pathogens, ensuring stable production capacity and supply-chain resilience.
  - Liaising with industry to signal demand for vaccine candidates at the earliest stages of threat identification.
  - Coordinating public-private partnerships to accelerate development and regulatory approvals.
  - Pre-negotiating agreements for fast-track approvals and strategic stockpiling of medical countermeasures.
- The Biosecurity Taskforce should:
  - Embed pre-approved adaptive clinical trial frameworks into the UK's Biological Security Strategy to enable rapid testing and deployment of new vaccines and treatments.
  - Ensure real-time data integration from electronic patient records to streamline trial enrolment and enhance discovery research.

    - Streamline regulatory processes and cut red tape, ensuring trial protocols are ready to activate immediately in response to novel threats.
- UKHSA should establish and maintain a strategic stockpile of vaccines, therapeutics and critical ingredients, including lipid nanoparticles and cell culture media, with regular supply testing to ensure emergency readiness. It should, where able, publish the contents of its stockpile to encourage a more substantive public debate on UK preparedness for biothreats.
- The UK should develop long-term agreements with CDMOs to secure priority production capacity for emergency vaccine and therapeutic manufacturing. DSIT should integrate CDMOs into the UK's industrial strategy, ensuring their manufacturing capacity can be leveraged for pandemic response and incentivising investments in modular and rapid-response manufacturing technologies.
- Establish a network of modular "lab hotels" to maintain warm manufacturing capacity, ensuring rapid scale-up in a crisis.
- Invest in antibody manufacturing capabilities to ensure immunocompromised individuals are protected in future pandemics.
- Amend the Online Safety Act to prevent social-media companies from promoting harmful health disinformation content within their algorithms. This would preserve freedom of speech by allowing adults to post and read disinformation, but without this content being actively presented to people through their newsfeeds. Existing fines and penalties in the Act would be extended to non-compliant platforms.

## Surveillance

- The UK should establish metagenomic surveillance at airports and seaports, using wastewater sampling to detect pathogens early and strengthen outbreak response, as well as inform government decisions on containment and travel restrictions. This should be modelled on the US CDC TGS programme and take the form of a public-private partnership that can leverage expertise from the private sector. The programme could be piloted at three airports, focusing on those with the greatest number of international flights, costing about £6 million per year and providing 30,000 samples each year.

- The UK should pilot a National Health Forecast system, using wastewater samples from sewers across the country to provide near-real-time infectious-disease tracking. A one-year pilot would cost £10 million, with the potential for scaling to full national coverage over two years for an additional £20 million.
- To establish an effective National Health Forecast, the UK should reform patient data-sharing regulations, easing restrictions like COPI to enable secure, real-time integration of clinical data with surveillance systems within the Biothreats Radar, ensuring faster outbreak detection and improved biosecurity innovation.
- Push for a NATO-wide pathogen-agnostic surveillance programme, modelled on the US CDC TGS programme. As a first step, the UK should seek to lead a pilot network across the ten JEF countries.
- Explore the potential for a metagenomics biosurveillance partnership between the UK and countries most at risk of a bioterrorist attack such as South Korea and Israel. This partnership should potentially involve other leading allied countries, such as the US, Germany or Japan.
- Launch a rapid review of the impacts of the US suspending the sharing of samples and data relating to pathogens of pandemic potential with the WHO. Immediately seek a priority bilateral agreement with the US to facilitate sample-sharing relating to influenza viruses with pandemic potential.
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- The UK should pre-develop a contact-tracing app that is ready to deploy as soon as a pandemic-capable pathogen reaches high-risk thresholds. This proactive approach would prevent the delays seen during Covid-19, allowing rapid identification and isolation of early cases to contain outbreaks before they spread.
- The UK should partner with leading wearable health-tech companies to pilot AI-driven infection detection, integrating biometric data into early-warning systems for rapid testing and response. If successful, the Regulatory Horizons Council should assess and address any regulatory barriers preventing the use of wearable technology for early infection detection, and advise on robust privacy and data safeguards.

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# Acknowledgements

The authors would like to thank the following experts for their input and feedback (while noting that contribution does not equal endorsement of all the points made in the paper).

Corinna Bull, Ellison Institute of Technology

Emily Clise, Ginkgo Bioworks

Miroslav Gasparek, Sensible Biotechnologies

Dr Vishal Gulati, Recode Ventures

Professor John Hammond, Pirbright Institute

Professor Mark Harrison, Oxford University

Daniel Kaszeta, independent CBRN expert

Jasmin Kaur, independent biosecurity expert

Craig Lewis, Pig Improvement Company

Sheila Mburu, International Pandemic Preparedness Secretariat

Dr Cassidy Nelson, Centre for Long-Term Resilience

Raj Panjabi, Flagship Pioneering

Heulwen Philpot, International Pandemic Preparedness Secretariat

Sutha Satkunarajah, Flagship Pioneering

Ask Eirik Storsve, Emergent BioSolutions

Marc Warner, Faculty

Joe Wright, EUK Consulting

Dr Sana Zakaria, RAND

# Endnotes


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