

PulseNet Asia Pacific

THE TRANSITION TO WHOLE GENOME SEQUENCING

The Global Cost of Unsafe Food

- **600 million** cases of **foodborne illnesses** occur globally each year¹
- **420,000 people die** as a result and **30%** of these are **children <5 years old**¹
- **275 million cases** occur in the **Asia Pacific**¹
- **Asia and Sub-Saharan Africa** have the **highest incidence** of disease²
- Annually **US\$110 billion** is **lost** to productivity and medical expenses²



What is PulseNet Asia Pacific?

PulseNet Asia Pacific (PNAP) is one of eight regional arms of PulseNet International (PNI), a global network established to improve public health by using **advanced molecular methods to track enteric bacterial foodborne outbreaks** across continents.

Over the last four years PNAP has focused on strengthening pathogen genomics capacity in the region using **DNA sequencing technology**, specifically **whole genome sequencing (WGS)** for **surveillance, outbreak detection** and **identification of antimicrobial resistance (AMR)** of **enteric bacterial pathogens**. When integrated into a public health system, this allows for a timely response to trace foodborne outbreaks and early detection of antibiotic resistant pathogens which prevents illnesses and deaths.

The network facilitates **capacity building, communication, data harmonisation** and **data sharing** amongst member labs with the end goal being **real-time data sharing** across the network.

CURRENTLY
22
MEMBER LABS



Why Use WGS?

Characterisation is an important step in identification and tracking of enteric pathogens.

In PNAP, the previous gold standard method for tracking was pulsed-field gel electrophoresis (PFGE). Increasingly, WGS is being implemented as it provides **more precise, comprehensive information**, and **higher resolution data** to strengthen enteric disease surveillance and outbreak response.

Crucially, WGS is also able to **identify and track genes** responsible for **AMR**.



AMR Detection

Antimicrobial resistance occurs when **pathogens evolve to resist the drugs designed to kill them**, turning treatable infections into deadly ones. AMR is an **increasing threat**, and it is **estimated** that it will result in over **10 million annual deaths by 2050** if there is no intervention, with the **highest burden falling on South and Southeast Asia**.³

MDR = multidrug-resistant

resist at least one agent in three or more drug categories/classes

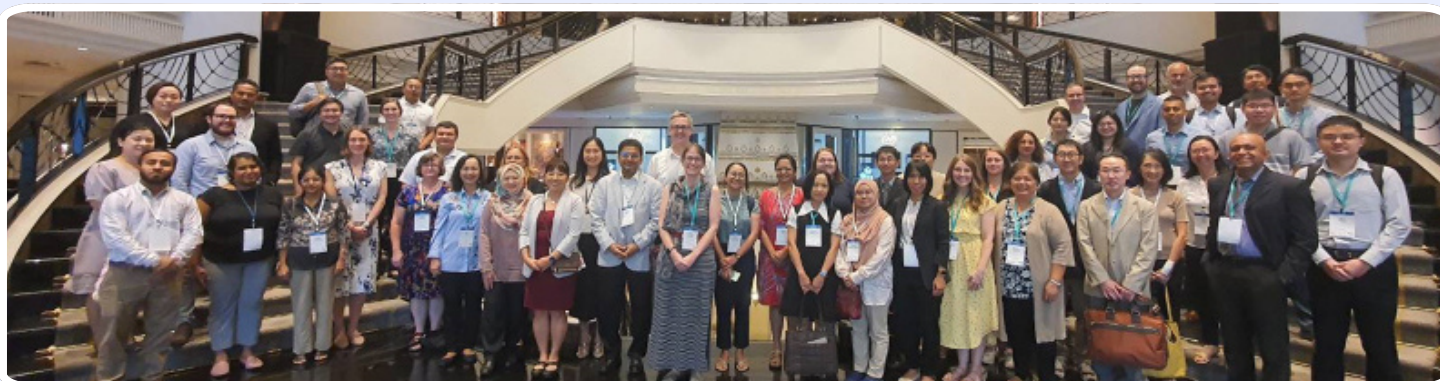
XDR = extensively drug-resistant

non-susceptibility to at least one agent in all but two or fewer antimicrobial categories/classes

Beyond the Instrument: Why Building Expertise is Key

The steps to procure and install sequencing infrastructure require a significant investment, therefore, consideration as to the feasibility and sustainability of its integration into public health laboratory practices must be duly considered. A competent and confident **workforce in wet lab sequencing, bioinformatics and genomic epidemiology is required for meaningful implementation, application and integration of pathogen genomics into public health laboratories.**

The PNAP feasibility study aimed to build the long term skills required to sustain and build on genomics implementation that is intentional and adaptable to the unique challenges of the region. **Since 2022**, PNAP has delivered **six training workshops**, having **trained over 40 scientists across 15 countries**. This training was followed by the provision of reagents to undertake the project in select sites, ongoing mentoring and troubleshooting assistance further refined capacities and capabilities. This future-proofing model with long term support helped to solidify training and skills building within country and encouraged the dissemination of knowledge and learning within country.

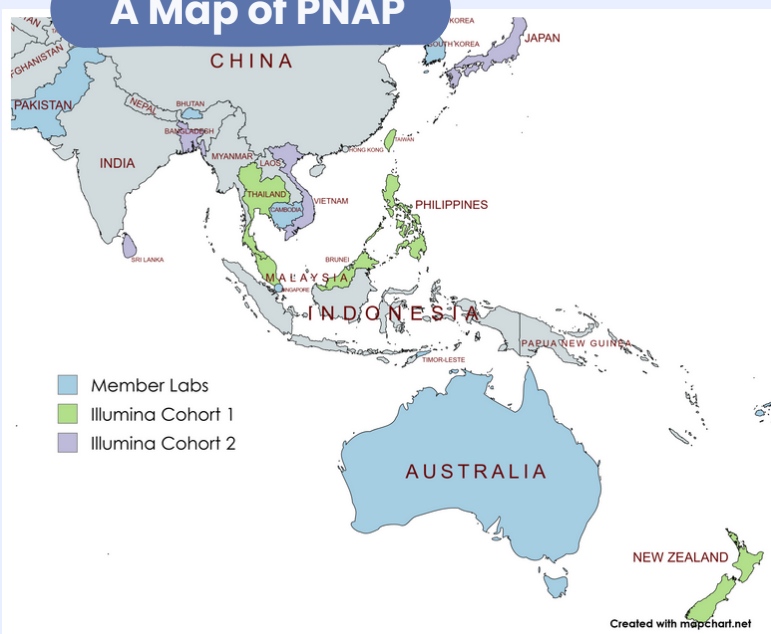


Feasibility Study

The PNAP Feasibility Study was designed to **facilitate the transition to WGS** and **demonstrate regionally coordinated capacity building, skills and data sharing.**

Eleven member laboratories across nine different countries participated. They were **trained on multiple methodologies** – essential for **equitable genomics access and sustainability**. This included wet lab training on both Illumina and ONT methods, and bioinformatic analysis using Terra.bio and Galaxy. Each laboratory sequenced and analysed 100 enteric bacterial samples to PNI standards. In 2026, our key focus is on the joint analysis and interpretation of data generated and how we can work towards better information and data sharing across the region.

A Map of PNAP



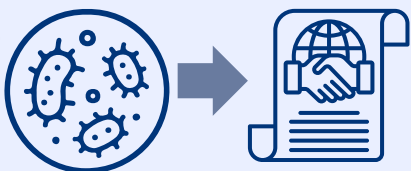
Feasibility Laboratories

Cohort 1

- **Malaysia** Institute for Medical Research
- **New Zealand** Institute for Public Health and Forensic Science
- **Philippines** Research Institute for Tropical Medicine
- **Taiwan** Taiwan CDC
- **Thailand** CDC Thailand
- **Thailand** Department of Medical Sciences Ministry of Public Health

Cohort 2

- **Bangladesh** International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b)
- **Japan** National Institute of Infectious Diseases
- **Sri Lanka** Medical Research Institute
- **Vietnam** National Institute Of Hygiene And Epidemiology
- **Vietnam** Pasteur Institute in Ho Chi Minh City



**1800+
SAMPLES
SEQUENCED IN THE
REGION**



Species of Interest

Campylobacter spp.

Escherichia spp.

Listeria spp.

Salmonella spp.

Shigella spp.

Vibrio spp.

Taiwan: From Pilot to Policy

Participation in PNAP has strengthened Taiwan's genomics capacity as they actively transition toward integrating WGS into their national surveillance system. PNAP-supported workflow development has improved the consistency and resolution of WGS for routine monitoring and outbreak investigations, enabling timely detection of MDR and XDR clones and more effective source tracing.

By standardising experimental and analytical workflows, Taiwan CDC are currently processing 2,500 isolates annually. The number of routine samples sequenced is expected to double with the addition of new sequencers in the laboratory. A multi-platform approach utilising ONT sequencing is being utilised for the bulk of the routine work and Illumina sequencing reserved for processing novel or uncharacterised species.

Taiwan CDC are now integrating PNAP-standardised laboratory processes into their national surveillance system to further enhance public health responsiveness.



Bangladesh: Moving Beyond Research

WGS in Bangladesh is largely research-driven and is not yet fully integrated into the public health system, creating challenges for routine implementation alongside existing diagnostic capabilities. PNAP support has allowed icddr,b to successfully sequence and analyse over 100 *Vibrio cholerae* genomes associated with cholera cases. This has led to the establishment of a genome analysis strategy, essential for incorporating WGS into public health surveillance and outbreak investigation.



Sri Lanka: On The Road to Self-Sufficiency

Sri Lanka has sequencing facilities and a strong public health system, however WGS is not used for routine infectious disease surveillance due to limitations in technical capacity and financial resources. The PNAP feasibility study significantly enhanced wet and dry lab capacity at MRI, and enabled the shift from a reliance on proprietary data platforms to the development of local, in-house data analysis, which is critical for long-term sustainability.

Support from PNAP has boosted laboratory confidence and capability. MRI, with further support from the Centre for Pathogen Genomics, was able to secure a WHO IPSN grant "Piloting the application of pathogen genomics for surveillance of food borne and AMR disease" to further apply their learnings.

MRI are hoping to continue their work in establishing genomic epidemiology as a routine tool for foodborne pathogen and AMR surveillance.



Vietnam: Scaling National Capacity

Vietnam has high enteric disease rates but lacks funding, resources, and policy for routine genomics, leading to gaps and delays in outbreak investigation. PNAP support built capacity and competence in sequencing. PI HCMC are now developing material to scale this knowledge nationally. They have engaged with the Ministry of Health to integrate sequencing into the national infectious disease surveillance program – a critical step to moving towards genomics-backed, source-traced surveillance.

Where To From Here?

The next phase of the program focuses on establishing a data sharing platform (Trakka) to allow the region to share data in real-time for epidemiological surveillance and outbreak detection. In completing the feasibility study we have **moved from basic training to a capable regional genomics workforce for enteric surveillance across 11 laboratories in the Asia Pacific**.

While the progress of the labs that participated in the feasibility study demonstrate what is possible, it is only the beginning. For a regional surveillance network to be effective, it requires regional representation, sustained capacity, resourcing and ongoing support to maintain the collaboration and coordination of systems needed to address public health threats that affect our region. PNAP strives to continue to broaden the network and secure sustainable resources to combat foodborne diseases in the Asia Pacific. For any questions, please contact us at PulseNet-AsiaPacific@unimelb.edu.au.



Acknowledgement and Project Funding

This project acknowledges the support and in-kind contributions from the PNAP Coordinators and team at the Centre for Pathogen Genomics, University of Melbourne and Microbiological Diagnostic Unit Public Health Laboratory at the Peter Doherty Institute. It was funded by the U.S. Centers for Disease Control and Prevention's (CDC) Antimicrobial Resistance Solutions Initiative through the **Global Antimicrobial Resistance Laboratory and Response Network** and by Cooperative Agreement Number CDC-RFA-CK21-2104. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the US Government.

References

1. Foodborne Illnesses in Asia-Pacific 'Needlessly' Sicken 275 Million Annually and Threaten Trade, FAO Regional Office for Asia and the Pacific (2019)
2. The Safe Food Imperative: Accelerating Progress in Low- and Middle-Income Countries, World Bank Group (2018)
3. Global Burden of Bacterial Antimicrobial Resistance 1990–2021: a Systematic Analysis with Forecasts to 2050, The Lancet (2021)