



Denmark is light green, what about the red ones?

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European AMR surveillance

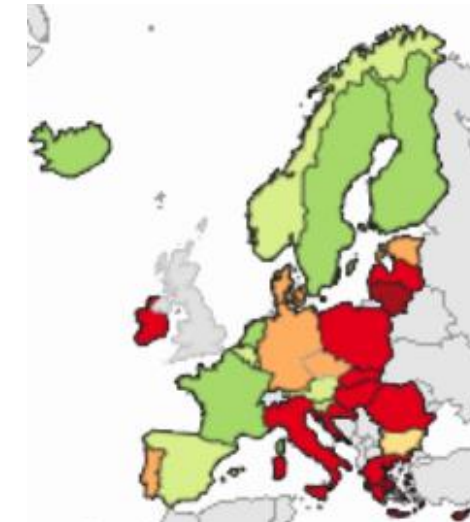
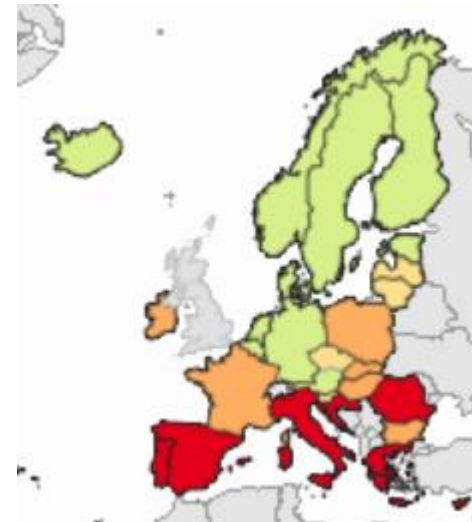
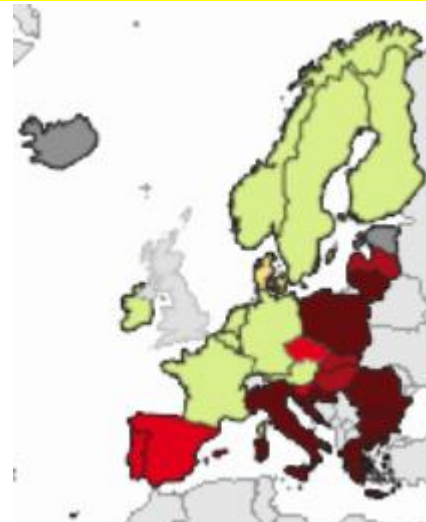
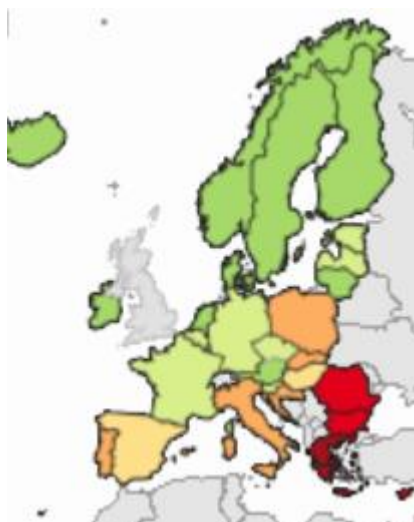
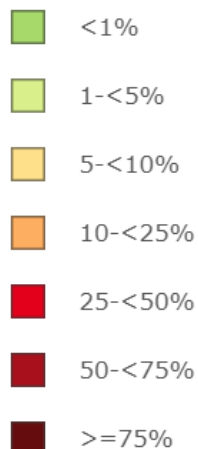
Klebsiella pneumoniae
Carbapenem Resistant

Acinetobacter species
Carbapenem Resistant

Methicillin Resistant
Staphylococcus aureus

Vancomycin Resistant
Enterococcus faecium

R - resistant isolates,
percentage (%)



The need for capacity building in Public Health laboratories in Europe

COVID-19 exposed disparities in health systems across Europe, which has triggered **large EU investments** to detect and monitor SARS-CoV-2 variants and **revision of legislation** to ensure a more structured EU-level approach to future health crises



Regulation on serious cross-border threats to health and repealing Decision

No 1082/2013/EU

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R2371>

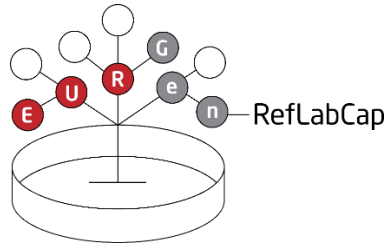
The national competent authorities
...shall communicate ... to the
participating authorities of the network
for epidemiological
surveillance:

**...molecular pathogen data, if required
for detecting or investigating serious cross-border
threats to health**

EU 4health initiatives

2021-27

- WGS infrastructure – HERA incubator– *supporting the capacity of local microbiological laboratories to perform whole genome sequencing (WGS)- (SSI: MicrobeSeq)*
- Ensure WGS capacity in NRLs– *supporting EU member states in building capacity at their AMR reference laboratories- (EURGEN-RefLabCap & FWD-AMR)*
- Increase bioinformatic capacity and integration of WGS in Public Health – *training of laboratory specialists, epidemiologists and bioinformaticians/IT managers to understand, use and integrate WGS data in their monitoring and public health systems- (GenEpi-BioTrain)*



EURGen/ FWD-AMR-RefLabCap



- 4-year contracts (Dec. 2020 – Dec. 2024)
- Funded by HaDEA
- Managed by DTU and SSI
- Coordination with ECDC and DG SANTE

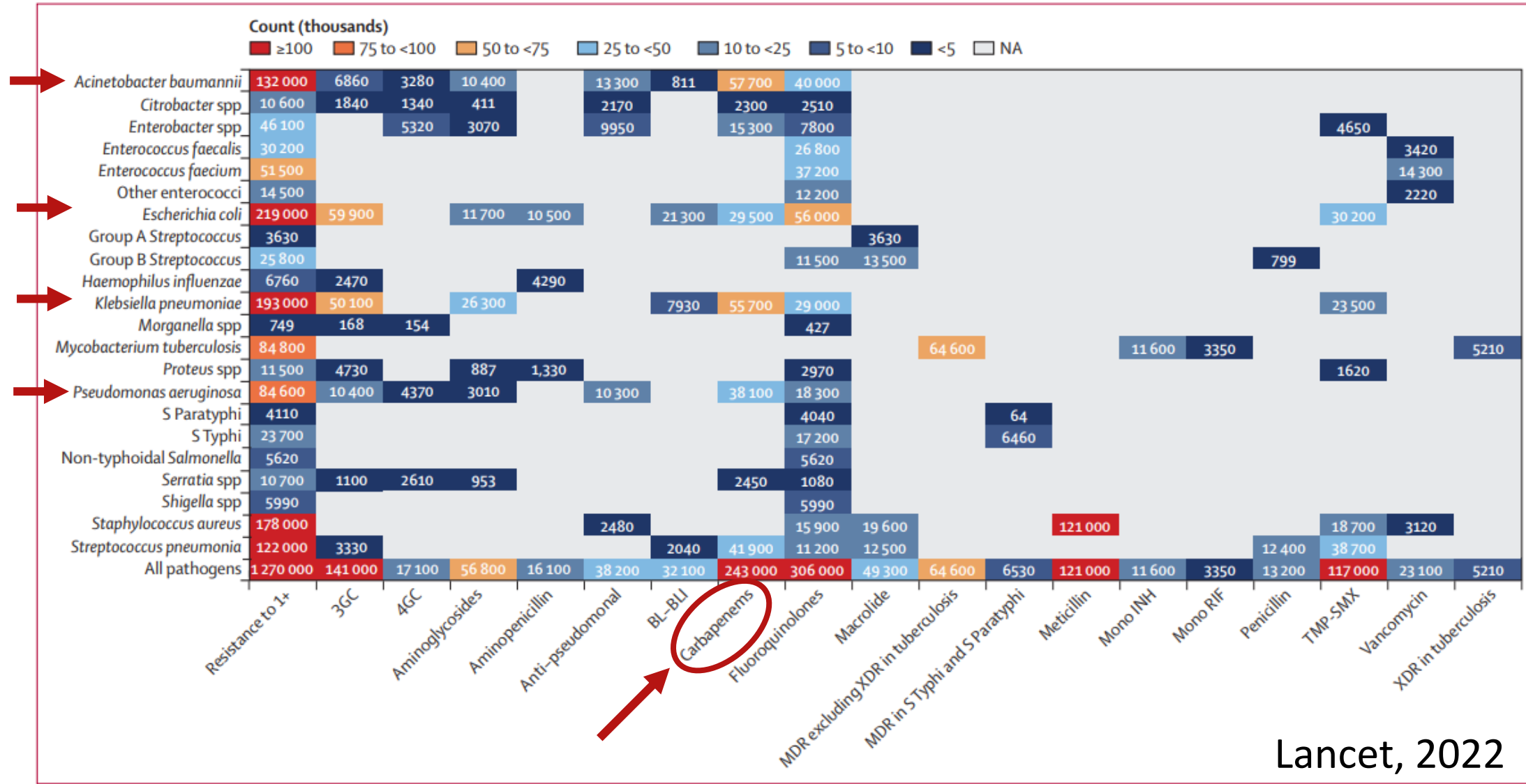
www.eurgen-reflabcap.eu

* HaDEA: European Health and Digital Executive Agency, DTU: Danish Technical University, ECDC: European Centre for Disease Prevention and Control, DG Sante: EU Commission Directorate-General for Health and Food Safety

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Carbapenem-resistant organisms are among the leading pathogens for deaths attributable to resistance (2019)



Lancet, 2022



Carbapenem-resistant organisms are among the top priorities for research and development of new antimicrobials

Panel: WHO priority list for research and development of new antibiotics for antibiotic-resistant bacteria

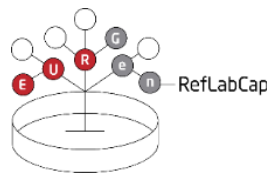
Multidrug-resistant and extensively-resistant *Mycobacterium tuberculosis*²⁵

Other priority bacteria

Priority 1: critical

- • *Acinetobacter baumannii*, carbapenem resistant
- • *Pseudomonas aeruginosa*, carbapenem resistant
- • Enterobacteriaceae, carbapenem resistant, third-generation cephalosporin resistant

Tacconelli et al., 2018



IMPACT

Reduce mortality and morbidity from infections with CCRE, carbapenem- and/or colistin-resistant *Acinetobacter baumannii* (C/CRAb) and *Pseudomonas aeruginosa* (C/CRPa) and improve patient safety

OBJECTIVE

Improve diagnosis and reporting of consistent and timely surveillance data on CCRE, C/CRAb and C/CRPa enhanced by Whole Genome Sequencing (WGS)

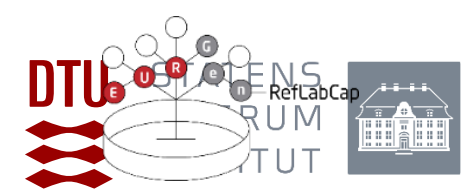
TASKS

- Capacity building activities** provided to NRLs
- to improve functions for AMR
 - to strengthen the role of the NRL to build capacity in regional and local laboratories

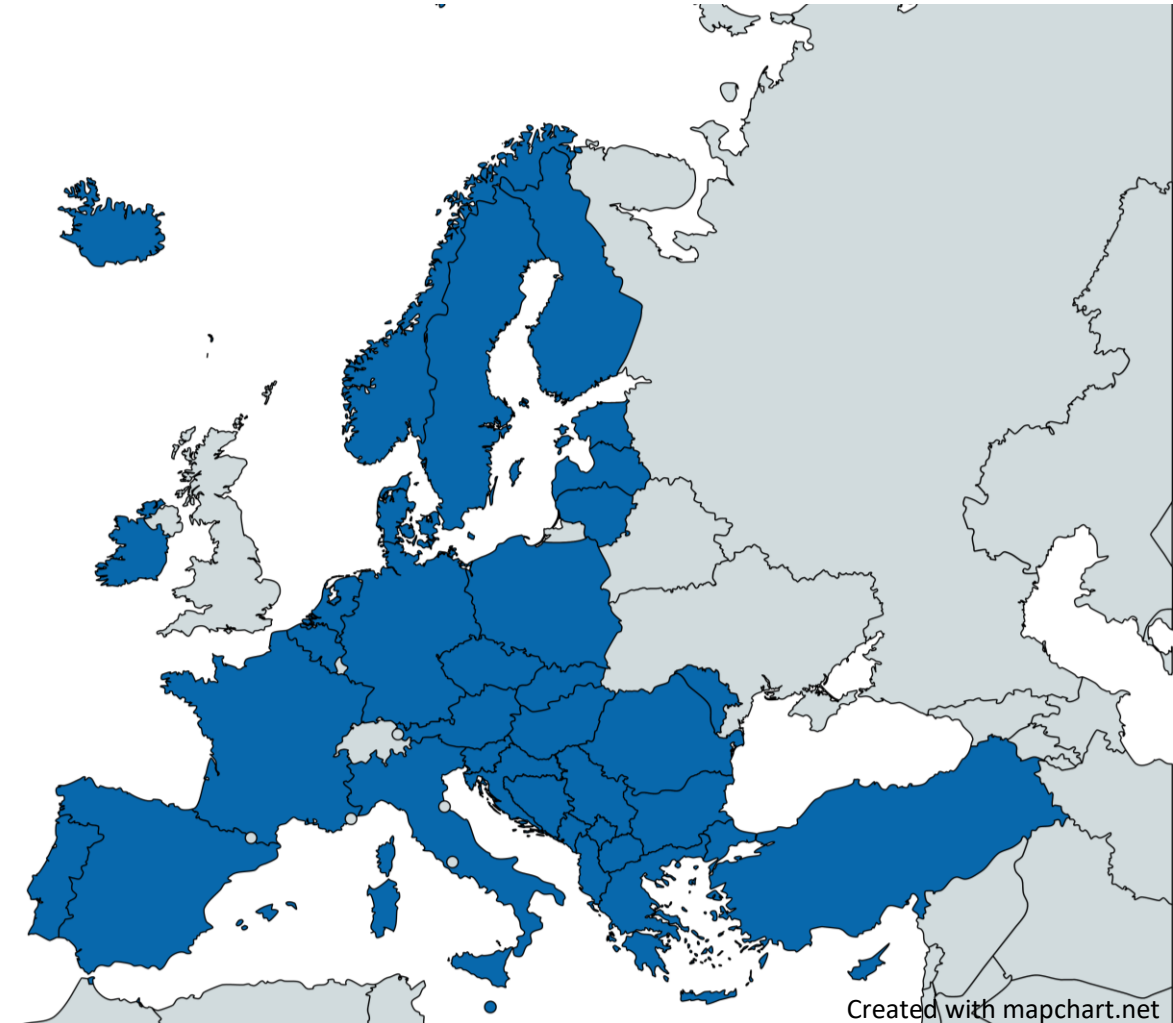
Modernisation of diagnostic and molecular typing tests using **WGS**



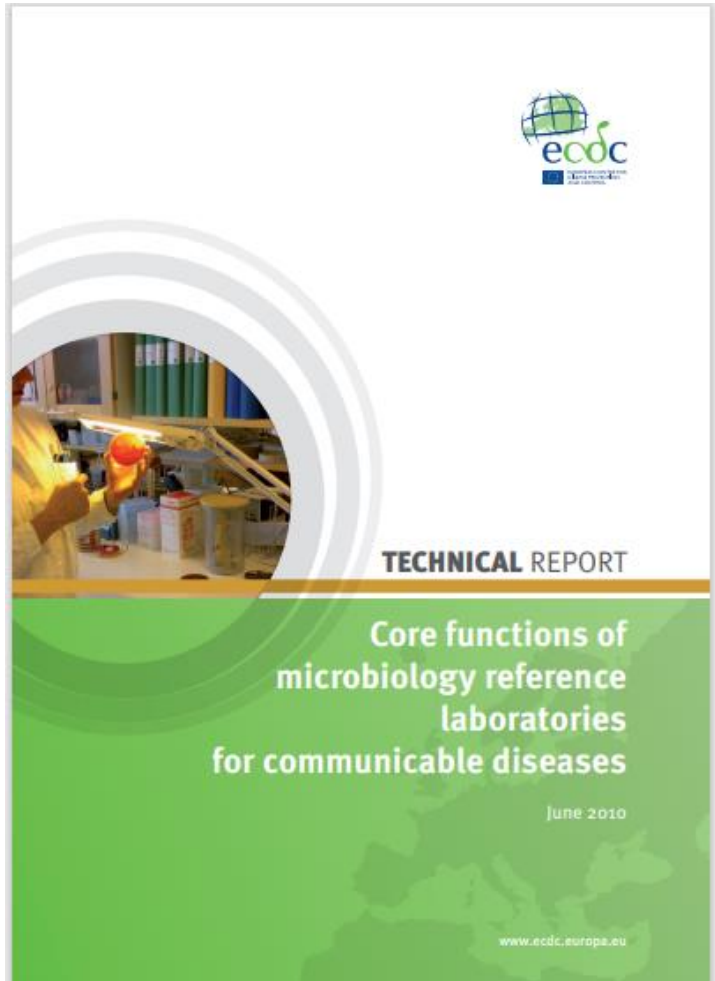
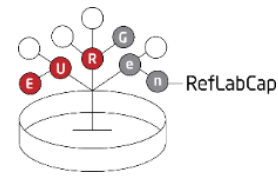
EURGen-RefLabCap network



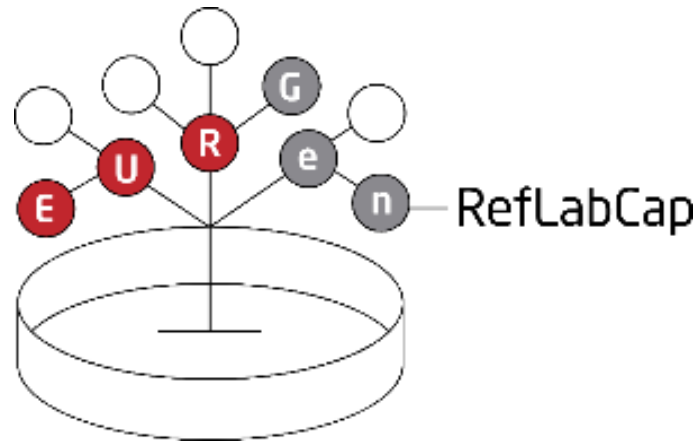
37 countries in Europe



EURGen-RefLabCap focus areas



Activities



Mapping surveys

Provision of guidance documents

Training courses on laboratory and surveillance methods

EQA

Train-the-trainer courses for development of national networks

Bespoke consultations

GenEpi-BioTrain



- 4-year contract (2023-2026)
- Funded by ECDC
- Managed by DTU and SSI
- Executed within a consortium of research and public health institutions in Europe





GenEpi-BioTrain

Support countries in building capacity for the **routine use of genomic information** for surveillance, preparedness and outbreak response

Why?

Who?

- Public health professionals:
- w. background in computational biology/bioinformatics
 - w/o. specific background in bioinformatics (microbiologists and epidemiologists)

Where?

DTU and SSI (DK),
IP (FR), KUH (SE),
RCB (DE), THL (FI)

GenEpi-BioTrain

How?

In-person and online training sessions

Pathogen waves

What?

2023-2026

When?

Pathogen waves in GenEpi-BioTrain

Year

1

Respiratory viruses (SARS-CoV-2, influenza)

AMR (CCRE, MRSA and *C. difficile*)

2

FWD (*Listeria*, *Salmonella*, STEC) (TBC)

VPI (*N. meningitidis*, *B. pertussis*) (TBC)

3

Tuberculosis

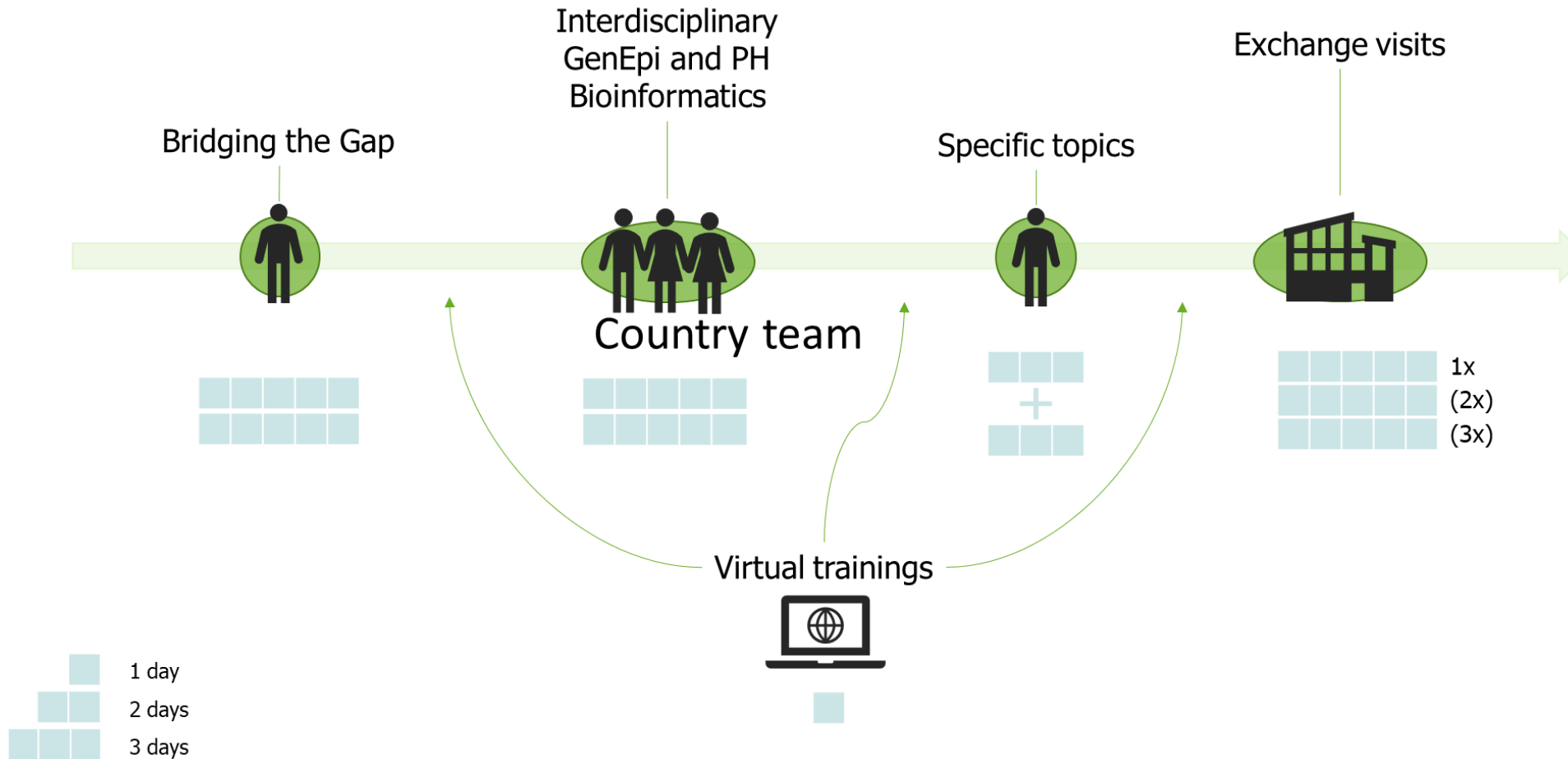
TBD

4

TBD

TBD

Training activities per pathogen wave in GenEpi-BioTrain



EU, Africa and Asia - at the same level building AMR and WGS capacity

1st stage
"Instrumentation"



2nd stage
"Building capacity"



"Modernisation of diagnostic and molecular typing tests used in health systems for the specified organisms using whole genome sequencing (WGS)"

3rd stage
"Train & Practice"

GenEpi-BioTrain

The UK AID Fleming Fund programme



- The Fleming Fund is a £ 235 Mill UK Aid programme supporting up to 25 low- and middle-income countries across Africa and Asia to tackle antimicrobial resistance with the aims to
 - We build partnerships across sectors, governments and organisations
 - We equip countries to collect and use data on drug resistance
 - We encourage clinicians and farmers to use antibiotics better
 - We encourage governments to invest in tackling antimicrobial resistance for a sustainable future
 - We encourage policy makers to make AMR a policy priority
- The Fund is managed by the Department of Health and Social Care and invests in strengthening surveillance systems through a portfolio of country and regional grants, global projects and fellowship schemes
- The programme was established in 2015 in response to the UK AMR Review and the WHO Global Action Plan on AMR, which called for funding to improve AMR surveillance, public awareness and responsible drug use



SeqAfrica objectives and goals



Aim

Generate data for action on the continent for the continent

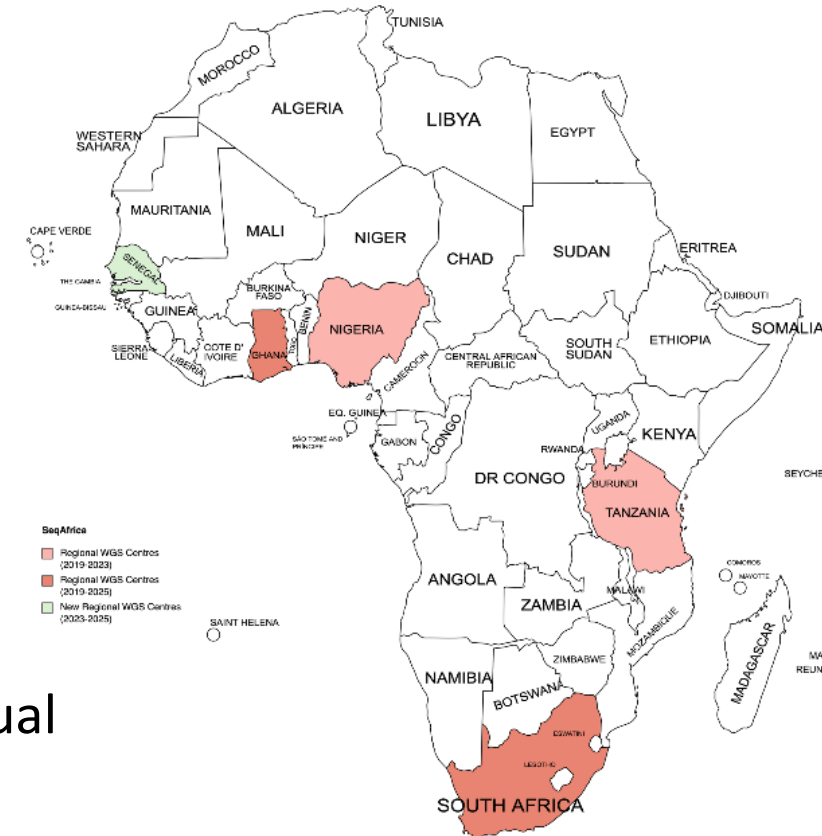
Project scope:

Capacity building for and support of AMR genomic surveillance efforts on the African continent through WGS of bacterial pathogens, bioinformatic analyses and training for all OH sectors

Goals

- Establish a network of 3 regional WGS sites (West, East and Southern Africa)
 - conduct genomic surveillance of AMR
 - act as a referral system for outbreak investigations and unusual AMR phenotypes
- Sequence 15.000 bacterial genomes
- In-person training of up to 25 individuals from FF countries on the use of WGS in AMR surveillance and bioinformatic analysis of sequencing data

<https://antimicrobialresistance.dk/seqafrica>



Achievements



Genomic data

- > 30,000 genomes
 - Bacterial and SARS-CoV-2
- 73% uploaded to public databases
- From 22 African countries

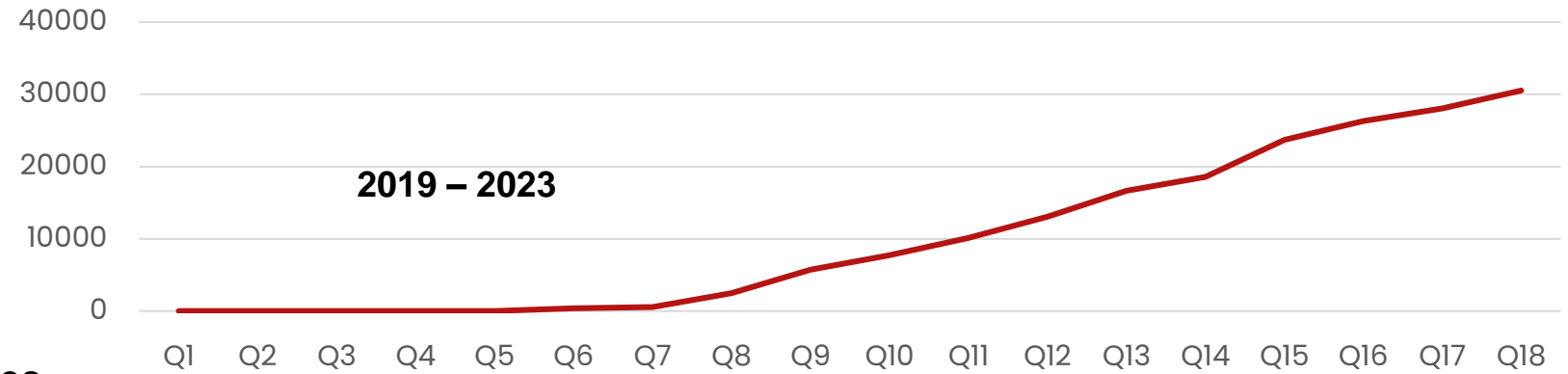
Training

- In-person and virtual
- Trainees
 - 18 African countries
 - Human and animal health

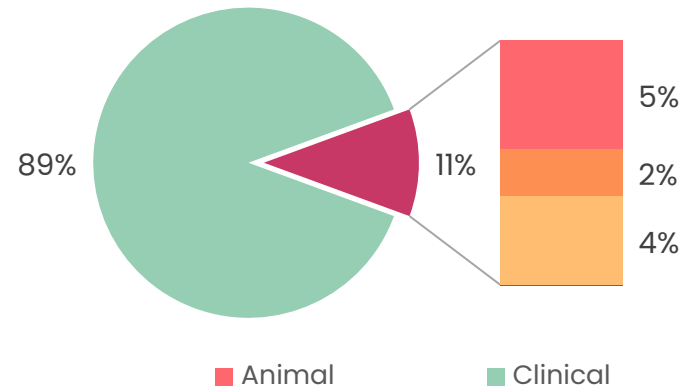
Publications

- 24 scientific publications
- More in prep

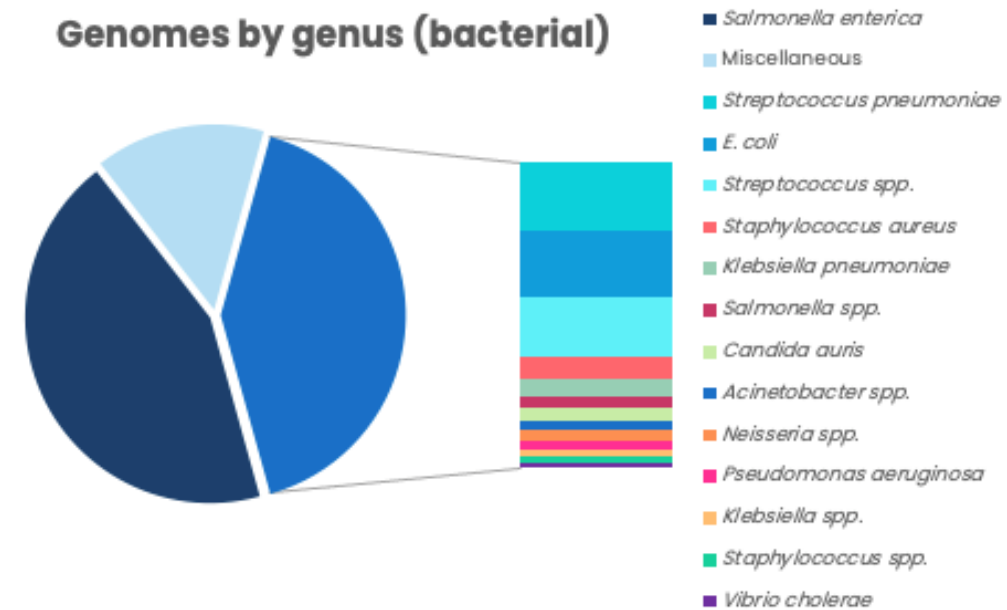
Total Genomes produced



Genomes by One Health source



Genomes by genus (bacterial)



“Democratizing WGS” - ONT and lab-top solutions

- Moving WGS to front to few line diagnostics and into the field for AMR surveillance
- ONT multiplexing and sequencing
 - Up to 12 isolates per flow cell
- Laptop-based analysis to identify, species, resistance determinants, plasmid replicons and clonality

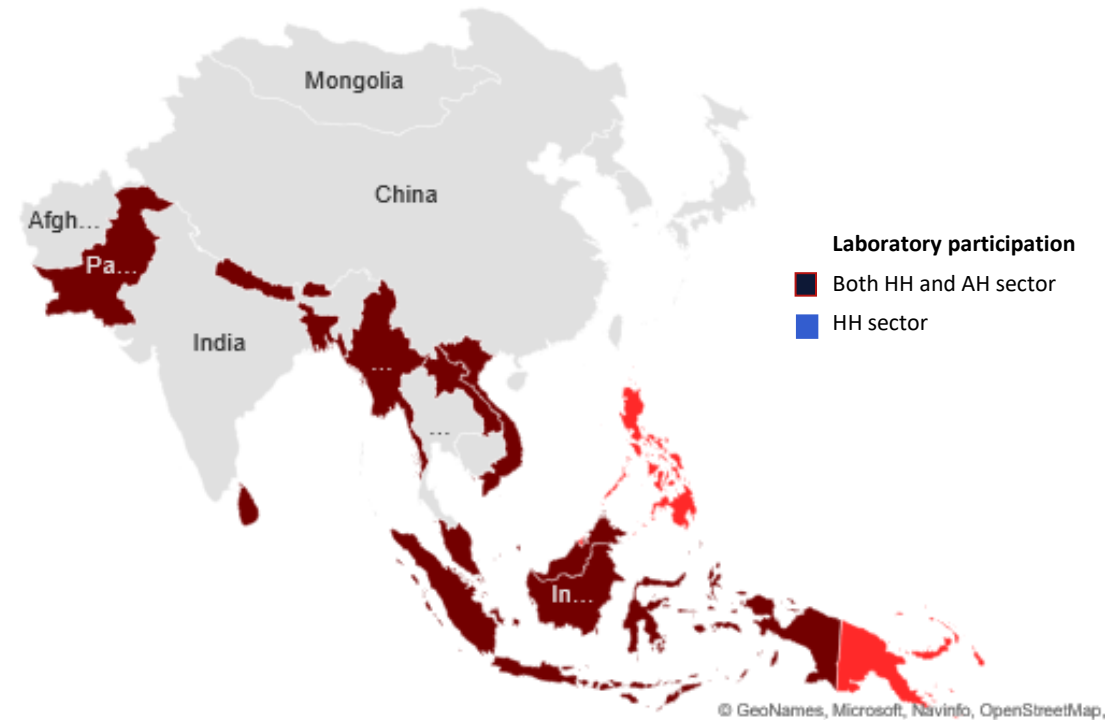


EQAsia Programme



Aim: To improve bacteriology diagnostics to combat AMR through the provision of External Quality Assessments (EQAs) and training programmes to low and middle-income countries in South and Southeast Asia.

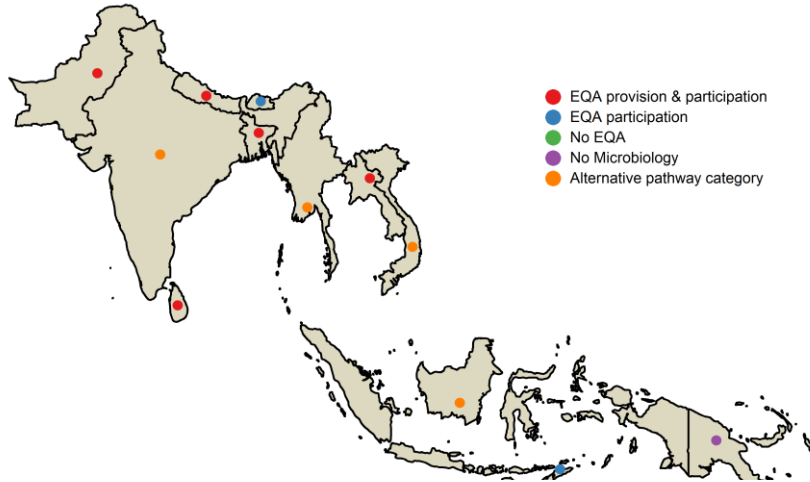
Project Scope: Under a One Health remit, EQAsia provides free of charge EQAs and training programmes to National Reference Laboratories (NRLs) and centres of excellence (CoEs) in 14 countries to date.



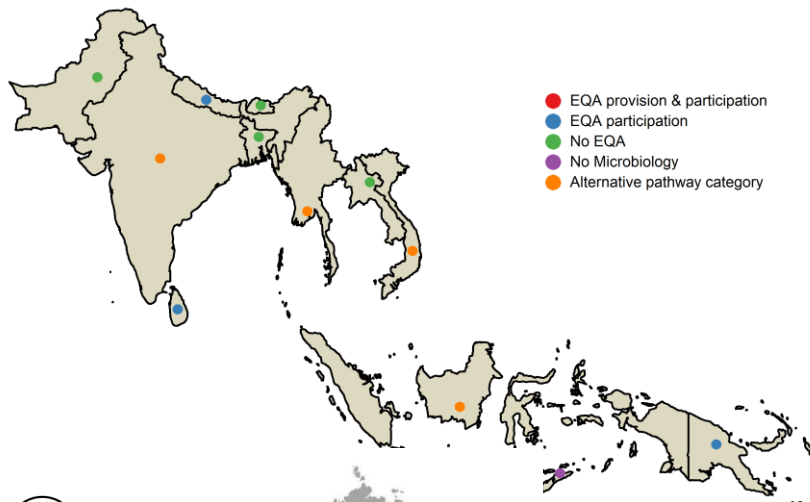
Bangladesh, Bhutan, Brunei, Indonesia, Lao PDR, Malaysia, Maldives, Nepal, Pakistan, PNG, Philippines, Sri Lanka, Timor-Leste, Vietnam.

Mapping EQA schemes in the Asian region

Human health

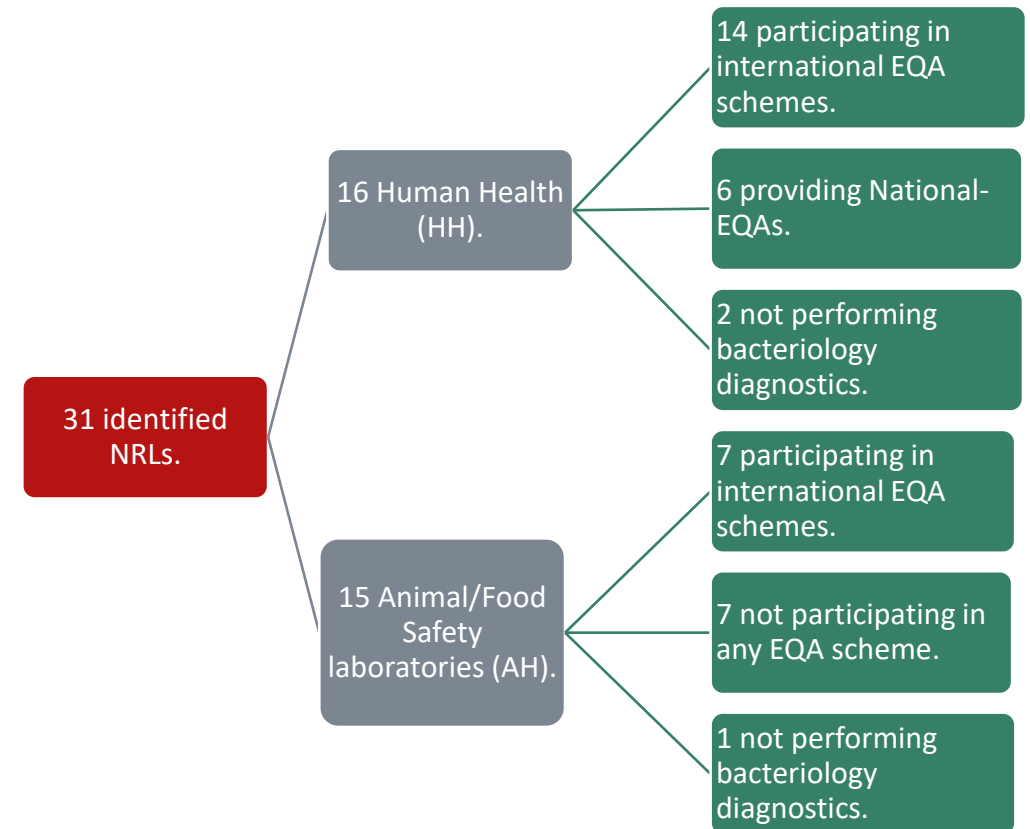


Animal health



3 EQA schemes in Asia.

Offering varying pathogens, frequency and support mechanisms for reporting and follow-up.



EQAsia Achievements



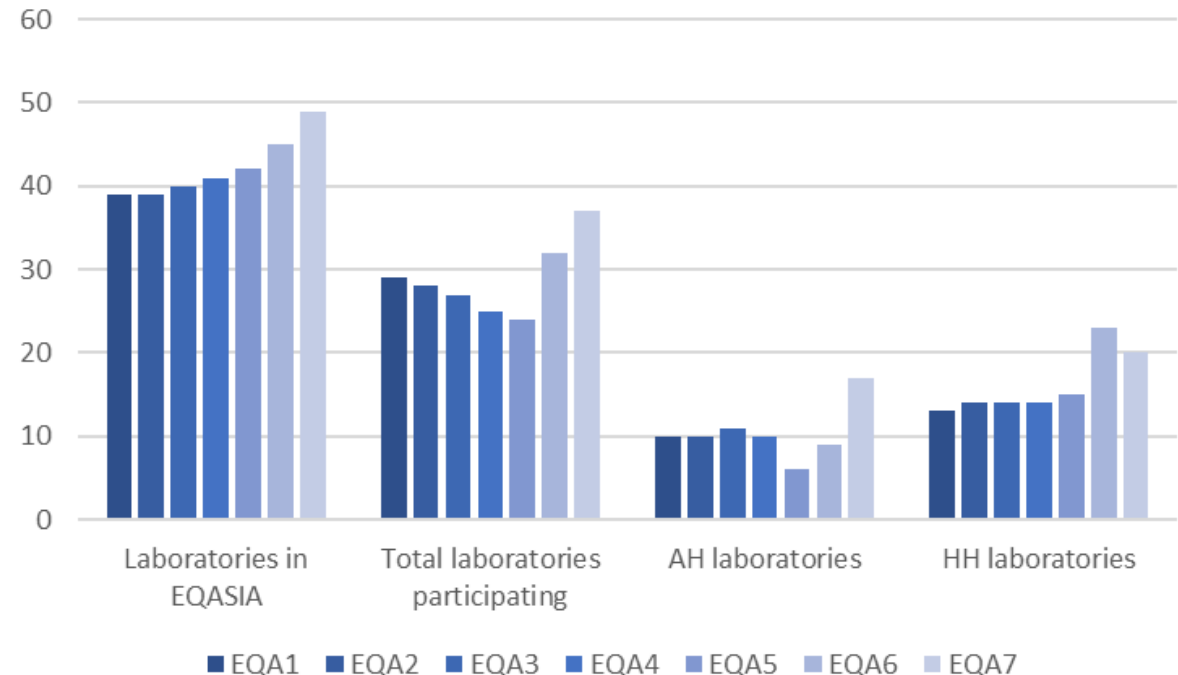
A growing AMR Community of Practice across South- and Southeast Asia

49 NRLs/CoEs working with HH, AH, Food, Environment and Aquaculture to date.

EQA scheme with One Stop Shop – One Health design

- EQAs covering the WHO GLASS and FAO priority pathogens.
- User friendly informatic module for reporting and analysis.
- 7 EQA trials:
 - ❖ Step increase in compliance
 - ❖ Interest increase in joining the EQA scheme
 - ❖ Large reporting increase from EQA1 – EQA6 (79% to 97%)

Phase I (2021-2023)



Phenotypic antimicrobial susceptibility testing - 2022



Results of the 5th EQA trial of the UK Aid Fleming Fund “EQAsia” programme

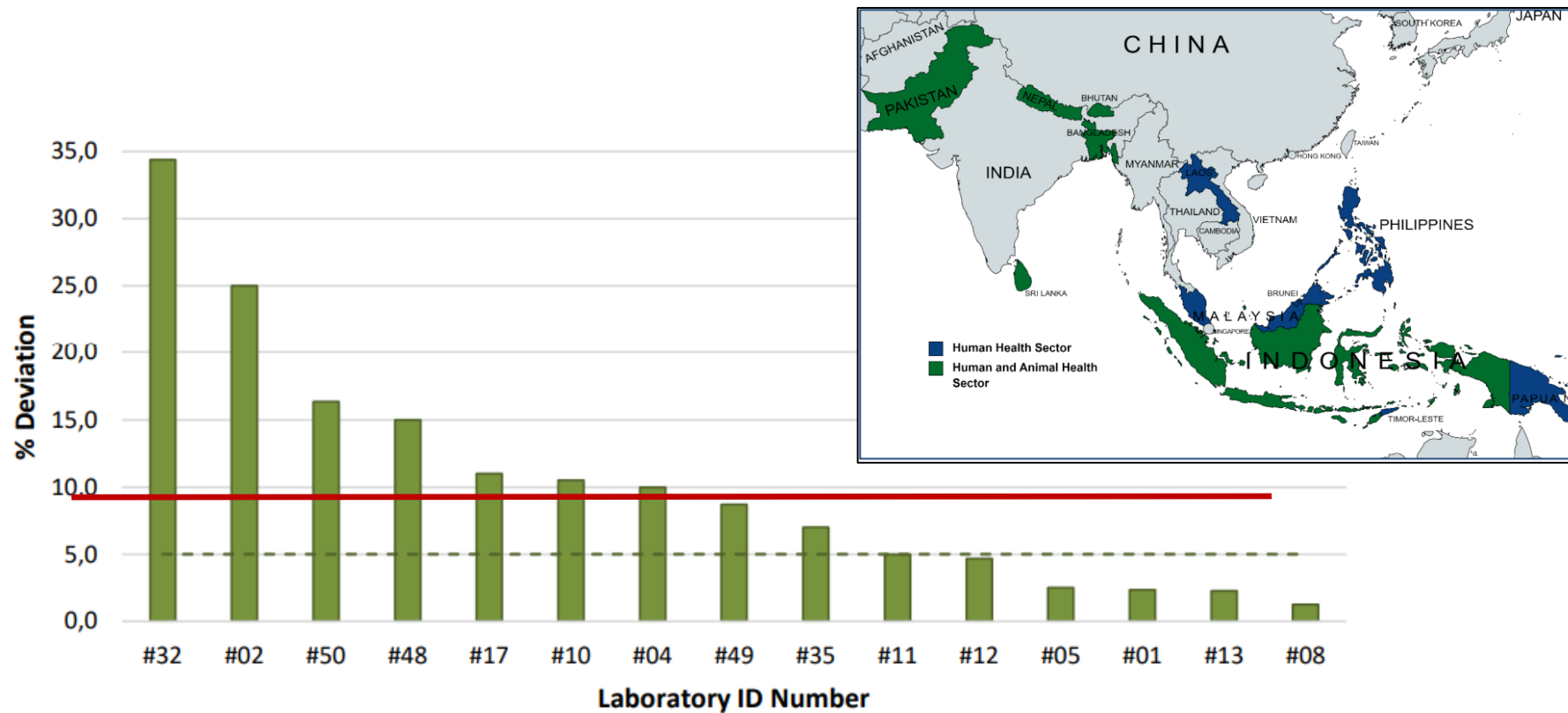


Figure 4. Percentage of deviation in the AST interpretation (R/I/S) among *E. faecium*/*E. faecalis* strains by HH laboratories (n=15) participating in the 5th EQA of the EQAsia project. Results are categorized by laboratory ID number.

EQAsia Achievements



Laboratory and QMS capacity and mentoring efforts

- Virtual and on-site follow up visits with laboratories to understand and address root cause for under-performance.
- Ad hoc online training, webinars, refresher courses.
- Workshops (virtual incl. “Tele-microbiology” and physical)
- Pilots setting up national EQAs



Implementation barriers and challenges



The barriers to implement phenotypic and genomic-based AMR surveillance differed with settings in LMIC hampering cost-effective operations and deterring investments

There is a need to identify the solutions to address the barriers sustaining the efforts in the implementation of genomics

- Country buy-in and funding
- Procurement and supply chains
- Lack of isolates
- Trust and data sharing
- Staff retention
- Knowledge, training and education
- IT Infrastructure



In summary



- The programs are very ambitious in strengthening the overall capacities in phenotypic and genomic-based AMR surveillance in Europe but also globally
 - Large added value of WGS to extract additional information to improve the understanding of emerging AMR
- Our experience is a great enthusiasm among the participating laboratories
- The suggestive programs are well planned and very timely
- Main barriers in many countries are the human and economic resources,
 - A need to build capacity in national ref. laboratories – to the same level as in academia
 - A need for political investments and country buy-in – to be prepared for the next pandemic
 - Too depended on temporary research grants
- A great and inspiring collaboration between ECDC, HADEA, DTU and SSI partners but also with the Fleming Fund

.....and it all started with the establishment of DANMAP more than 25 years go





Acknowledgement

Key participants and many more

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