

Pakistan

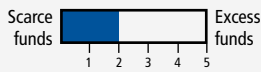
Country Profile

Results from the Asia PGI Landscape Assessment (2023)

This country report provides a snapshot of the status of pathogen genomic surveillance through next generation sequencing (NGS) in Pakistan. Results are based on a landscape assessment conducted with country experts working across the National Institute of Health, The Aga Khan University, University of Health Sciences Lahore, Khyber Medical University and Baqai Medical University. While pathogen genomic sequencing for surveillance is still a recently adopted practice in Pakistan, both national and global efforts are striving to make it a priority for the country's defence against infectious diseases. Findings below are presented through five overarching themes ranging from financing to bioinformatics and data sharing, including 16 key indicators covering major barriers in pathogen genomics sequencing and surveillance. The data captured below is as of March 2023.

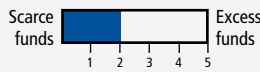
Financing

Sufficient funding for NGS



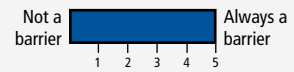
A ranking of perceived sufficiency of funding to support pathogen genomic surveillance over the next 5-year period.

Sustainable funding for NGS



A ranking of perceived sustainability of funding to support pathogen genomic surveillance over the next 5-year period.

Reliance on external support



Country reliance on external support for conducting adequate and effective NGS.

Policy and guidelines

Strategic plan

In progress

Status of national strategic plan which includes pathogen genomic surveillance.

National expert panel

Well integrated

Formation of national expert panel or technical advisory group mandated to advise government on pathogen genomic surveillance.

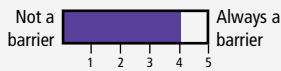
NGS guidelines for public health surveillance

Well integrated

Development of national guidelines for infectious disease surveillance using NGS.

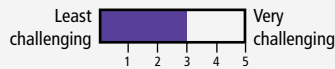
Supply chain

Equipment repair lead time



A ranking of perceived challenges with equipment repair lead time in the last 6 months.

Stock availability – reagents and consumables



A ranking of perceived challenges with reagents/consumables stock-outs for sequencing in the last 6 months.

Resupply time length

5.8
weeks

Average re-supply time between order and receipt at the laboratory for reagents and consumables.

Laboratory infrastructure

Laboratory capacity

7
0.3 per 10,000,000 population

Total number of laboratories in country performing NGS for infectious disease surveillance.

Sequencing output

150
6.7 per 10,000,000 population

Average monthly sequencing output within the past year.

Sequencing utilization

75%

Proportion of average actual monthly sequencing output over maximum monthly sequencing capacity for the past 12 months.

External quality assurance

Participating

Laboratories participating in any proficiency testing or external quality assurance audits for NGS.

Bioinformatics and data sharing

Bioinformatics pipelines for NGS

In use

Containerized, locally installed or in-house pipelines/workflows.

In use

Tools provided by NGS manufacturer or proprietary software.

Data sharing

> 75%

Estimated monthly proportion of sequences shared on public databases (eg. NCBI, GISAID) compared to total sequences.

Reporting frequency



Reporting frequency of pathogen genomic surveillance results to relevant government ministries.

Summary

- Between 2020 and 2022, 60% of NGS for pathogen genomic surveillance took place in the public sector and 40% in the private sector.
- None of the samples from Pakistan were processed out-of country.
- Over the past year, the estimated proportion of spending on NGS for pathogen genomics surveillance was;
 - » 60% from external partner-based funding,
 - » 25% through donations,
 - » 10% through academic grants,
 - » 5% from other entities like NGOs.
- There is currently no national annual budget allocation for genomic surveillance in the country.
- Policy guidelines for pathogen genomic surveillance are still under development.
- Pakistan has particularly limited resources allocated to the early stages of NGS such as sample pre-processing and wet lab sequencing. But the country has gained strong external partner support during COVID-19 through direct financing, donation of equipment and reagents, laboratory training, bioinformatics training, data processing and data analysis.
- Key external partners include The Bill and Melinda Gates Foundation, UK Health Security Agency, National Institute of Health USA, World Health Organisation, Wellcome, Centre for Disease Control etc. among others.
- Pakistan uses all the major sequencing platforms including Sanger, Illumina, Oxford Nanopore Technologies (ONT) and Thermo Fisher. However, none of the machines are currently running in full capacity.
- A national laboratory quality assurance mechanism exists. However, $\leq 25\%$ of laboratories conducting NGS for pathogen genomic surveillance have been certified or accredited by local/international recognized programs.
- Laboratory supplies & consumables were identified as major cost drivers followed by staff training as moderate cost drivers for direct sample and processing costs. With respect to indirect costs, maintenance contracts, supply chain & procurement-related costs were major cost drivers.
- The main process barriers faced by laboratories conducting NGS for pathogen genomic surveillance were related to reagents and consumables.
- All financing barriers for NGS were ranked as “always a barrier” highlighting that financing on the whole, ranging from inadequate national budgets to over-reliance on external funders, were perceived as a major barrier to performing NGS for pathogen genomic surveillance in Pakistan.
- In terms of the country’s main training priorities, data analysis and bioinformatics were ranked the highest.