

MAKING IMPACT



**ONE
HEALTH
POULTRY
HUB**



2024

TRACKING VIRUS MUTATIONS TO PROTECT PEOPLE

The One Health Poultry Hub was less than a year old when SARS-CoV-2, the COVID-19 virus, was first detected in China. And it was in the midst of the Hub's first annual conference, in February 2020 in Gujarat, India, that international travel restrictions began to be imposed and the World Health Organization (WHO) and national health ministries across the world galvanised their efforts to avert calamity.

So it was, that as Hub scientists met to discuss how to implement their plans to investigate the potential pandemic risks of poultry production, that a real-life pandemic, with its roots in another part of the food system, was getting underway.

A central feature of the Hub's proposition was the application of a holistic understanding of disease evolution, emergence and management – this 'One Health' approach recognising that the complex science in these areas requires multiple inputs from multiple disciplines. Although a stated objective was to investigate how avian influenza ('bird flu') viruses move and evolve along poultry production and distribution networks as a way to predict future pandemics, as the pandemic unfolded that same One Health approach could be applied to the novel virus.

From the detection of the first positive COVID-19 cases, it was

clear that surveillance would be essential to track transmission of SARS-CoV-2. But useful though tracking disease transmission is in an outbreak situation, of even greater value is an understanding of how a fast-evolving virus is mutating as it spreads. Such information is like gold dust to public health decision makers, who can use it to inform the best steps to take to minimise disease spread. For example, it can help them determine if and to what degree social distancing should be recommended, or when and where lockdowns should be imposed.

Phylogenetics is this study of virus genomes and it can be used to gain insights into the infection or epidemic behaviour of viruses. It offers a picture of virus evolution and ecology,

IN BRIEF
A research proposal went from theory to practice in super-quick time when it found surprise application in the COVID-19 pandemic. Interdisciplinary techniques and new collaborations helped inform vital public health decisions.

showing how a virus mutates as it moves through a population. It is also a powerful way to understand virus transmission dynamics from just a small proportion of sampled infections. Scientists behind the Hub's interdisciplinary partnerships quickly refocused their work once SARS-CoV-2 was identified. Virtual discussions were convened and a plan put in place: partners skilled in



Sanitising Ahmedabad's old city in the wake of COVID-19 cases. Image: iStock.com/Kalpita Bhachech



Understanding how a fast-evolving virus is mutating is like gold dust to public health decision makers

genomic analysis would work closely with modellers on the other side of the world to generate vital information on viral spread and mutation.

Hub scientists worked together to investigate the transmission dynamics of SARS-CoV-2 in Gujarat during the Indian state's first epidemic wave. Genomic analysis (sequencing) took place at Gujarat Biotechnology Research Centre (GBRC), followed by phylodynamic analysis, using this data, in the UK at the Royal Veterinary College, University of Oxford and University of Edinburgh.

The use of these new methods to handle millions of sequences had not been seen before. It enabled researchers to investigate the early stages of the SARS-CoV-2 epidemic dynamics in a relatively short

time. The scientists were able to reconstruct the epidemic dynamics and spatial spread of SARS-CoV-2 in Gujarat. They showed how international travel was a major driver of the virus and how urban centres contributed disproportionately to the virus's spread. Ahmedabad, a city of 7.5 million – and, coincidentally, location for the Hub's first conference – was identified as a significant source of virus exportation within Gujarat.

The continued efforts of GBRC led to its inclusion in the SARS-CoV-2 Genomics Consortium (INSACOG), the pan-India network to monitor genomic variations in SARS-CoV-2, providing information to high-level public health committees at state and national level in India to aid the public health response. Moreover, GBRC was a core member of the State Pandemic Response Committee, chaired by the Chief Minister of Gujarat, for which genomics surveillance data, regularly updated, were used for policy decisions during the pandemic. UK analyses were communicated to the UK Scientific Advice Group for Emergencies (SAGE) and the UK's Chief

Medical Officer and Chief Scientific Officer .

Two and a half years on from the start of the pandemic, GBRC had completed sequencing close to 14,000 SARS-CoV-2 genomes.

In May 2020, GBRC also undertook wastewater-based surveillance of SARS-CoV-2, and proved for the first time the effective use of wastewater surveillance for this virus. Such surveillance requires far fewer samples and less labour than clinical testing to know the presence of infected people in a particular area. It also gives information about emerging variants in the population. The findings from this environmental surveillance enabled GBRC to give an early warning of just two weeks of the likely upcoming COVID-19 situation. The protocols used for this work are now referenced in World Health Organization (WHO) guidelines for completing public health environmental surveillance of SARS CoV-2.

FURTHER READING

GBRC Corona Virus Genome Resources: covid.gbrc.res.in/

'Genomic epidemiology of early SARS-CoV-2 transmission dynamics, Gujarat, India', in *Emerging Infectious Diseases*. Chaitanya G. Joshi et al.

'Phylodynamic approaches to studying avian influenza virus', in *Avian Pathology*. Lorcan Carnegie, Jayna Raghwaní, Guillaume Fournié, Sarah Hill.

'First proof of the capability of wastewater surveillance for COVID-19 in India through detection of genetic material of SARS-CoV-2', in *Science of The Total Environment*. Chaitanya G. Joshi et al.

Environmental surveillance for SARS-CoV-2 to complement other public health surveillance. World Health Organization, 2023.

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ABOUT US

The GCRF One Health Poultry Hub is an impact-driven research and development programme working to help meet Asia's growing demand for chicken meat and eggs while minimising risk to local and global public health. Working in Bangladesh, India, Sri Lanka and Vietnam, it is taking an interdisciplinary and intersectoral 'One Health' approach, exploring how rapid expansion of poultry production increases risk of infectious disease and why certain processes and behaviours are risky. It is funded by UK Research and Innovation through the Global Challenges Research Fund, a key component in delivering the UK aid strategy.

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