PATHOGEN GENOMICS COST & SUPPLY CHAIN DYNAMICS

SOUTH & SOUTHEAST ASIA

PATHOGEN GENOMICS PRIORITIZATION & IMPLEMENTATION WORKSHOP

September 9-13, 2024
Bangkok, Thailand

WORKSHOP PARTNERS

CDC U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION

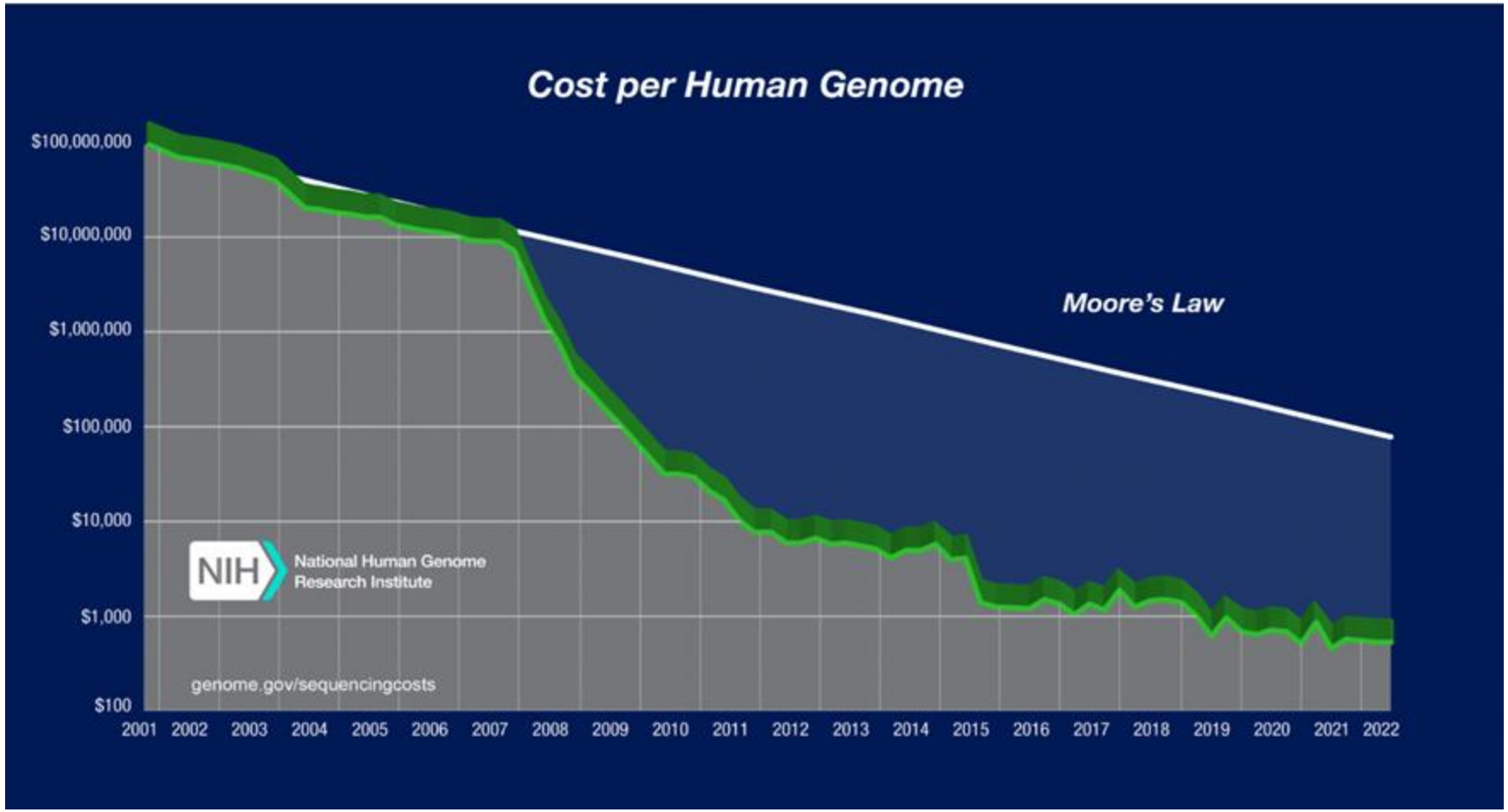
DukeNUS Medical School
Asia Pathogen Genomics Initiative

CENTRE FOR PATHOGEN GENOMICS

Sydney Infectious Diseases Institute
Centre for Infectious Diseases & Microbiology
WHO Southeast Asia Regional Office (SEARO)
WHO Western Pacific Regional Office (WPRO)
WHO International Pathogen Surveillance Network (IPSN)

Cost reductions in genomics

A historical perspective



Unraveling NGS cost drivers

Costing the NGS process

Nucleic acid extraction

Average nucleic acid extraction kit cost per sample

Library preparation + amplification

Amplification:
Total cost of kit, enzyme and nuclease water per sample
+
Thermocycler amortized cost per sample (10 years)

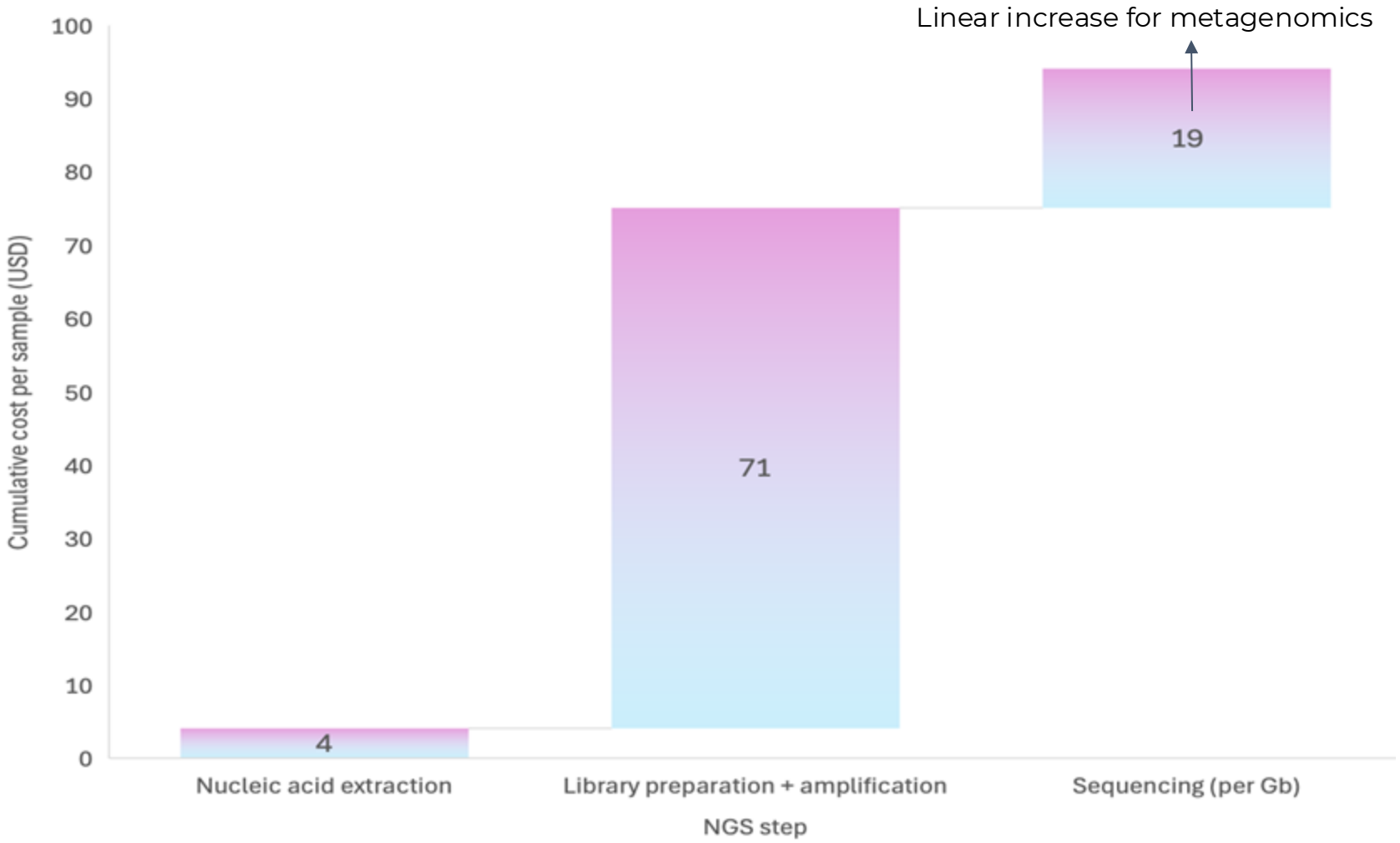
Library preparation:
Average kit and reagent costs per sample
+
Equipment (Qubit, Bioanalyser) amortized cost per sample
+
Other consumables cost per sample

Sequencing (per Gigabase)

Average flow cell costs per GBp
+
Average equipment and maintenance
(ONT MK1C,MGI G99, Illumina MiSeq) amortized costs per sample

NGS cost drivers

Cost per sample per Gigabase

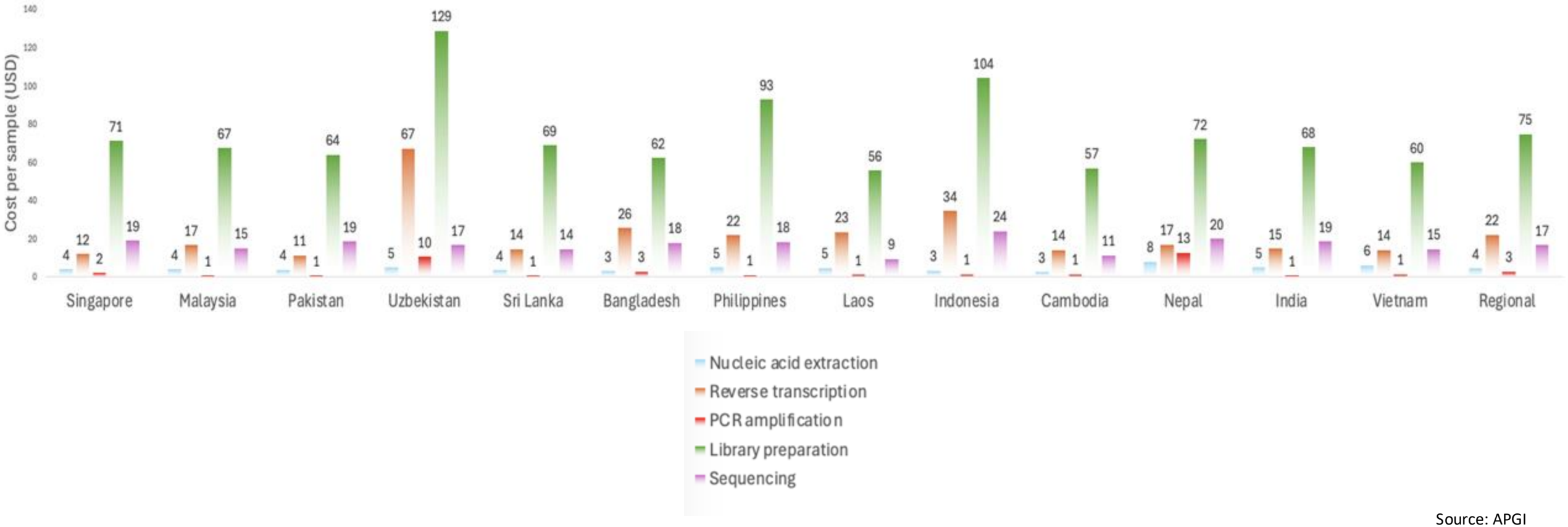


Source: APGI

NGS cost drivers

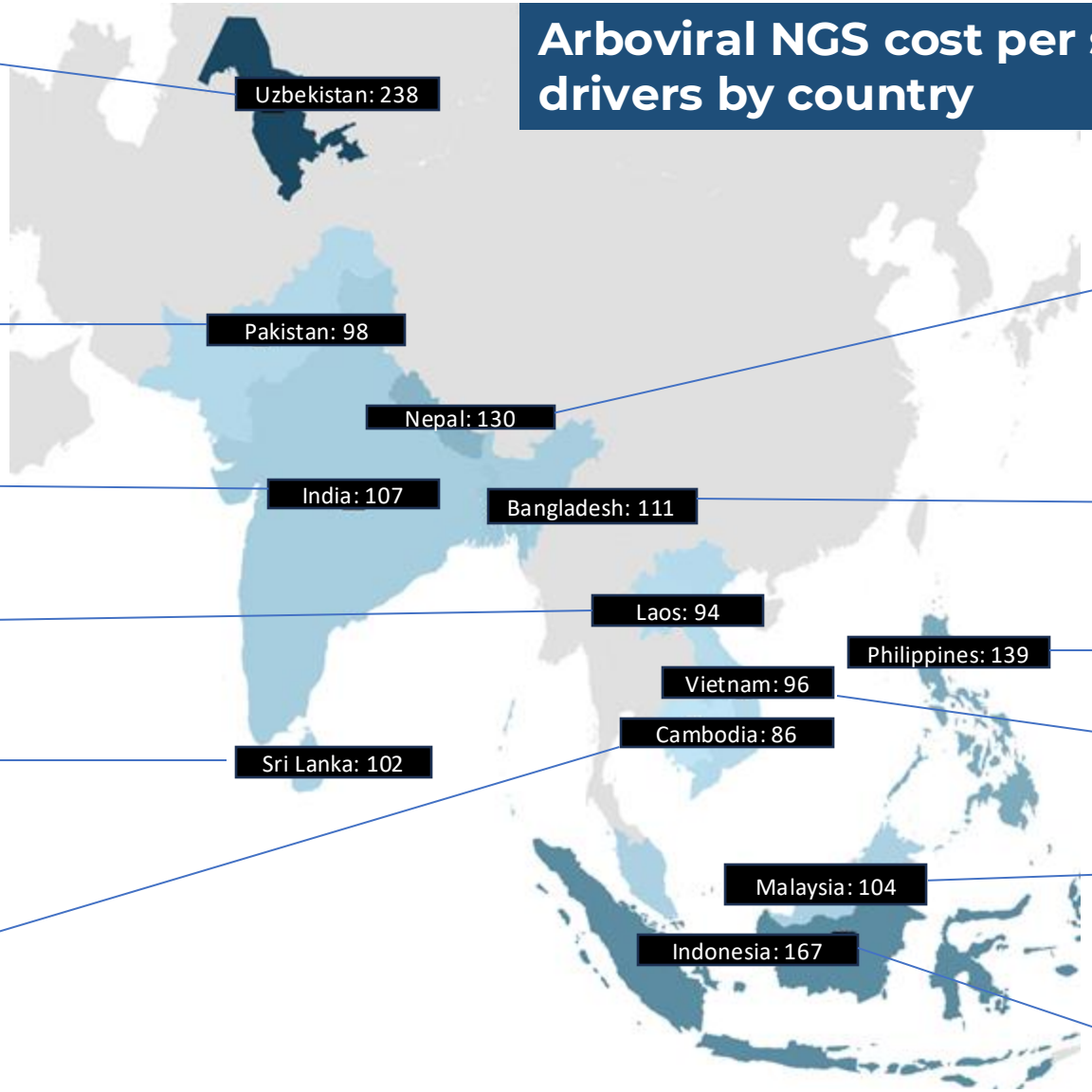
Regional variation

Average arboviral NGS cost per sample by country (USD)



Source: APGI

Arboviral NGS cost per sample (USD) and cost drivers by country



- Ukraine – Russia war
- Distributor charges

- Frequent change in technologies disrupt protocol standardisation and consistency of project results.
- Uses third party reagents

- Pooled procurement

- Shipping from Thailand

- Currency depreciation
- High VAT
- Pooled procurement – long lead times

- Maintenance cost

- Distributor charges - Sole authorised distributor from Malaysia despite closer distance to India.
- Pooled procurement – long lead times, decrease reagent shelf life

- Orders through tax exempted institutions
- Maintenance cost

- Shipping cost

- Distributor charges

- Distributor charges - no pricing transparency

- Shipping costs
- Maintenance costs
- Distributor charges

Source: APGI

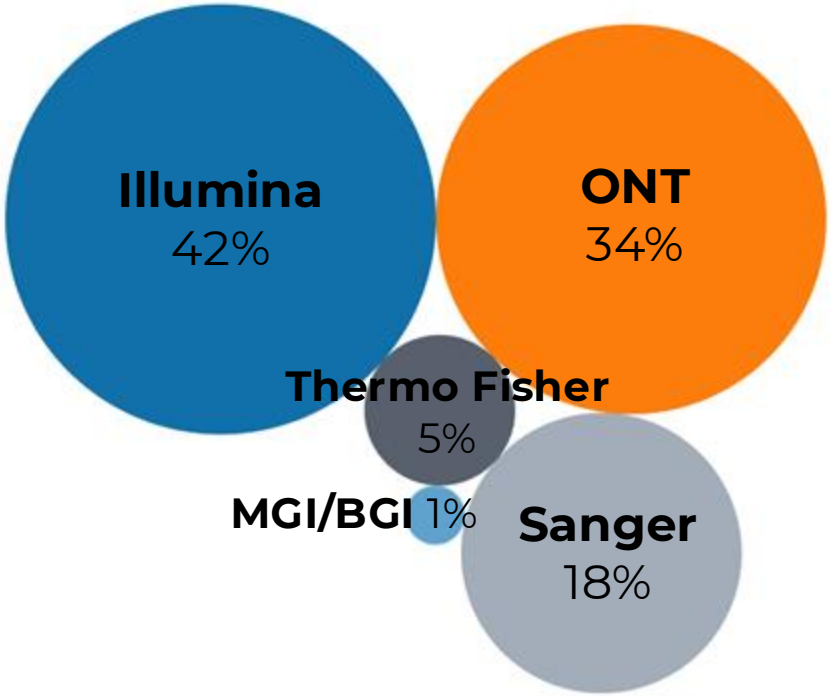
Supply chain inequalities

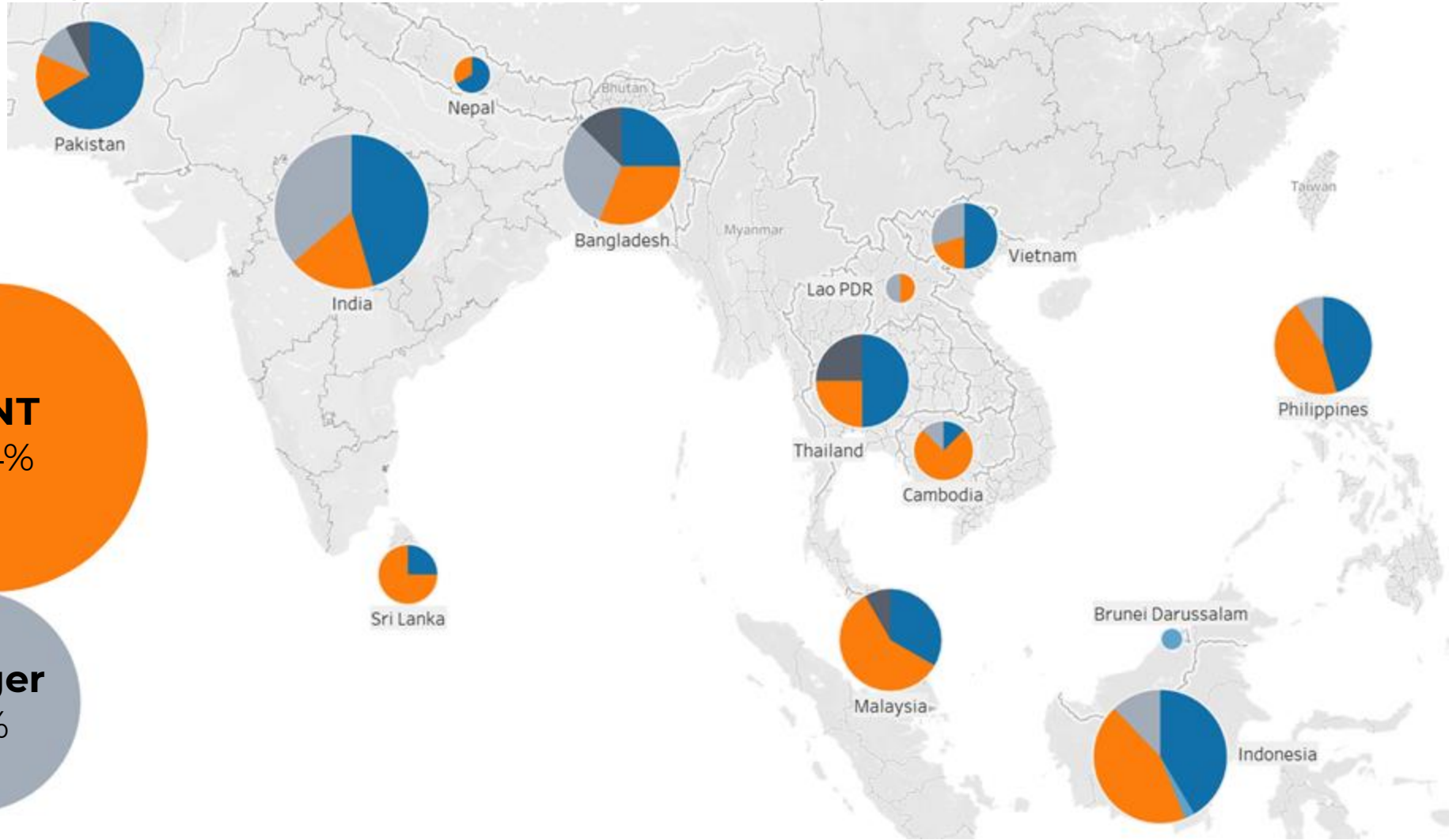
Driven by restricted market dynamics

13 countries

253 sequencers

156 laboratories

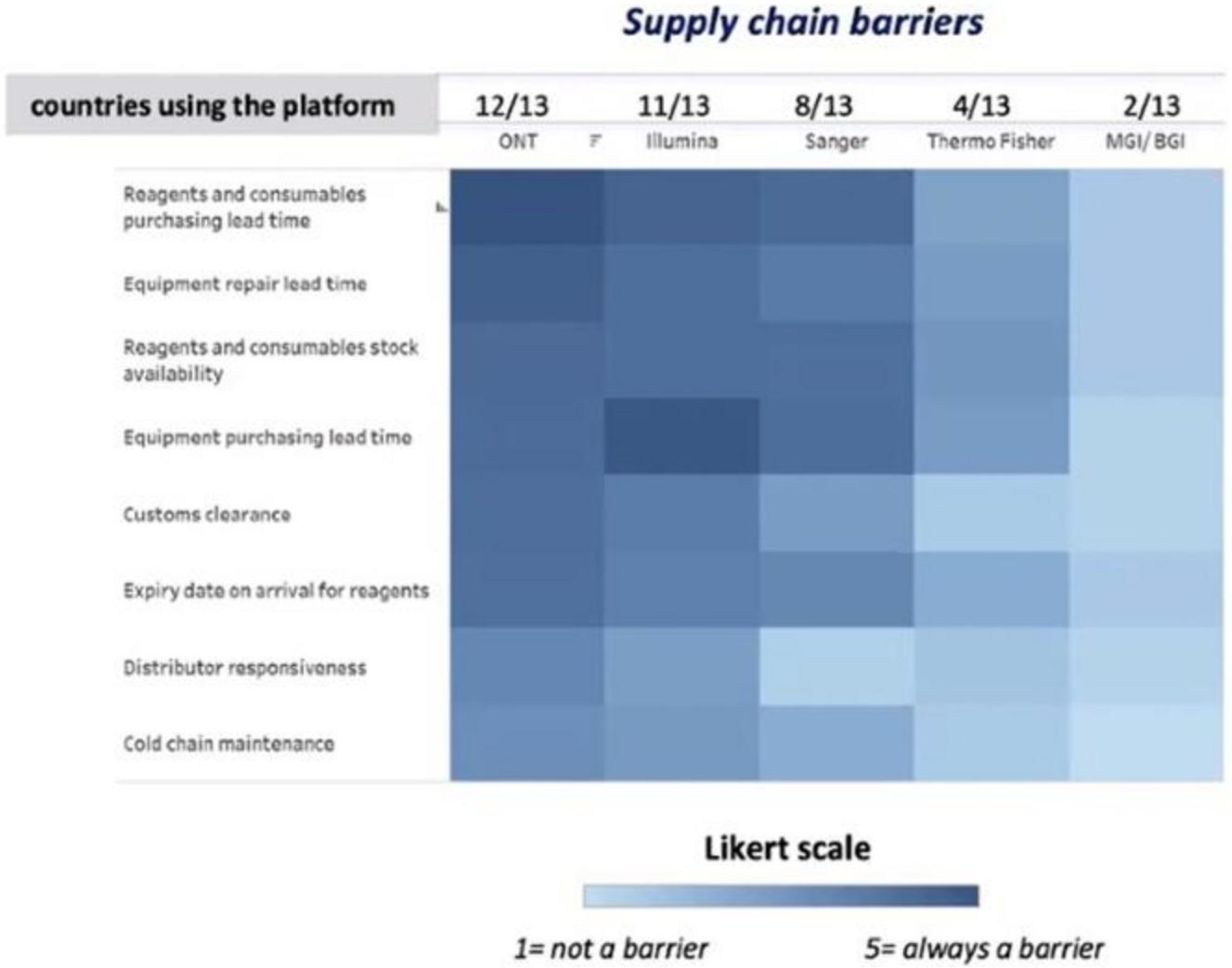




Source: APGI

Supply chain barriers

Platform comparison



Source: APGI

NGS access schemes

Preferential pricing and simplified ordering

illumina

Expanding Access to Genomics for Global Health

Illumina's Global Health Access initiative aims to increase equitable access to genomics worldwide, especially in low and middle income countries. The initiative establishes a robust and enduring framework across logistics, pricing, service and support and training that fosters coordinated utilization of genomics to bolster health systems and promote global health security. The initiative also enables discounted, consistent, simplified and transparent pricing of surveillance applications across regions, making it easier for budgeting and sustainable implementation of genomic surveillance.

The Initiative Provides:

- Set, discounted pricing for selected Illumina sequencing instruments and consumables for eligible organizations.
- Single-part-number ordering for library preparation, sequencing, and data analysis of important infectious disease genomic surveillance applications to simplify budgeting and ordering.
- No minimum order quantities required.

MGI

Pathogen Preparedness Program (PPP)

Infrastructure

Applications

Preferential Access and Pricing

Sequencers
Low – High Throughput
Local processing for bioinformatics

Option for Automation*

Single Pathogen
MTB DR, MPXV etc

Multiple Pathogen
>300 viruses, bacteria, fungi, AMR etc

Metagenomics

Access scheme comparison

Instrument pricing and specifications

Sequencer	DNBSEQ-E25RS	DNBSEQ-E25ARS	DNBSEQ-G99RS	DNBSEQ-G99ARS
Applications	Targeted Gene Sequencing, Gene expression, Small WGS (microbe, virus)		Targeted Gene Sequencing, WES, Methylation sequencing, Transcriptome Sequencing, Low-pass WGS, small WGS (microbe, virus)	
Built-In Bioinformatics Server	Standard Computing Module	Yes	No	Yes
Reads per Flow Cell	25 M		80 M	
Max. Flow Cells per Run	1		2	
List Price (USD)	45,000	69,000	165,000	205,000
Program Price (USD)*	23,000	36,000	85,000	102,000

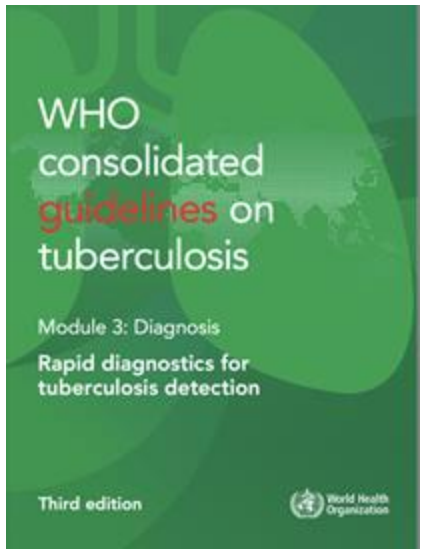
MiniSeq System

MiSeq System

	MiniSeq System	MiSeq System
Run time	4–24 hr	5–55 hr
Maximum output per run	7.5 Gb	15 Gb
Maximum single reads per run	25M[a]	25M[b]
Maximum read length	2 × 150 bp	2 × 300 bp
Data analysis offerings[c]	BaseSpace Sequence Hub, Illumina Connected Analytics, on-premises DRAGEN server	BaseSpace Sequence Hub, Illumina Connected Analytics, on-premises DRAGEN server
GHAI price	$ 42,075	$ 84,150

Access scheme comparison

Illumina GHAI DR-TB applications



Lib Prep

Seq

Report

Genoscreen Deeplex Myc-TB Combo Kit with IDP library prep, 48 samples

MiSeq Reagent Kit v2 (300 cycles)

Software analysis

Cost per test

USD 109

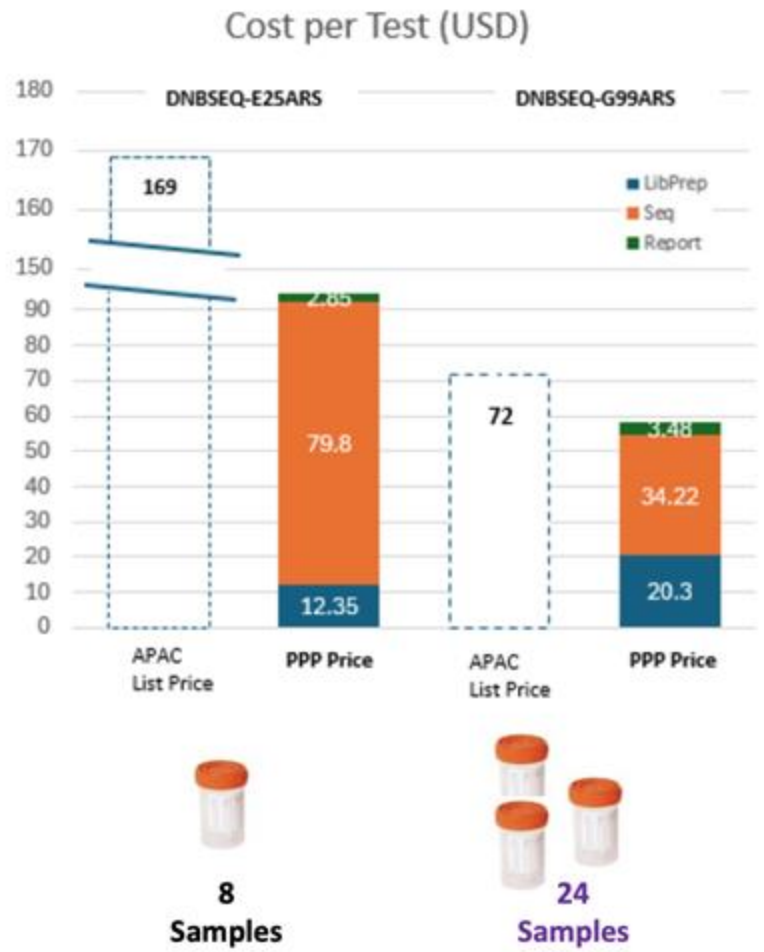
USD 100

Source: Illumina

Access scheme comparison

MGI DR-TB PPP applications

Lib Prep	• ATOPlex MTB Library Preparation Set USD 1,830 (96 Rxn) / Kit	• ATOPlex MTB Library Preparation Set USD 1,830 (96 Rxn) / Kit • DNBSEQ One Step DNB Make Reagent Kit USD 210 (4 Rxn) / Kit
Seq	• DNBSEQ-E25RS FCL PE150 USD 620 / Kit (3M reads / sample, 8 / FC)	• G99 SM FCL PE150 USD 860 / Kit (3M reads / sample, 24 / FC)
Report	• MTB-Explorer Software USD 60 / 16 Reports	• MTB-Explorer Software USD 60 / 16 reports



Source: MGI

Strengthening procurement capacity

Access schemes benefits and future direction

Pricing transparency and distributor charges

Service and maintenance costs

Shipping costs

Taxes and duties

Access scheme information

Guidance notes for APGI partners

Contains information on:

GHAI and PPP products: pricing and specifications

Eligibility for GHAI and PPP

Distribution networks

Post sales support

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Jitendra Narayanan
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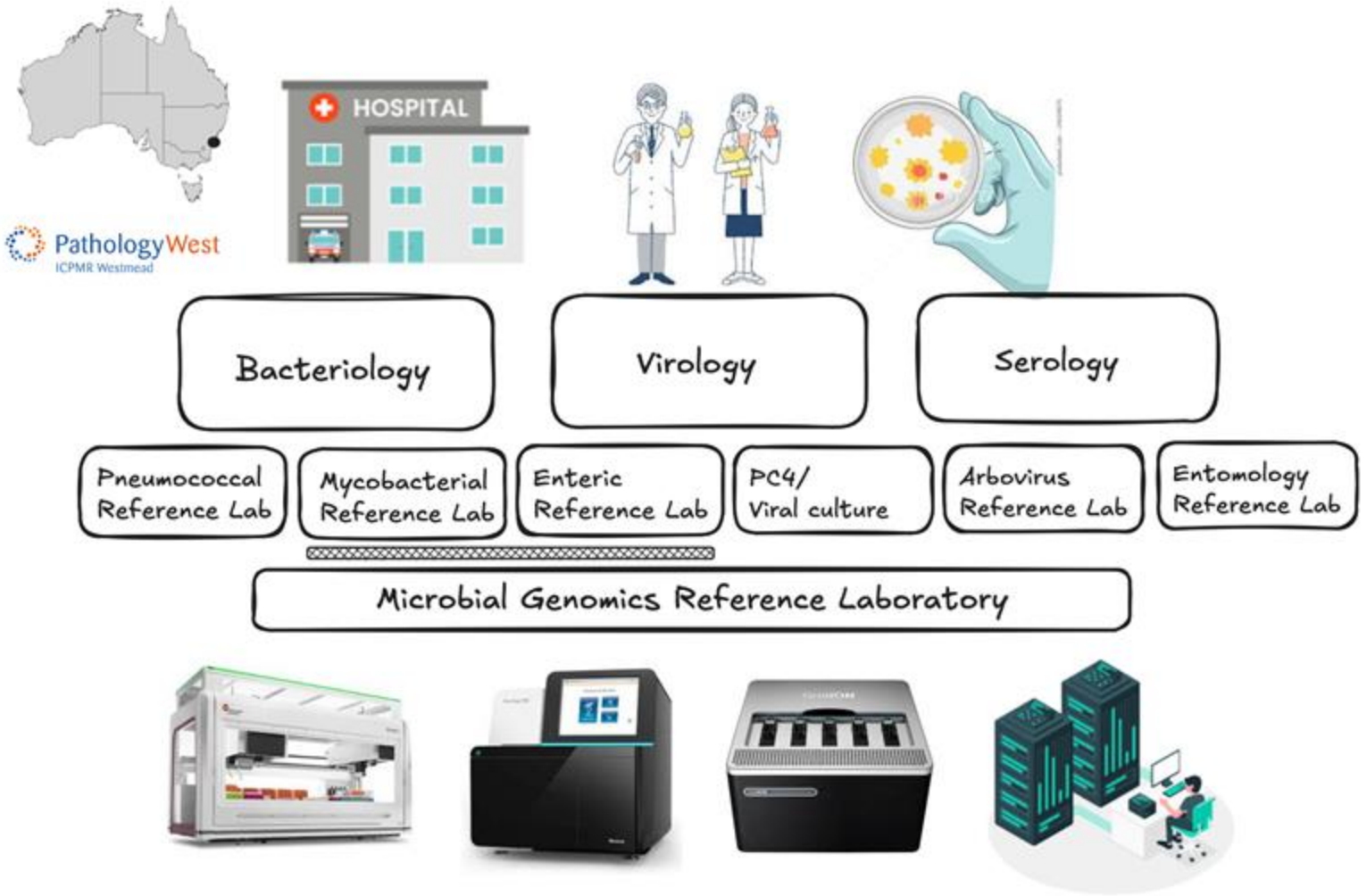
National Public Health Laboratory, Singapore

OPTIMIZING NGS COSTS IN LABORATORY SYSTEMS AND PROCESSES

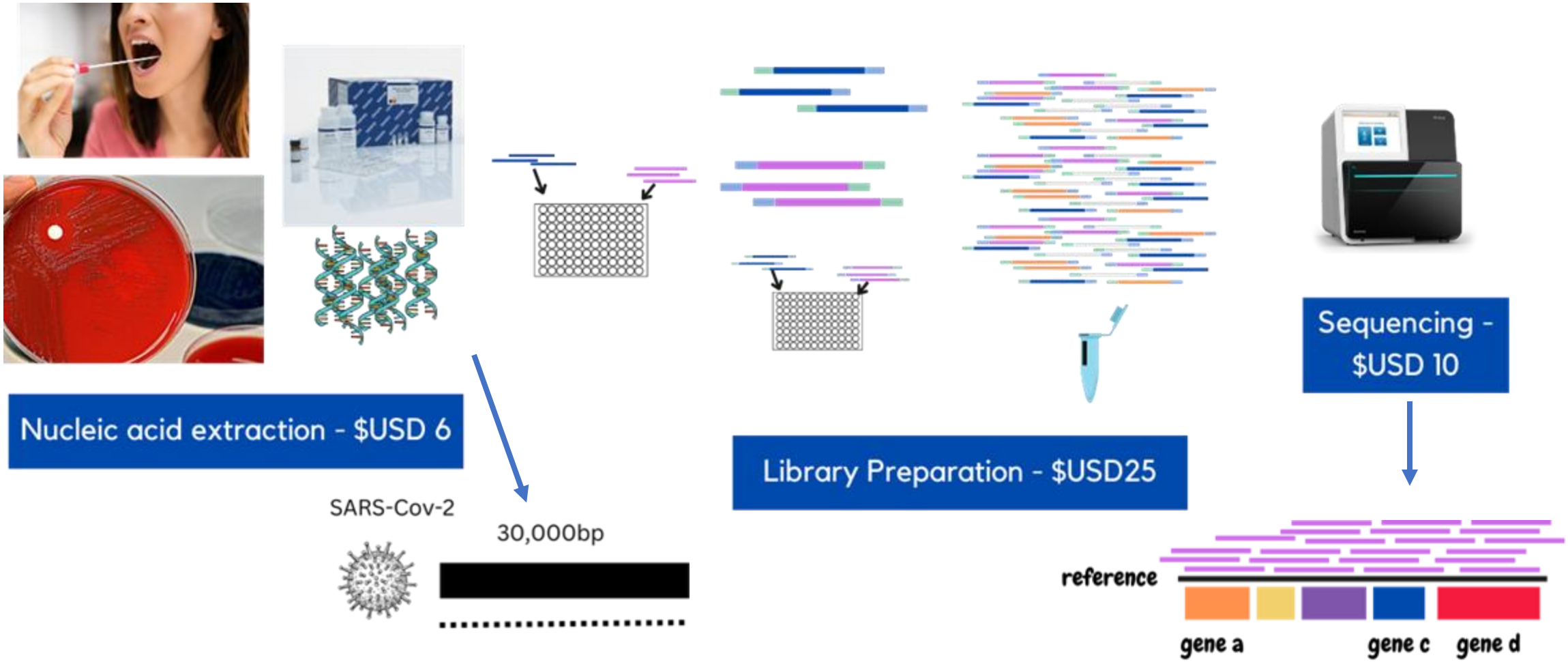
Integrated laboratory networks

Cost-sensitive design



Reducing costs in NGS sequencing

Sequencing workflow & costs



Reducing costs in NGS sequencing

Miniaturizing library preparation

- Using non-Illumina library preparation kit
- Miniaturization of library preparation
  - Use ½ or ¼ of the recommended library preparation reagent volumes
  - Common practice many laboratories
  - Reduces library preparation costs to USD$12.5 or USD$6.25
  - Can be done without robotics
- Increase batch sizes

Miniaturization protocols
https://doi.org/10.1371/journal.pone.0283219

Reducing costs in NGS sequencing

Increasing sequencing breadth

SARS-Cov-2

30,000bp

mpox

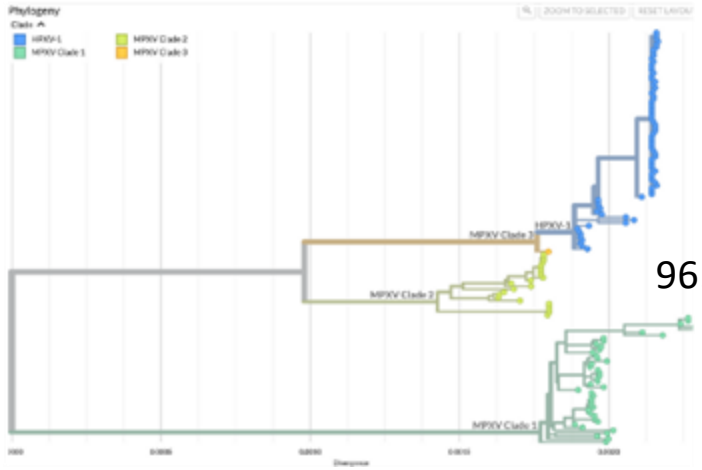
200,000bp

influenza

13,000bp

JEV

7,000bp



clade II amplicons

96.5% nucleotide identity

clade I amplicons

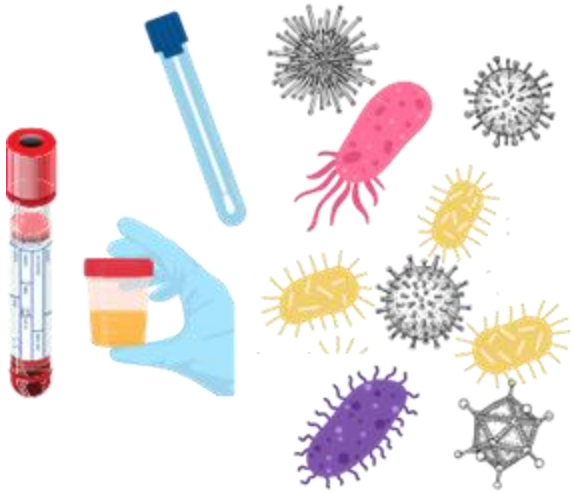
primalscheme

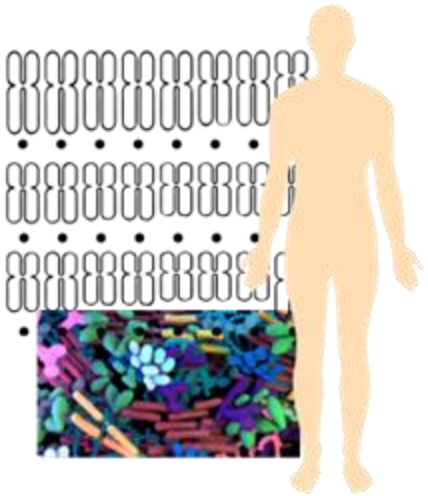
primer panels for multiplex PCR

https://primalscheme.com/

Reducing costs in NGS sequencing

Metagenomics workflow and costs



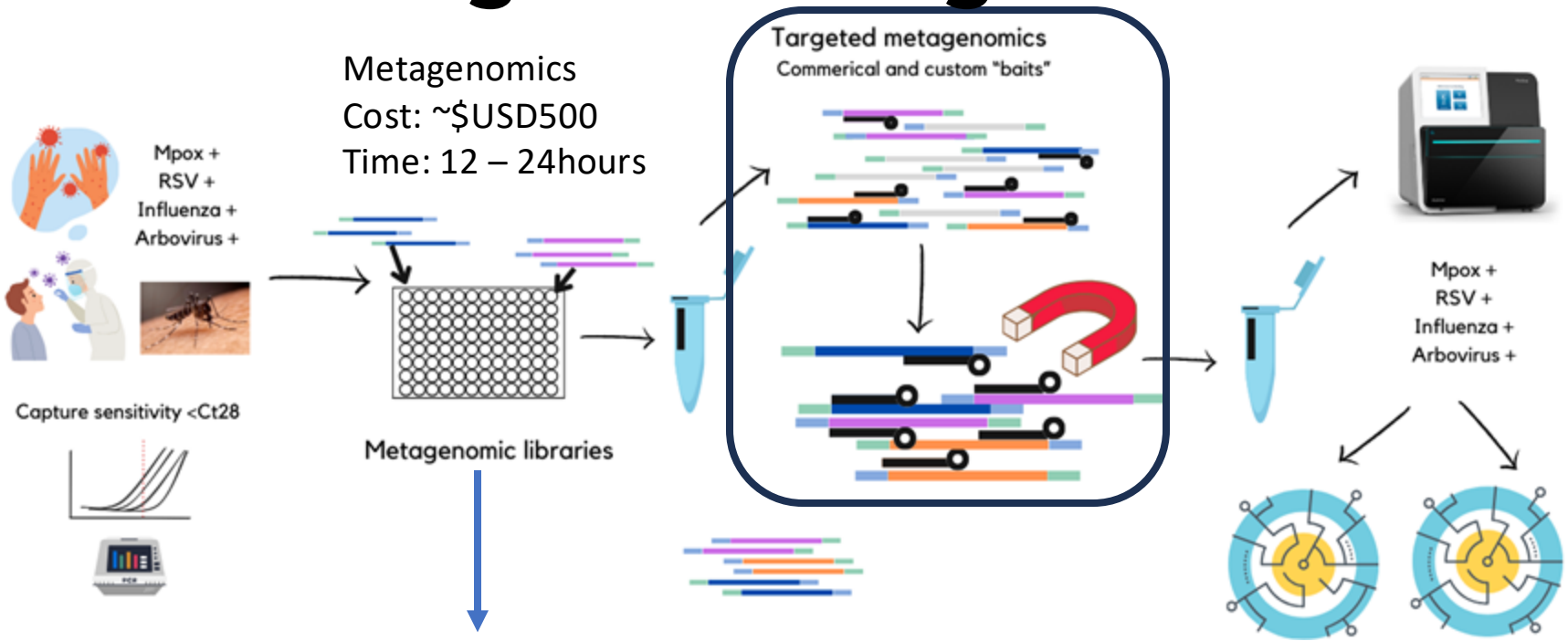


Whole genome amplification
Cost: $USD100
Time: 24 – 48 hours

Metagenomics
Cost: ~$USD 500
Time: 12 – 24 hours

Reducing costs in NGS sequencing

Targeted metagenomics



Time:
Library prep - >12hours
Capture – 17 hours
Cost ~ $USD30

List price of capture alone = $USD26
Recommended 12plex captures
Can be increased to 96plex captures = $USD2.5
Or
Probes can be diluted 1:100 then used in singleplex = $USD3.5

THANK YOU!

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