Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report

Early implementation

2020

Antimicrobial Resistance

- **Antimicrobial resistance (AMR)** occurs when bacteria, viruses, fungi and parasites become resistant to the antimicrobial drugs used to treat them

- AMR is **one of the greatest threats to modern medicine**

  - In some G20 countries, more than **40%** of infections are due to bacteria that are resistant to antibiotics*

  - Economic damage of uncontrolled resistance will be comparable to the 2008-2009 global financial crisis

- AMR threatens achievement of the **Sustainable Development Goals**

Source: IACG. (2019). No time to wait: Securing the future from drug-resistant infections. Report to the Secretary-General of the United Nations. Available at:
https://www.who.int/antimicrobial-resistance/interagency-coordination-group/IACG_final_report_EN.pdf?ua=1

Global Action Plan on AMR

1. Improve awareness and understanding

2. Strengthen knowledge through surveillance & research

3. Reduce the incidence of infection

4. Optimize the use of antimicrobial medicines

5. Ensure sustainable investment

World Health Assembly, 2015, Resolution WHA68.7

Interangency Coordination Group on AMR

➢ **Accelerated implementation of One Health national action plans must be at the heart of the global response to antimicrobial resistance**

▪ "Strengthening monitoring and surveillance is important to:

• track the use of antimicrobials and the spread of resistance in humans, animals, plants and food;

• build the evidence base for action;

• support multisectoral collaboration; and

• monitor progress."

NO TIME TO WAIT: SECURING THE FUTURE FROM DRUG-RESISTANT INFECTIONS

REPORT TO THE SECRETARY-GENERAL OF THE UNITED NATIONS

APRIL 2019

IACG | Interagency Coordination Group on **Antimicrobial Resistance**

What is the purpose of GLASS?

- **Objectives:**

  − foster national surveillance systems through harmonised global standards

  − estimate the extent of AMR globally

  − detect AMR emergence and spread

  − generate data to inform AMR burden estimates

  − inform strategies to tackle AMR

What is GLASS?

Global Antimicrobial Resistance and Use Surveillance System

- The first global system to incorporate official national data from surveillance of AMR

  − standardized approach to the collection, analysis, and sharing of AMR, AMC and AMU data

  − One Health model for AMR surveillance

  − epidemiological, clinical, and microbiological data

GLASS activities

ROUTINE DATA SURVEILLANCE

Antimicrobial Resistance surveillance (**GLASS-AMR**)

Antimicrobial Consumption surveillance **(GLASS-AMC)**

FOCUSSED SURVEILLANCE

Emerging Antimicrobial Resistance Reporting (**GLASS-EAR**)

PILOT PHASE

Enhanced Gonorrhoeae surveillance (**GLASS-EGASP**)

PILOT PHASE

Candida spp. AMR surveillance (**GLASS-Fungi**)

SURVEYS AND STUDIES

PILOT PHASE

One Health AMR surveillance (**GLASS-One Health**)

PILOT PHASE

Point Prevalence Survey on AMU in hospital

PILOT PHASE

Assessment of AMR attributable mortality

Countries enrolled in GLASS
As of 20 May 2020

92 countries, territories and areas

Enrolled in both AMR and AMC
Enrolled in AMR
Enrolled in AMC
Not Enrolled
Not Applicable

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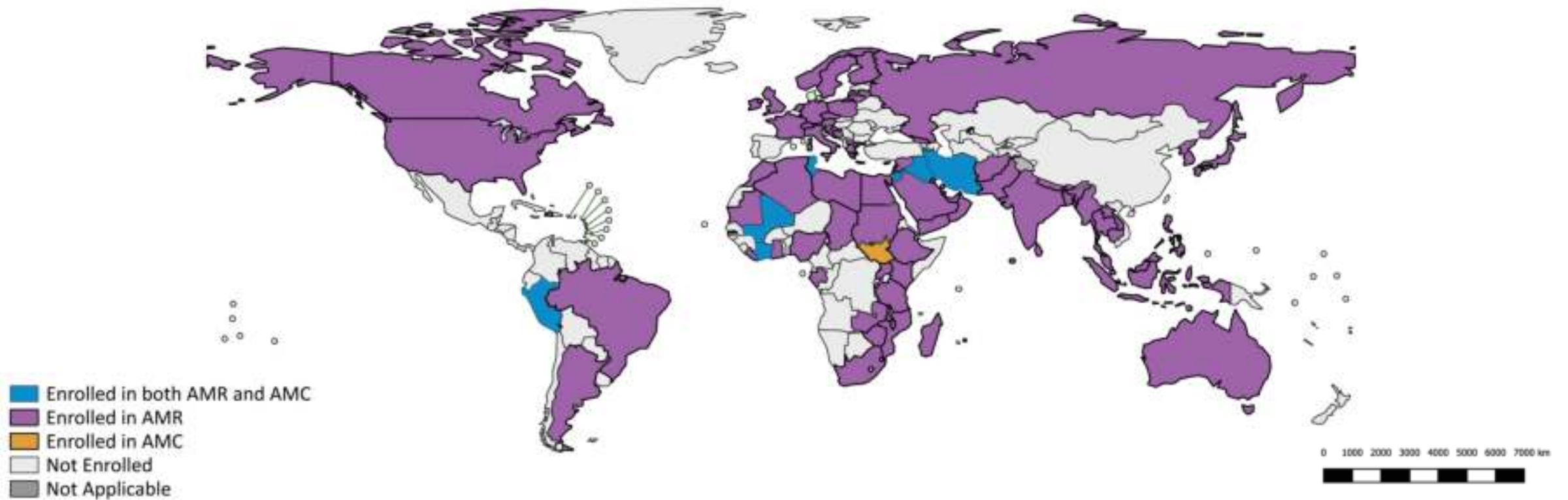
GLASS Report 2020

✓Summarizes information from 78 countries collected between May-Jul 2019

- on the status of development of national AMR surveillance systems; and

- AMR rates due to selected pathogens in four infection sites (bloodstream, urinary tract, gastro-intestinal and genital)

✓ Summarizes global AMR surveillance in DR-TB, HIV-DR, and malaria;

✓ Summarizes AMR surveillance activities in all WHO Regions; and

✓ Describes ongoing development of GLASS

Global Antimicrobial
Resistance and Use Surveillance
System (GLASS) Report

Early implementation
2020

DR Tuberculosis

Data Summary

Dr Anna Dean

WHO Global TB Programme

Burden of rifampicin-resistant TB

***Mycobacterium tuberculosis* is a major contributor to AMR burden:**
484,000 new cases of rifampicin-resistant TB and
214,000 deaths due to rifampicin-resistant TB
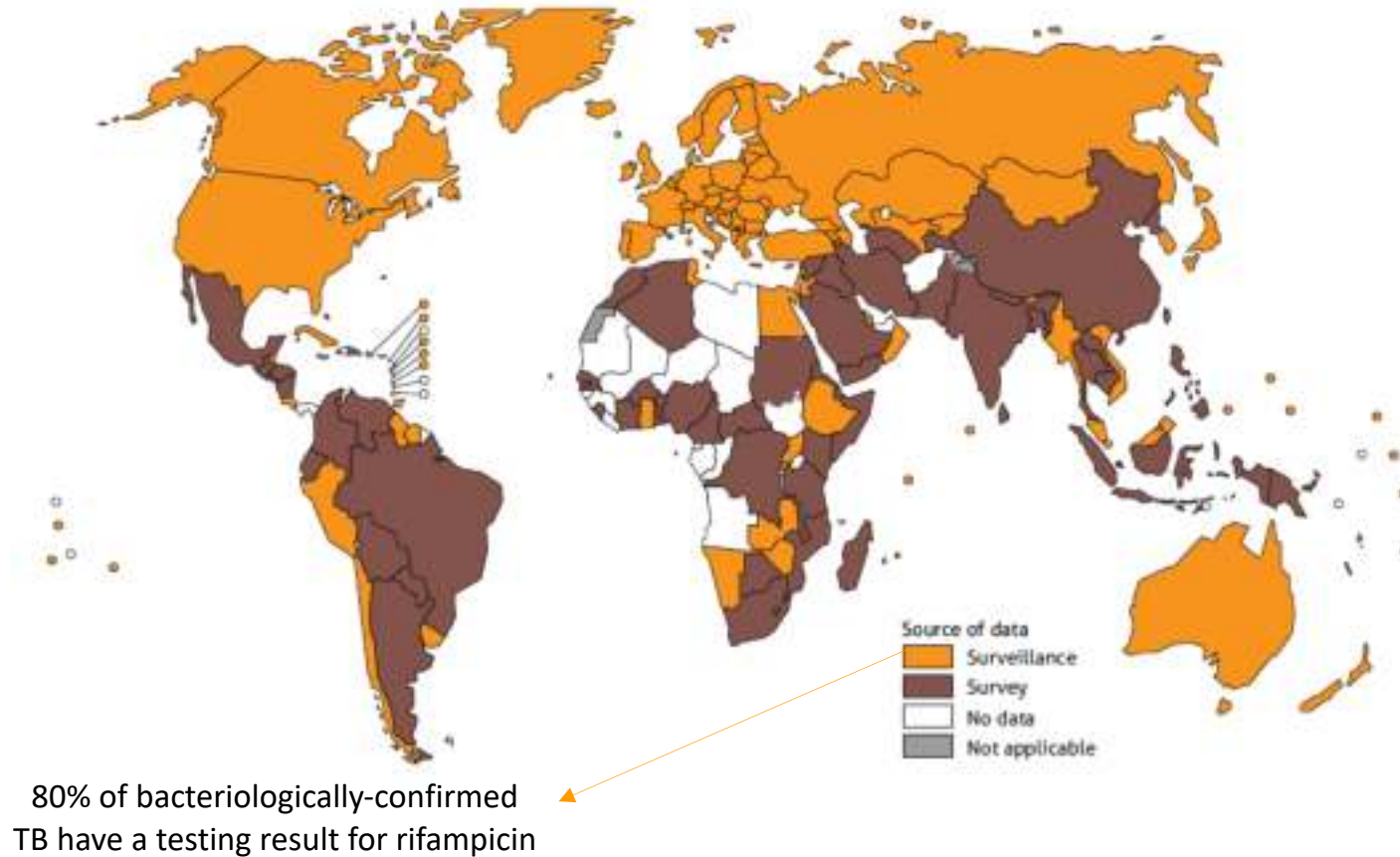were estimated to have occurred in 2018

Most recent year of data: rifampicin-resistant TB

GLASS
Global Antimicrobial
Resistance and Use
Surveillance System

Year of most
recent data

- 1995–1999
- 2000–2004
- 2005–2009
- 2010–2014
- 2015–2019
- Ongoing survey in 2019
- Subnational data
- No data
- Not applicable
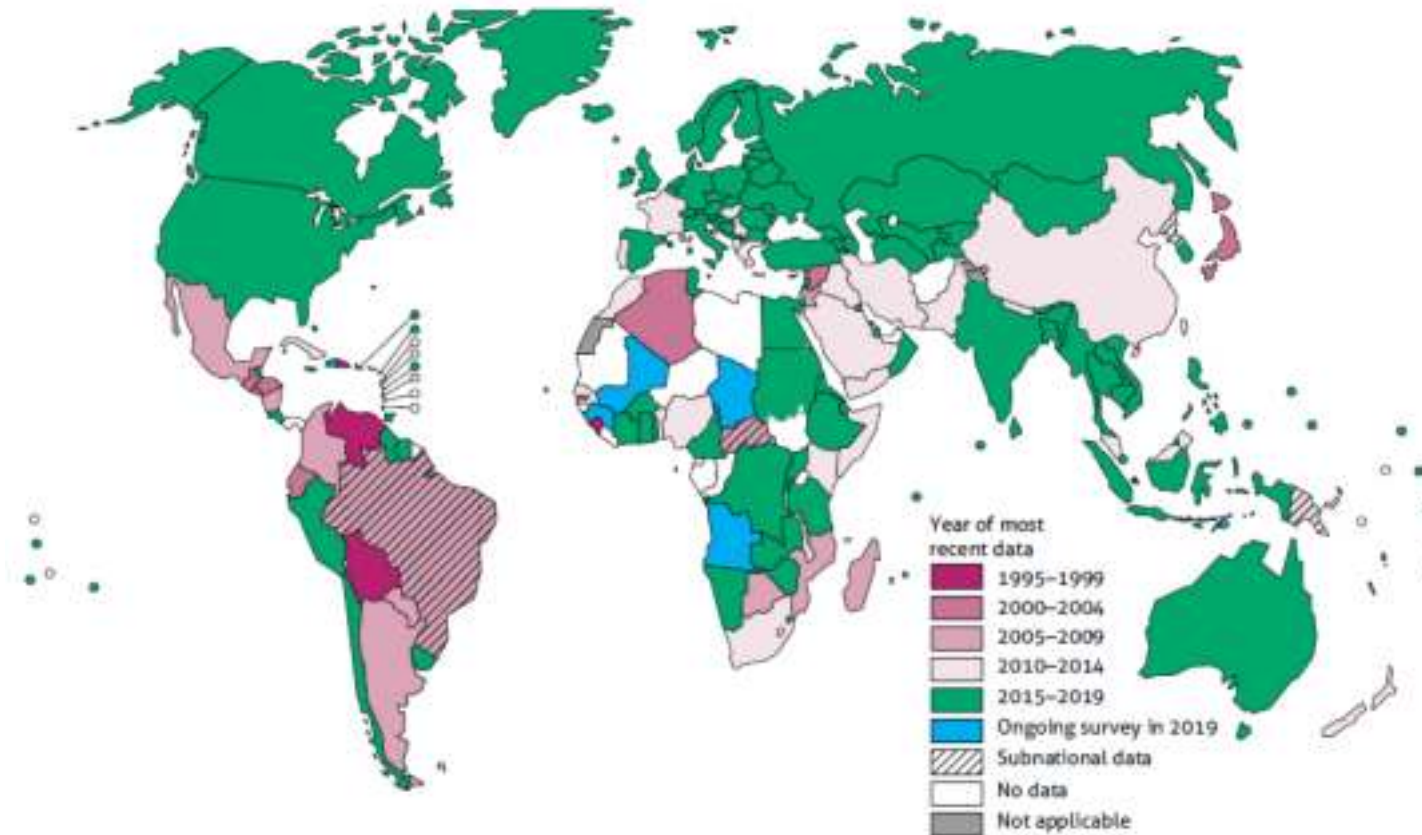
Oldest and largest global AMR surveillance project:
Representative data from 164 countries (99% of the world's TB cases) since 1995

World Health Organization

Sources of data: rifampicin-resistant TB

Source of data
- Surveillance
- Survey
- No data
- Not applicable

80% of bacteriologically-confirmed
TB have a testing result for rifampicin

Strengthening continuous surveillance through expansion of rapid molecular testing networks:
Representative data from 105 countries in 2018, versus 91 countries in 2017

More information

Revised guidelines due late 2020
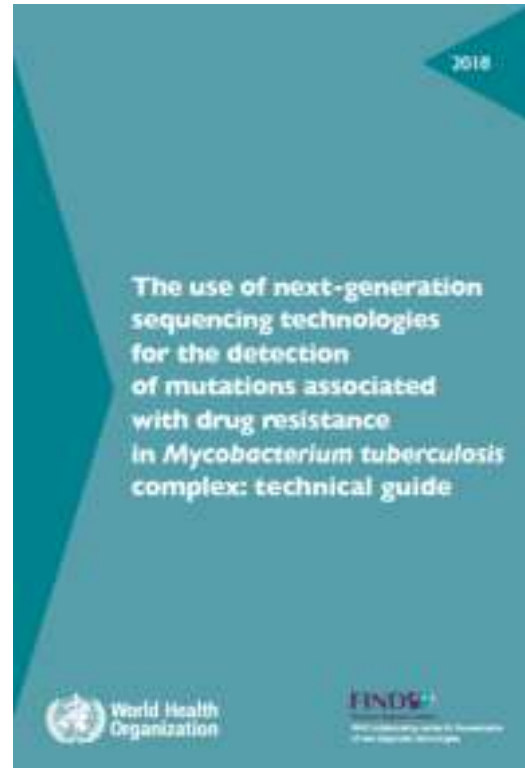
Implementation guide for
next-generation sequencing due late 2020

Updated data due October 2020

DR HIV

Data Summary

Dr Silvia Bertagnolio
HIV Drug Resistance Programme

HIV drug resistance surveillance and monitoring strategy

1. Monitoring of early warning indicators of HIV drug resistance

2. Surveillance of HIV drug resistance among:

   − Adults initiating antiretroviral therapy

   − Children <18 months with a new diagnosis of HIV

   − Adults and children receiving antiretroviral therapy
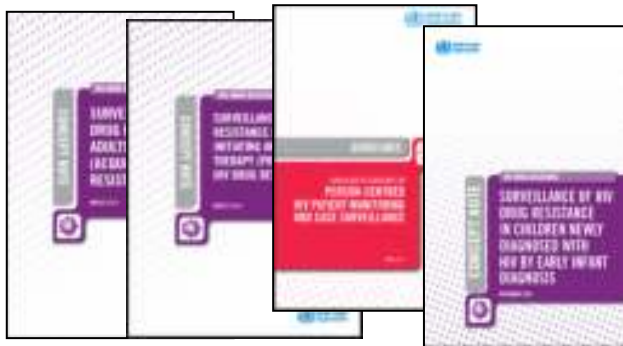
WHO HIVDR surveillance guidance

Global network of WHO-designated labs for HIVDR testing

WHO HIVDR Database

Surveys of HIV drug resistance conducted with WHO-recommended standard methods (2004–2019)

Year of most recent survey
- 2004-2013
- 2014-2017
- 2018-2019
- Planned
- Data not available
- Not applicable

Increasing levels of pretreatment HIV drug resistance

2019 WHO HIVDR Report

Lancet HIV, 2017

Phillips, et al. JID, 2017

Response in Countries with high levels of HIVDR

GLASS
Global Antimicrobial
Resistance and Use
Surveillance System

CUBA: PDR to EFV/NVP 22.8%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (and in women of child-bearing potential who are on reliable and consistent contraception

HONDURAS: PDR to EFV/NVP 25.9%.
Revision of national guidelines to use DTG as preferred first-line ART planned

GUATEMALA: PDR to EFV/NVP 13.2%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (and in women of child-bearing potential who are on reliable and consistent contraception

NICARAGUA: PDR to EFV/NVP 19.3%.
Revision of national guidelines to use DTG as preferred first-line ART planned

PDR to NNRTI >10%
Not applicable

ARGENTINA: PDR to EFV/NVP 10.9%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (and women of child-bearing potential who are on reliable and consistent contraception). Genotypic resistance testing used to guide treatment in women of child-bearing potential not eligible to use DTG

NAMIBIA: PDR to EFV/NVP 13.8%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

ZIMBABWE: PDR to EFV/NVP 10.9%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

ESWATINI: PDR to EFV/NVP 10.5%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

UGANDA: PDR to EFV/NVP 15.4%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

NEPAL: PDR to EFV/NVP 10.2%.
Revision of national guidelines to use DTG as preferred first-line ART planned

PAPUA NEW GUINEA: PDR to EFV/NVP 17.8%.
National guidelines revised to include the use of DTG as preferred first-line ART

SOUTH AFRICA: PDR to EFV/NVP 23.6%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

Using evidence from surveys to inform optimal regimen selection and HIV Treatment Guidelines

GUIDELINES
THE PUBLIC HEALTH RESPONSE TO PRETREATMENT HIV DRUG RESISTANCE

GUIDELINES
THE USE OF ANTIRETROVIRAL DRUGS FOR TREATING AND PREVENTING HIV INFECTION

WHO HIV drug resistance:
https://www.who.int/hiv/topics/drugresistance/en/

Malaria TES

Data Summary

Dr Charlotte Rasmussen
Global Malaria Programme

Introduction: Antimalarial drug efficacy and resistance

- Antimalarial drug resistance has repeatedly developed, causing increases in malaria morbidity and mortality

- Currently, WHO recommends Artemisinin-based Combinations Therapy (ACTs) for the treatment of *P. falciparum* malaria and chloroquine or ACTs for *P. vivax*.

- In most of the world, these antimalarial drugs are highly efficacious.

- However, P. falciparum resistance in the Greater Mekong Sub-region does pose a challenge.

Antimalarial drug resistance: Tools for monitoring

- Therapeutic Efficacy Studies (TES) are the gold standard for monitoring antimalarial drug efficacy, and is needed to inform the national treatment policies.

- WHO recommends that TES are done in sentinel sites in malaria endemic countries at least once every 2 years.

- WHO has developed tools and a standard protocol to help countries do efficacy studies.

- In addition, different genetic mutations found to be associated with resistance to specific drugs have been identified. These molecular markers are useful to confirm resistance and help monitor the spread of resistance.
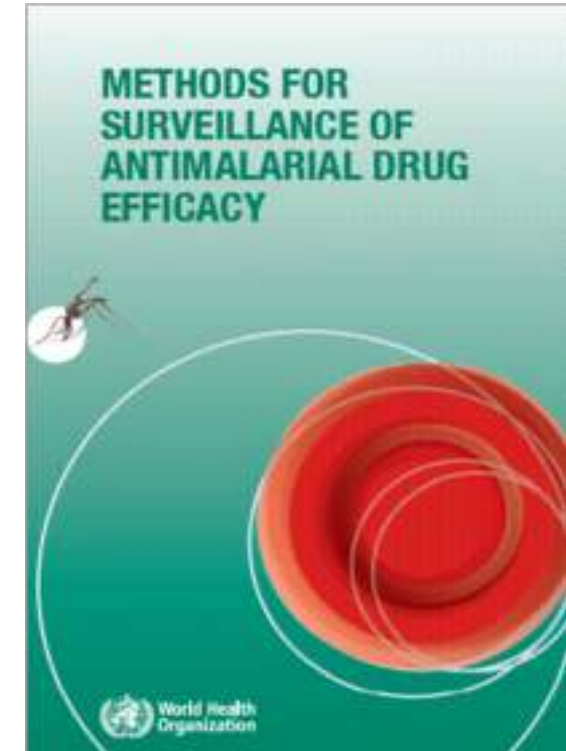
Antimalarial drug resistance: Data availability

TES studies for *P. falciparum*: 912
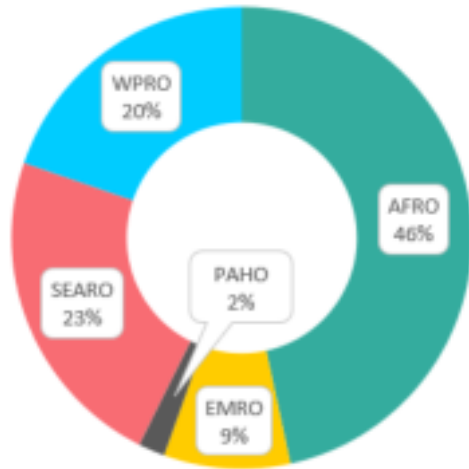
TES studies for *P. vivax*: 192

Malaria threat maps
http://apps.who.int/malaria/maps/threats/
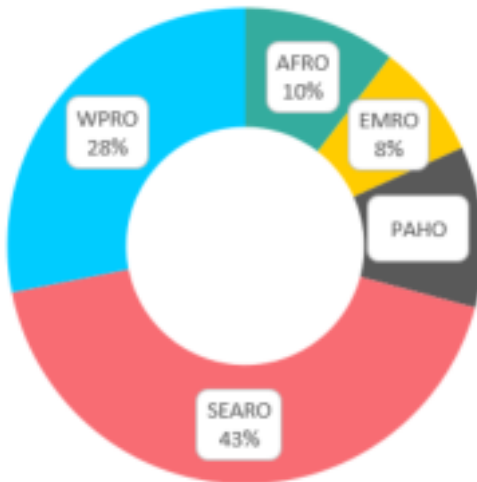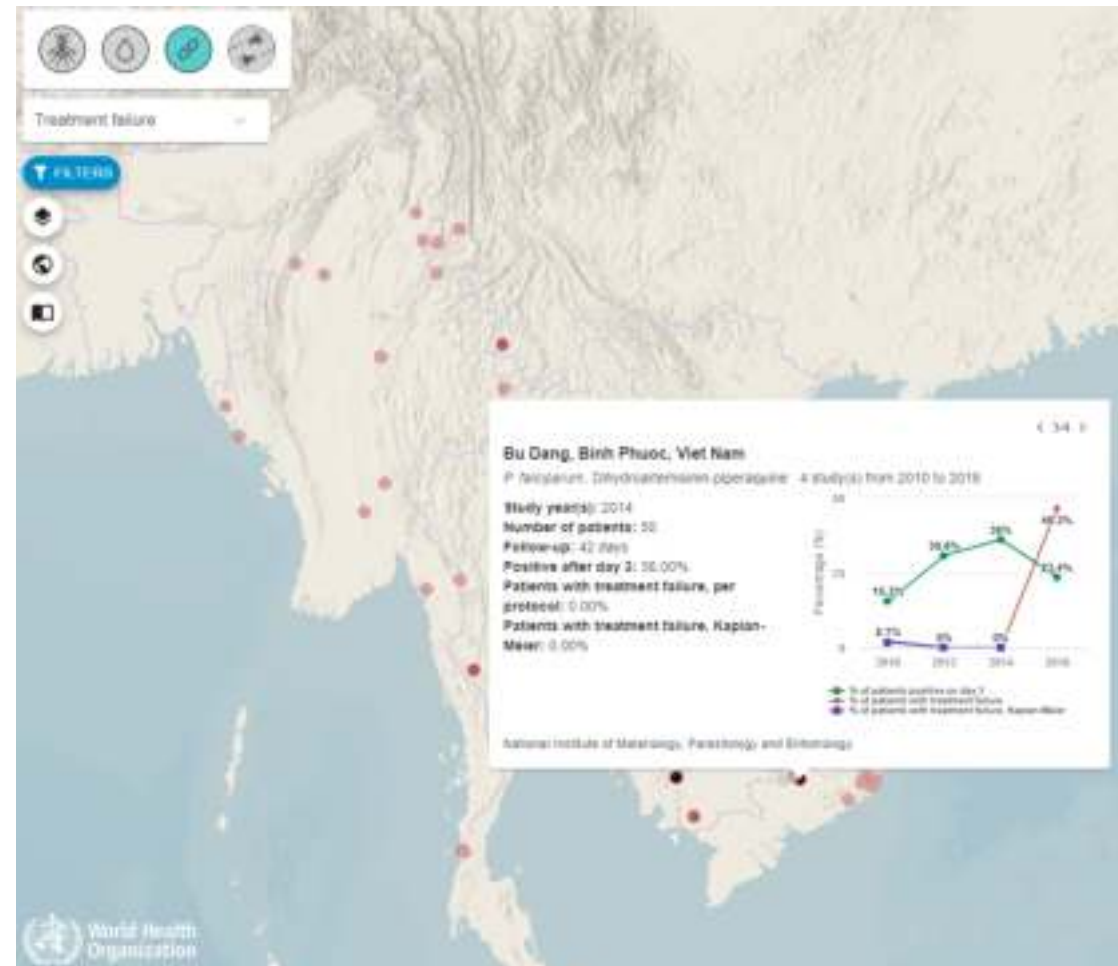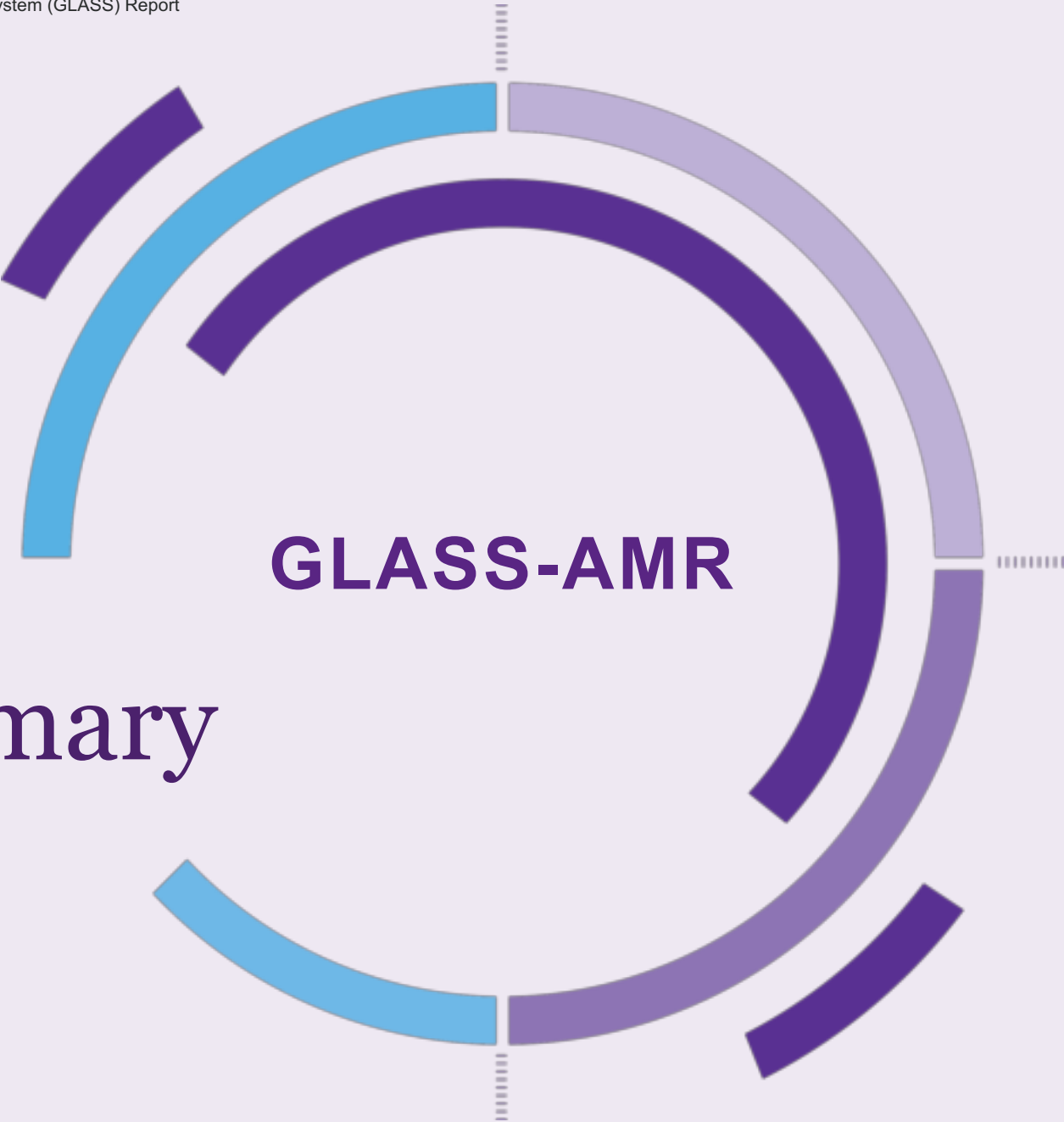
GLASS-AMR

Data Summary

What data does GLASS-AMR collects?

Status of national AMR surveillance system

- Indicators collected: overall coordination, surveillance system structure, and quality control

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AMR data

- for eight priority human bacterial pathogens isolated from clinical specimens

  ✓ blood, urine, stool, and cervical and urethral specimens

- population data:

  ✓ overall number of patients tested per specific specimen

  ✓ age, gender, and infection origin (hospital versus community)

GLASS-AMR specimens/pathogens/Ab

Infection site	Pathogen
Bloodstream	*Acinetobacter spp.*
	E. coli
	K. pneumoniae
	Salmonella spp.
	S. aureus
	S. pneumoniae
Urinary tract	*E. coli*
	K. pneumoniae
Gastroenteric	*Salmonella spp.*
	Shigella spp.
Genital	*N. gonorrhoeae*

- Specimen type as a proxy for infection
- 4 target sites
- 8 target pathogens causing common human infections
- List of antimicrobials assessed for drug resistance
  - ✓ Sulfonamides and Trimethoprim
  - ✓ Fluoroquinolones
  - ✓ Third Generation cephalosporins
  - ✓ Fourth Generation cephalosporins
  - ✓ Carbapenems
  - ✓ Polymixins
  - ✓ Tetracycline
  - ✓ Aminoglycosides
  - ✓ Penicillins
  - ✓ Penicillinase-stable beta lactams
  - ✓ Macrolides
  - ✓ Aminocyclitols

GLASS-AMR submission

By the end of data call, 31st July 2019

- **82** countries/territories/areas enrolled

- **78** countries/territories/areas submitted data

  - **12** countries provided only the information on the status of their national AMR surveillance systems.

  - **One** country provided AMR rates only

  - **65** countries provided the information on the status of their national AMR surveillance systems and 2018 AMR rates

Legend:
- No Data Reported
- AMR data reported
- Information on national surveillance system reported
- Information on national surveillance system and AMR data reported
- Not enrolled
- Not Applicable

World Health Organization
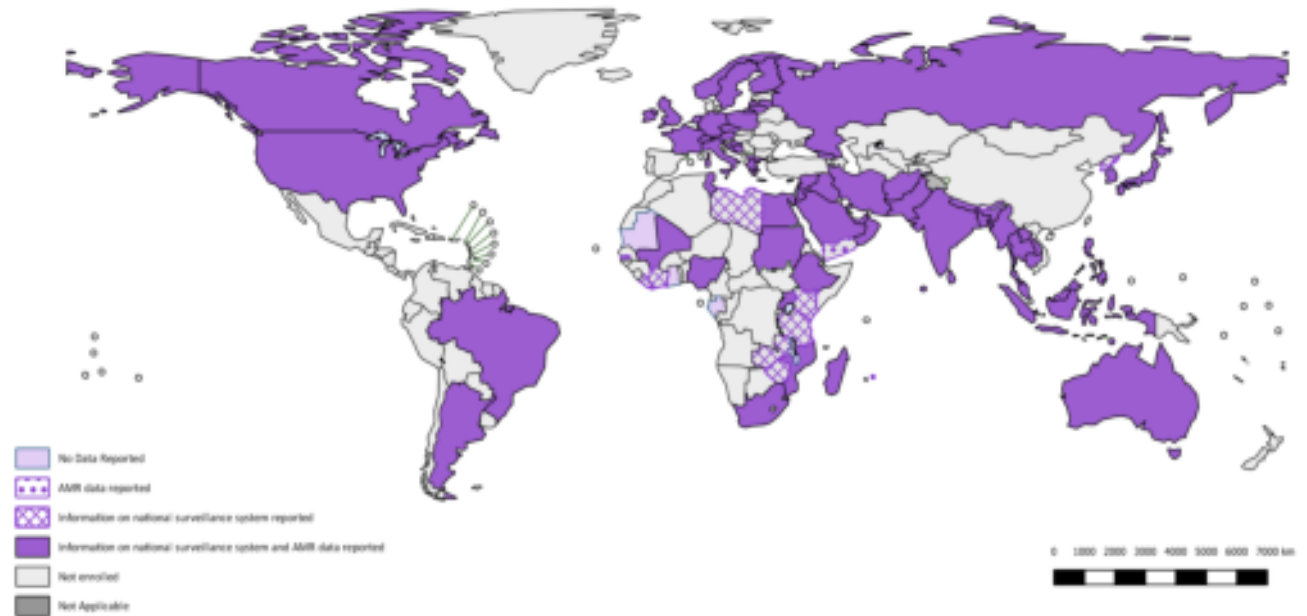
Reporting by Economic Status
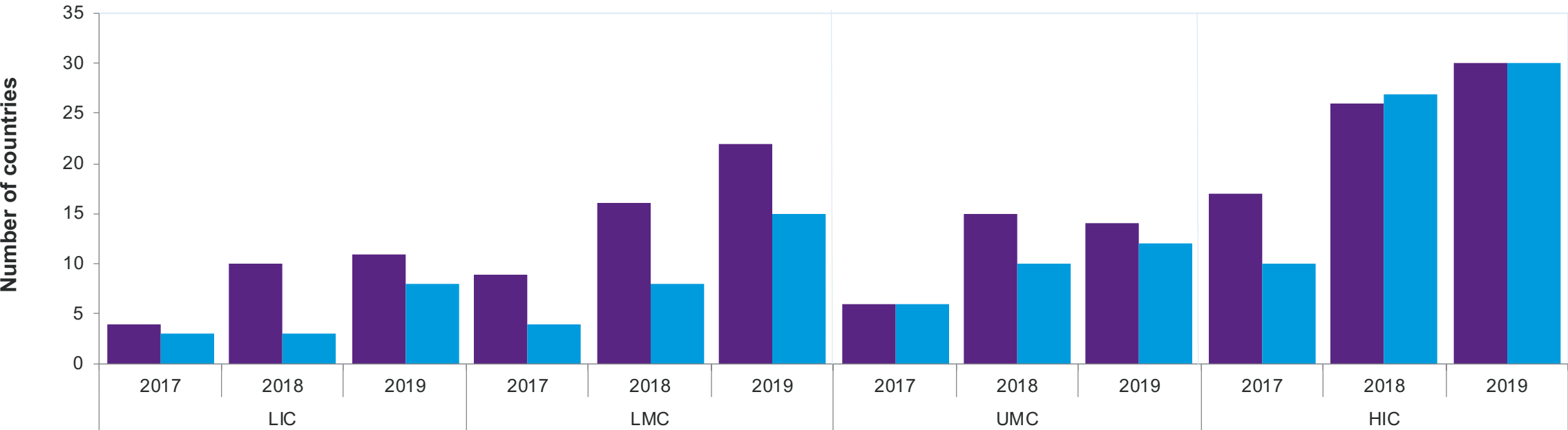
Economic status (World Bank 2019)

■ Information on surveillance system   ■ AMR rates

GLASS Profiles

Implementation of surveillance activities

- AMR

- Antimicrobial consumption (AMC)

- HIV DR

- DR TB

- Malaria therapeutic efficacy studies

- One Health AMR surveillance ESBL *E. coli* across sectors (Tricycle Project)

- Enhanced gonorrhoea AMR surveillance (EGASP)

Specific indicators on
- Core components of AMR surveillance
- HIV DR
- DR TB
- AMR data submission to GLASS

National rates of AMR on WHO-GHO

- All data produced by GLASS is available free online and will be updated regularly.
  - − GLASS data visualization page on the WHO Global Health Observatory http://who.int/entity/gho/glass/en/index.html
  - − GLASS website http://www.who.int/glass/en/

Data provided by countries are available with the online report's supplementary material

AMR data: Progress in reporting

Reported to GLASS - AMR	2017 (22 countries)	2018 (48 countries)	2019 (66 countries)
Number of sites			
Hospitals	466	3,097	5,521
Outpatients clinics	139	2,358	56,818
In-out patients	N.A.	N.A.	1,998
Other institutions	124	560	424
Total	**729**	**6,015**	**64,761**
Number of patients with suspected infection			
Blood stream	81,920	262,265	441,794
Urinary tract	415,679	1,424,011	1,888,545
Gastro-intestinal	7,477	10,735	17,061
Sexually transmitted	2,847	9567	18,572
Total	**507,923**	**1,706,578**	**2,365,972**

Most countries reporting for the third year in a row showed an increase in the number of surveillance sites reporting
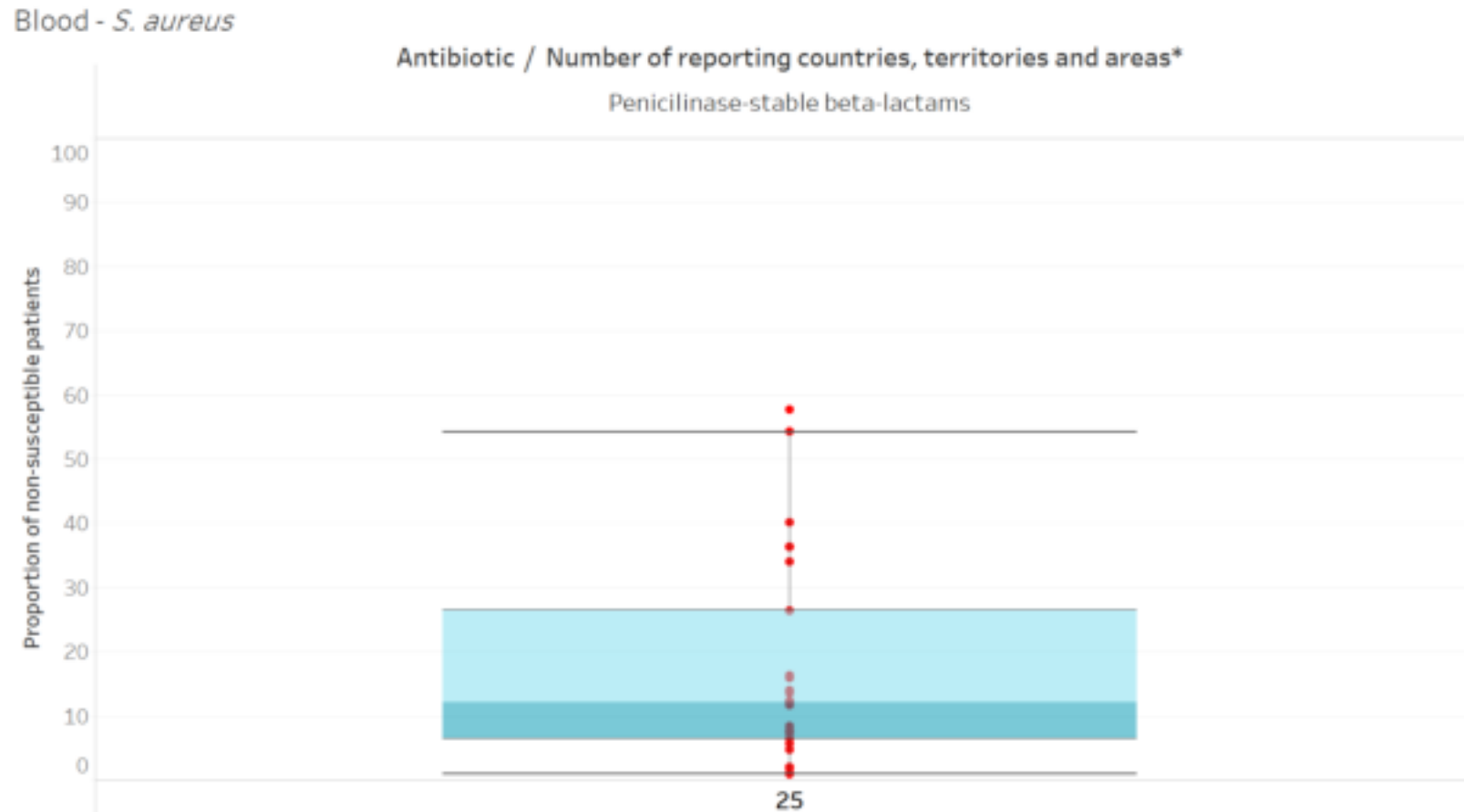
Reported infections by pathogen

Infection site	Total number of infected patients	Pathogen	Number of infected patients (by pathogen)				Number of patients with AST results	Pathogen	Number of patients with AST results(by pathogen)[a]			
			Community	Hospital	Unknown	TOTAL	Total		Community	Hospital	Unknown	TOTAL
Bloodstream	**441 794**	*Acinetobacter spp.*	1 780	2 736	12 922	**17 438**	**426 010**	*Acinetobacter spp.*	1 495	2 464	11526	**15485**
		E. coli	48 939	35 974	144 701	**229 614**		*E. coli*	46 788	35 544	142140	**224472**
		K. pneumoniae	15 306	15 455	44 279	**75 040**		*K. pneumoniae*	14 465	14 951	42088	**71504**
		Salmonella spp.	2 947	334	7 907	**11 188**		*Salmonella spp.*	1 528	270	7113	**8911**
		S. aureus	12 030	17 408	60 054	**89 492**		*S. aureus*	10 325	17 007	59728	**87060**
		S. pneumoniae	3 627	1 274	14 121	**19 022**		*S. pneumoniae*	3 261	1 236	14081	**18578**
Urinary tract	**1 888 545**	*E. coli*	405 942	164 385	1 121 325	**1 691 652**	**1 705 167**	*E. coli*	293 063	157 075	1079508	**1529646**
		K. pneumoniae	64 571	42 206	90 116	**196 893**		*K. pneumoniae*	51 154	40 541	83826	**175521**
Gastroenteric	**17 061**	*Salmonella spp.*	2 630	257	9 269	**12 156**	**15 029**	*Salmonella spp.*	1 966	152	8207	**10325**
		Shigella spp.	375	42	4 488	**4 905**		*Shigella spp.*	358	29	4317	**4704**
Genital	**18 572**	*N. gonorrhoeae*	16 336	1	2 235	**18 572**	**18 362**	*N. gonorrhoeae*	16 195	0	2167	**18362**
Total	**2 365 972**		574 483	280 072	1 511 417	**2 365 972**	**2 164 568**		440 598	269 269	1,454,701	**2,164,568**

Global summaries of AMR rates
Bloodstream infections

Blood - *S. aureus*

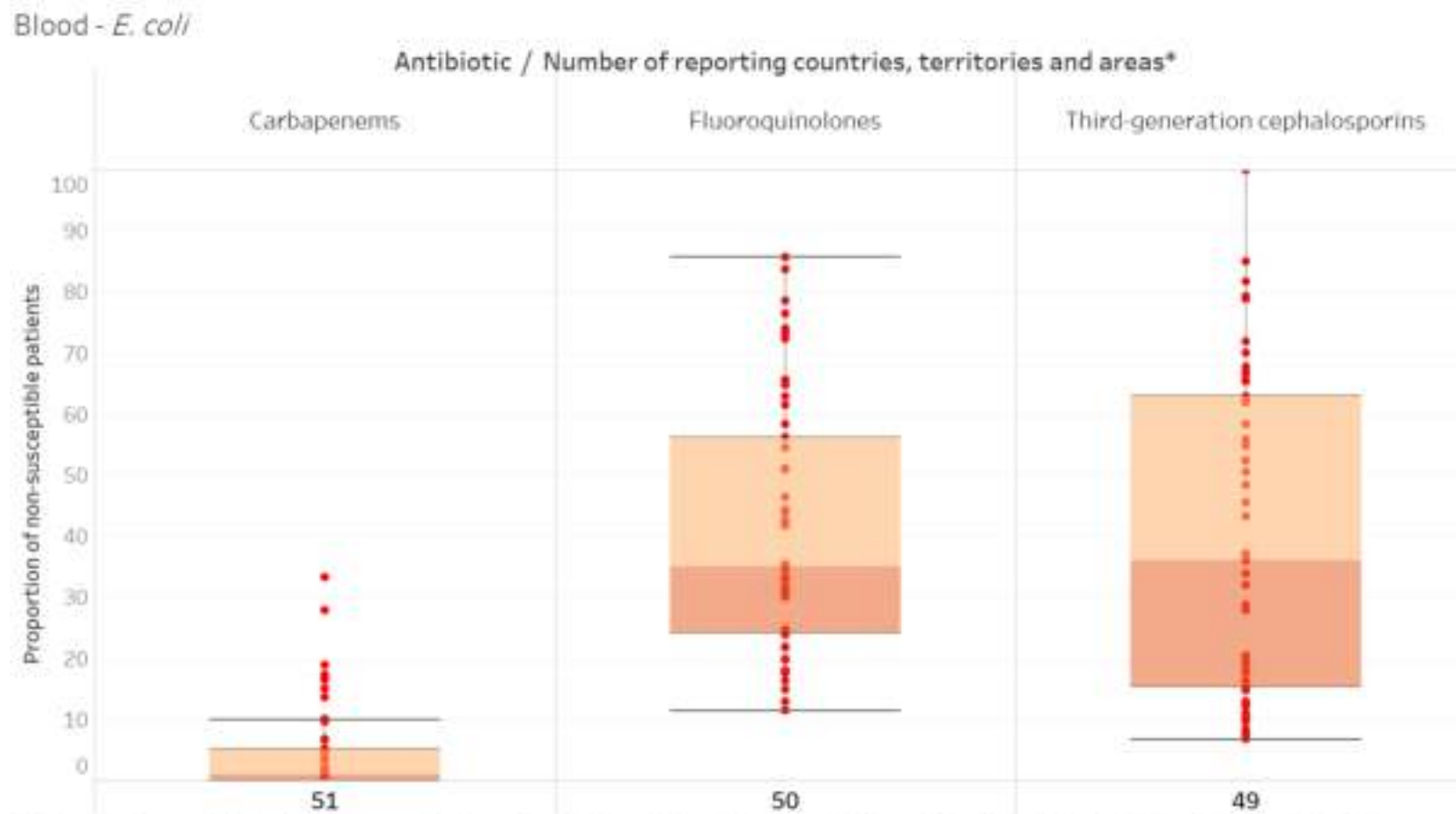Antibiotic / Number of reporting countries, territories and areas*

Penicilinase-stable beta-lactams

*Rates are shown only if results were reported for > 10 patients and for pathogen–antibiotic combinations with > 10 AST results and < 30% unknown results. Single antibiotic results are shown only if data were submitted by at least 50% of the countries reporting on the specimen-pathogen combination.
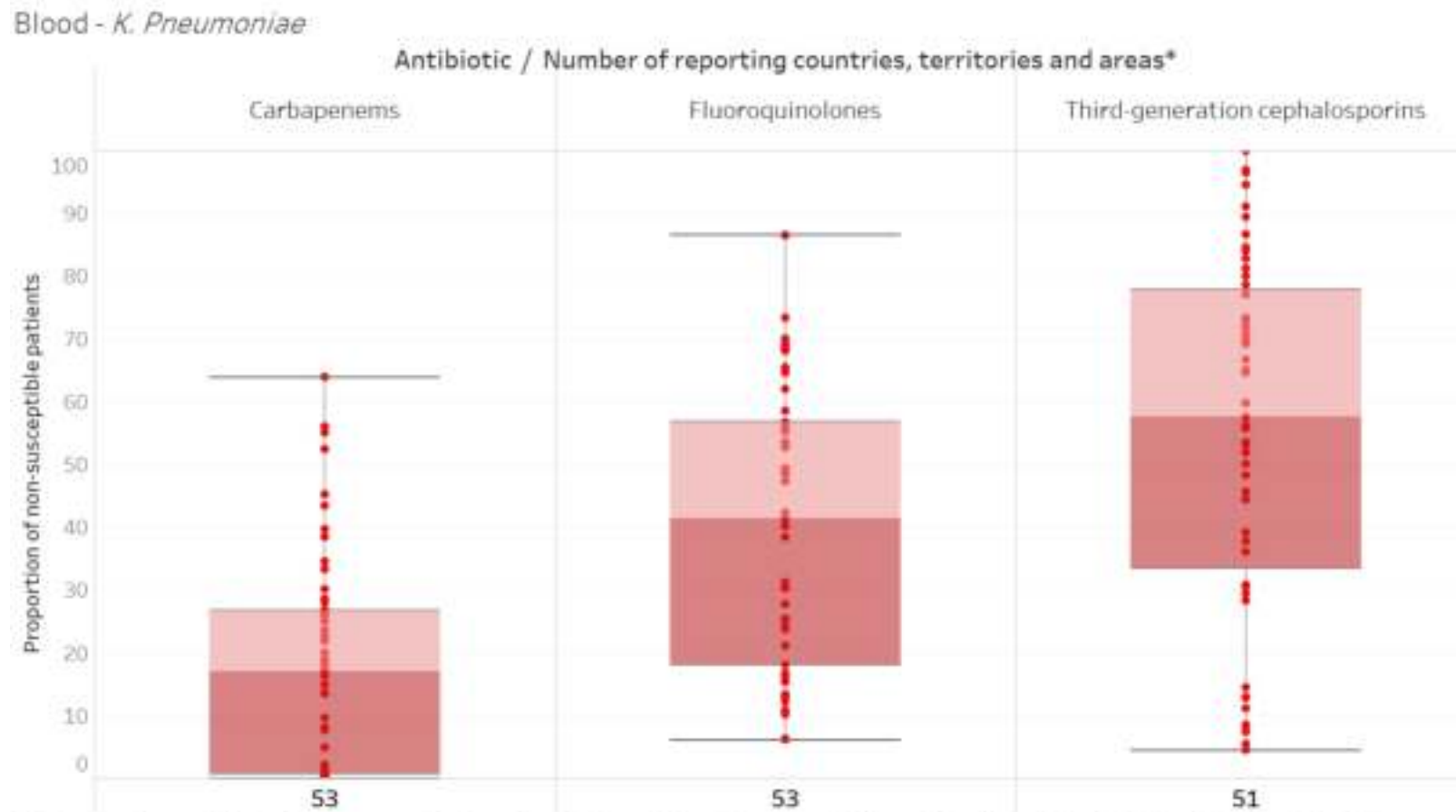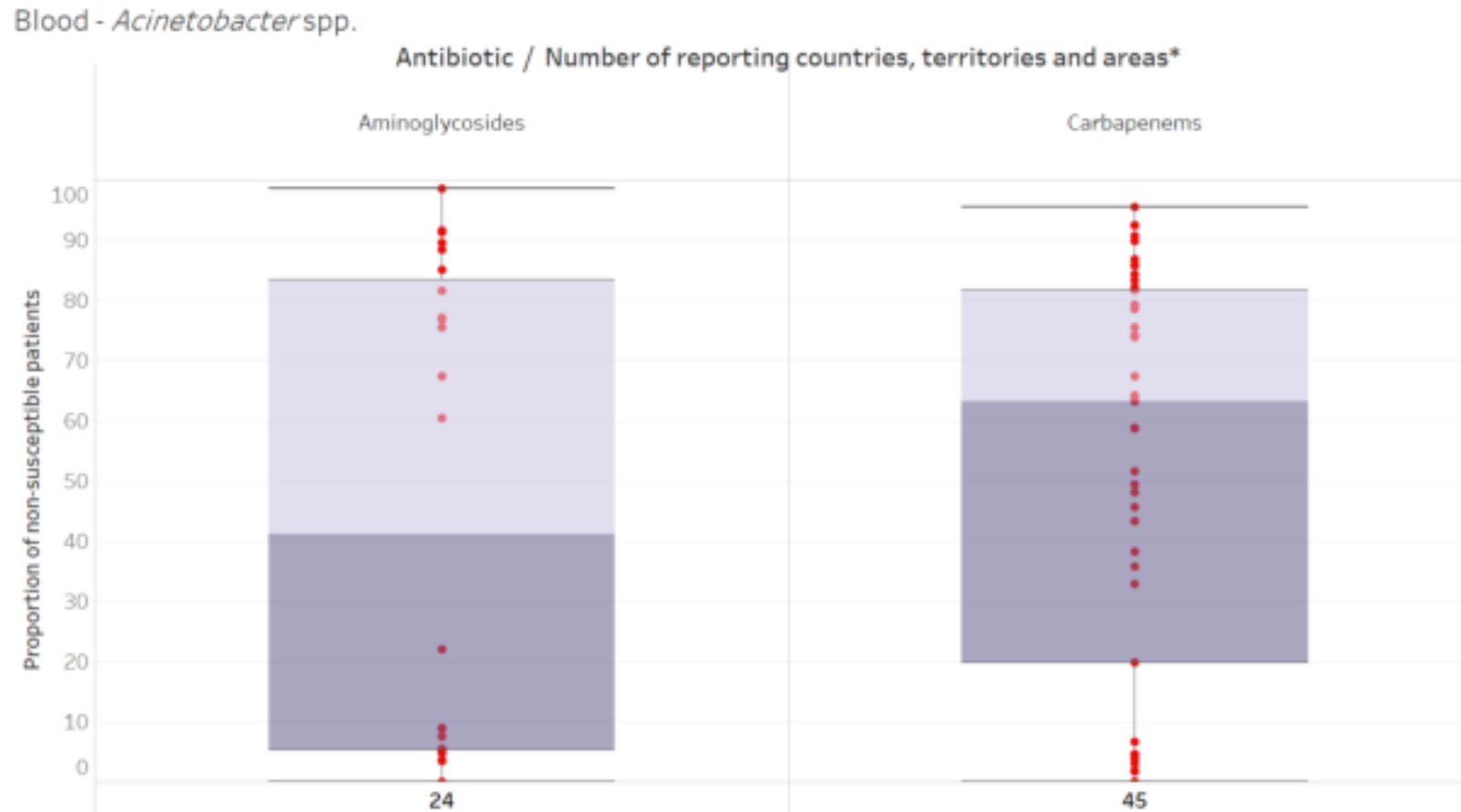
Global summaries of AMR rates
Bloodstream infections

Blood - *E. coli*

Global summaries of AMR rates
Bloodstream infections

Blood - *K. Pneumoniae*

*Rates are shown only if results were reported for > 10 patients and for pathogen–antibiotic combinations with > 10 AST results and < 30% unknown results. Single antibiotic results are shown only if data were submitted by at least 50% of the countries reporting on the specimen-pathogen combination.
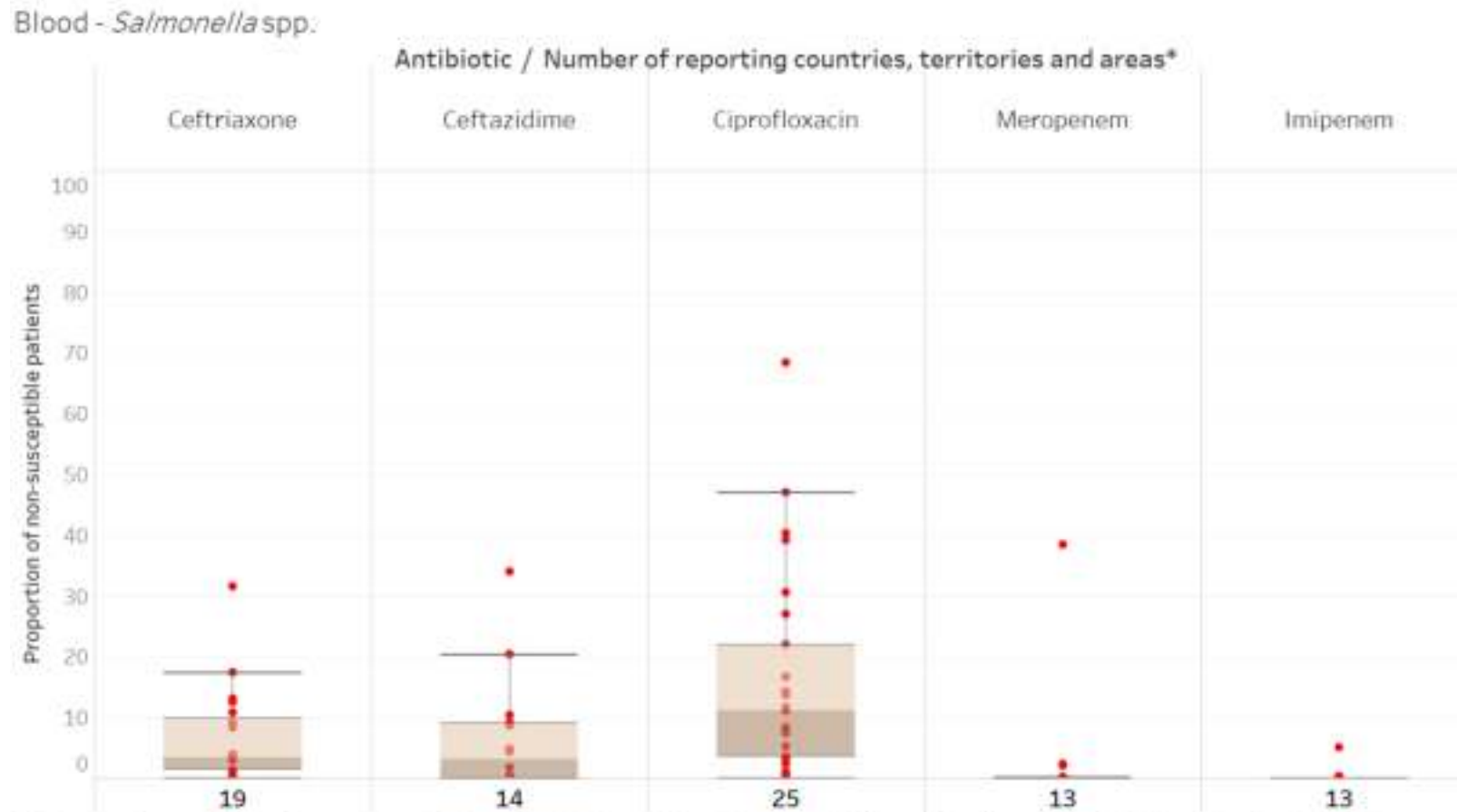
Global summaries of AMR rates
Bloodstream infections

Blood - *Acinetobacter* spp.

Global summaries of AMR rates
Bloodstream infections

Blood - *Salmonella* spp.

Global summaries of AMR rates
Bloodstream infections

Blood - *S. pneumoniae*

Antibiotic / Number of reporting countries, territories and areas*

Penicillins

20

*Rates are shown only if results were reported for > 10 patients and for pathogen–antibiotic combinations with > 10 AST results and < 30% unknown results. Single antibiotic results are shown only if data were submitted by at least 50% of the countries reporting on the specimen-pathogen combination.
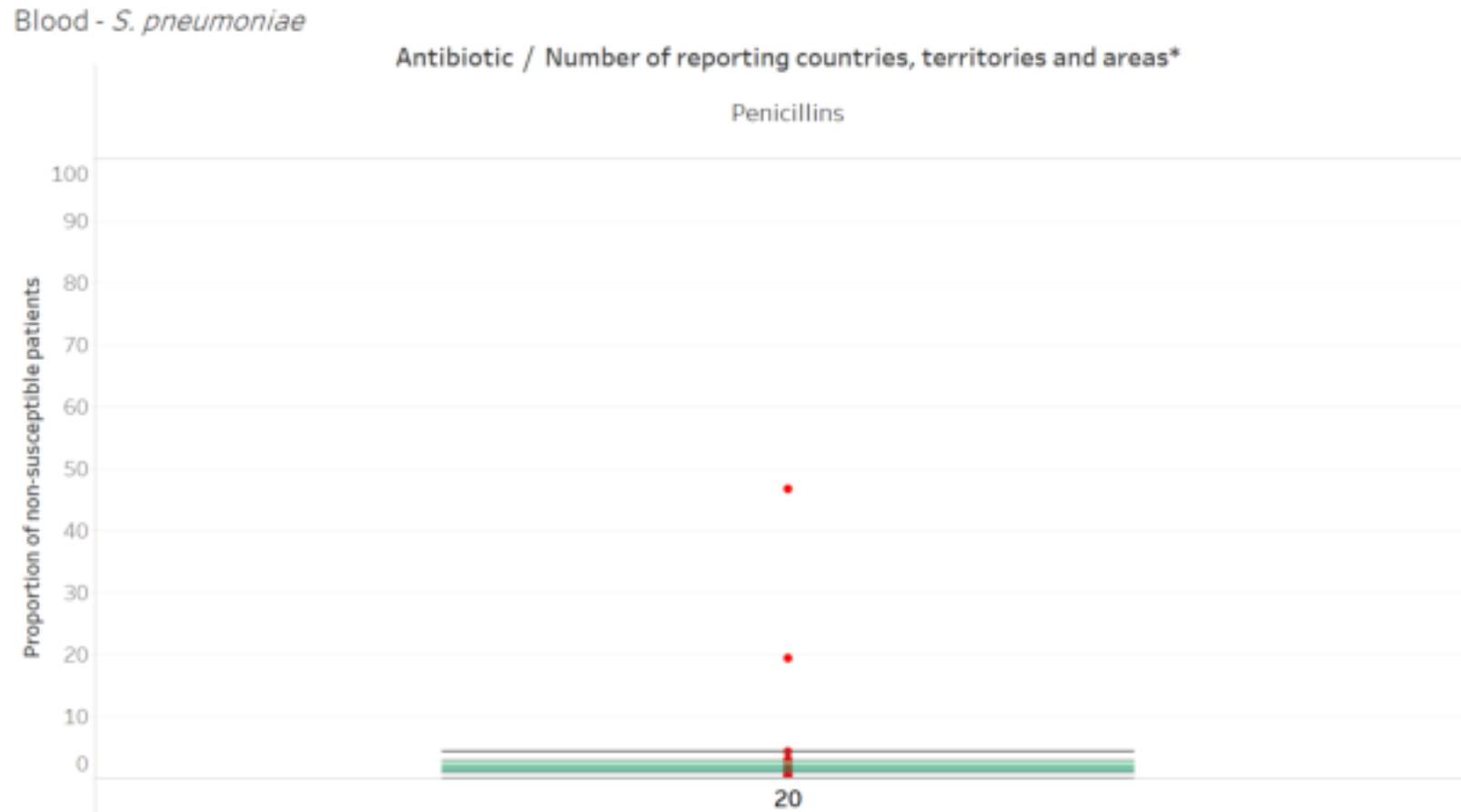
38

Global summaries of AMR rates
Urinary Tract infections

Urine - *E. coli*

Global summaries of AMR rates
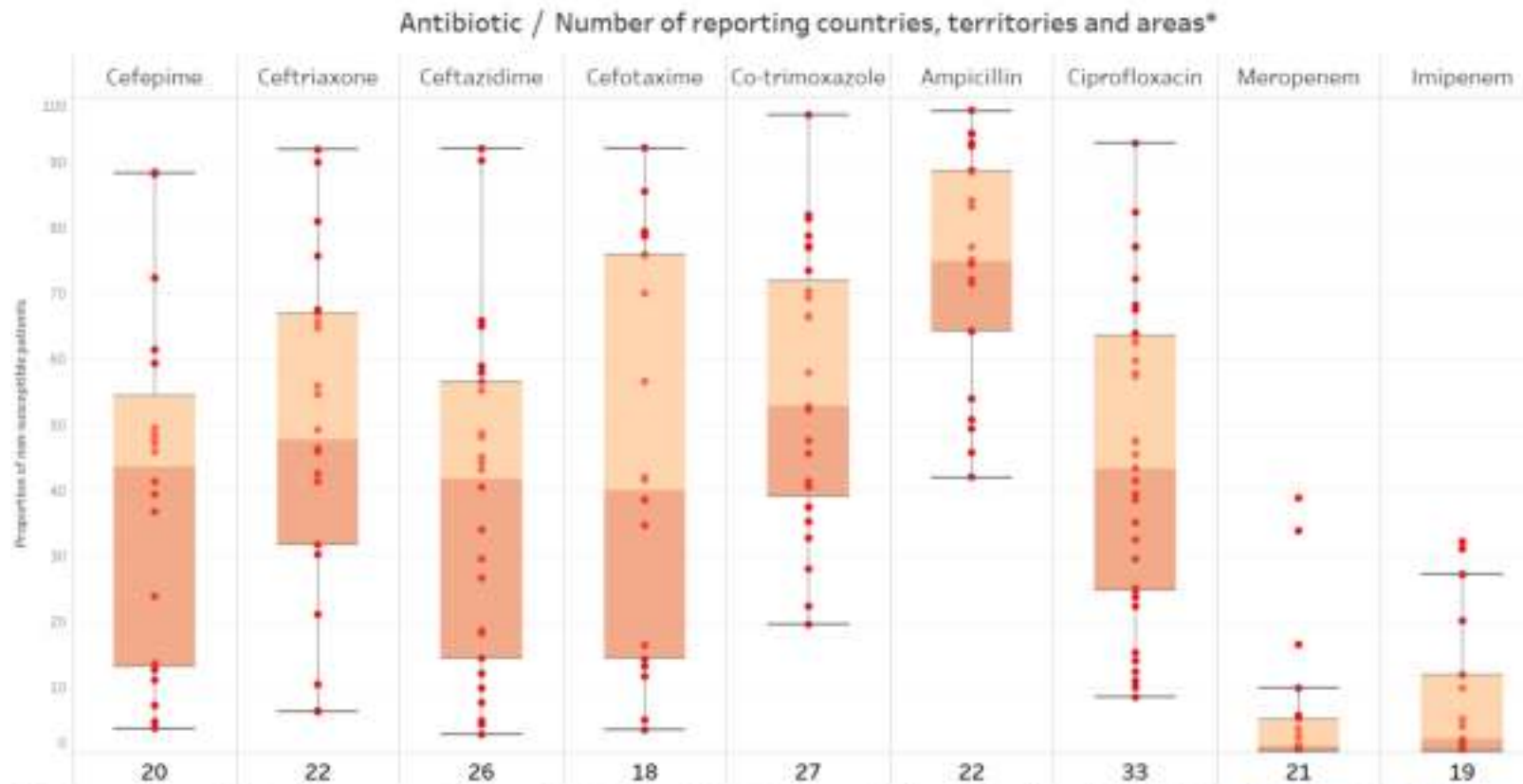## Urinary Tract infections

Urine - *K. Pneumoniae*

*Rates are shown only if results were reported for > 10 patients and for pathogen–antibiotic combinations with > 10 AST results and < 30% unknown results. Single antibiotic results are shown only if data were submitted by at least 50% of the countries reporting on the specimen-pathogen combination.

Global summaries of AMR rates
Gastrointestinal infections

Stool - *Salmonella* spp.

Global summaries of AMR rates
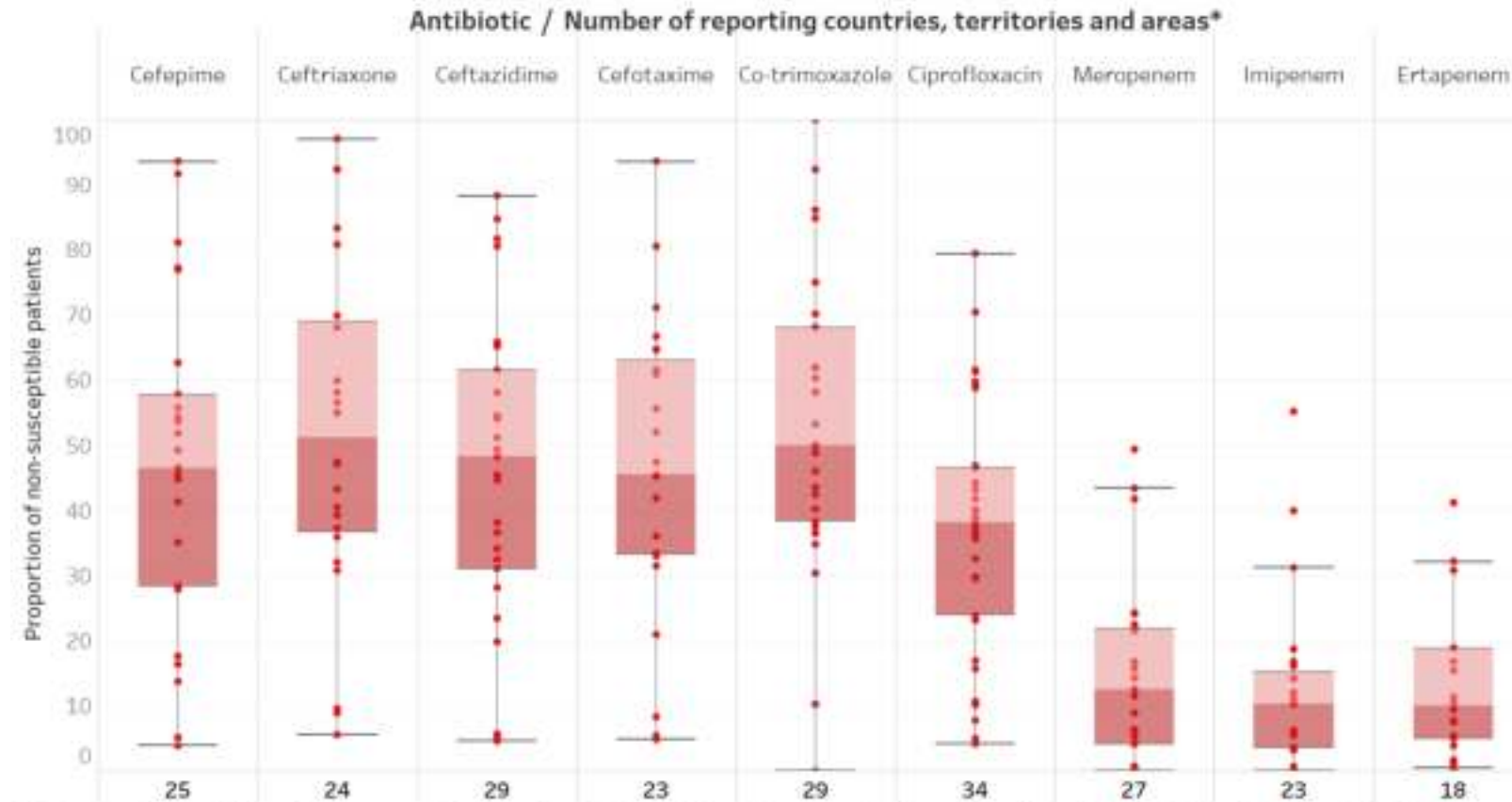## Gastrointestinal infections

Stool - *Shigella* spp.

*Rates are shown only if results were reported for > 10 patients and for pathogen–antibiotic combinations with > 10 AST results and < 30% unknown results. Single antibiotic results are shown only if data were submitted by at least 50% of the countries reporting on the specimen-pathogen combination.

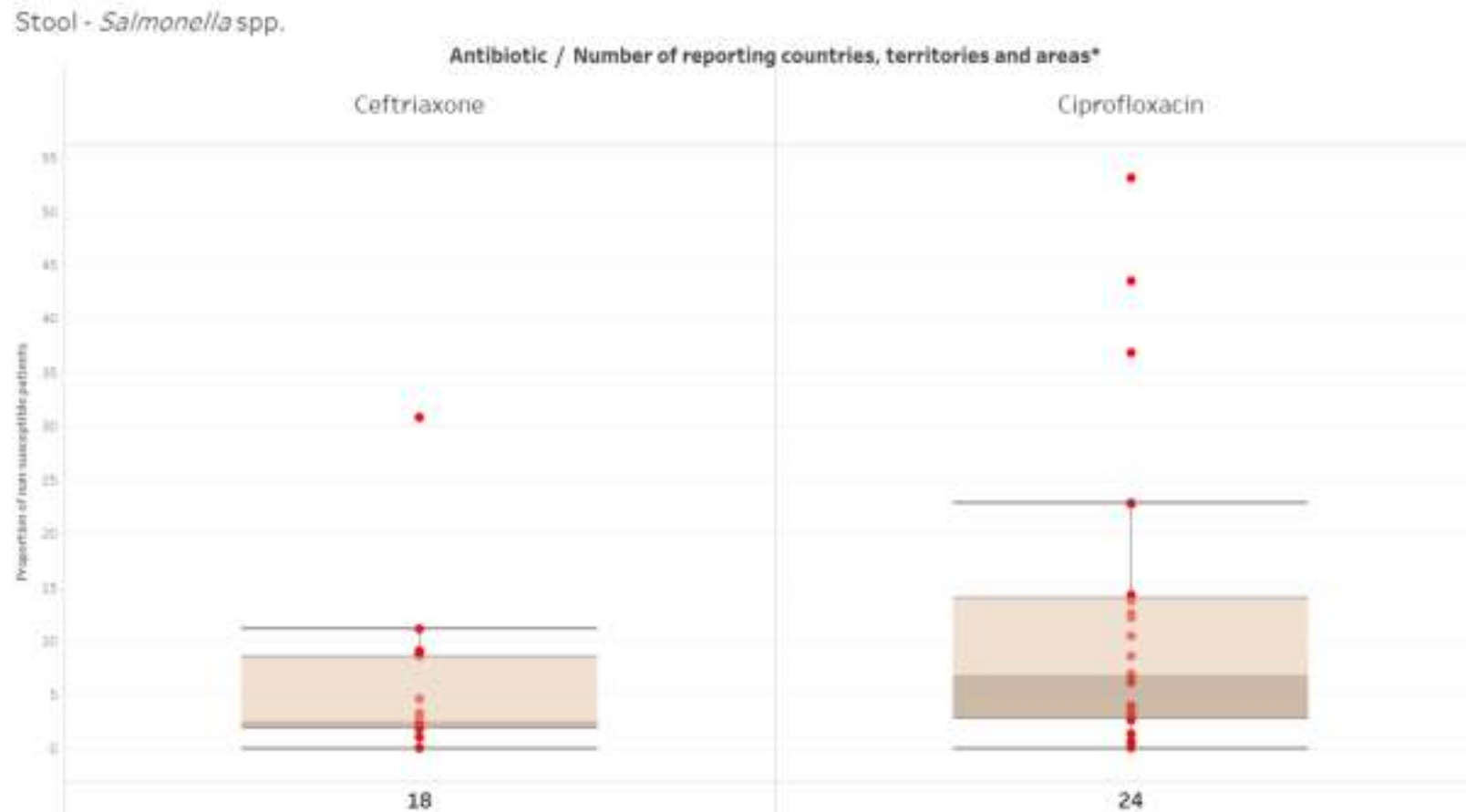# Global summaries of AMR rates
Gonorrhoea (genital infection)

Genital - *N. gonorrhoeae*

*Rates are shown only if results were reported for > 10 patients and for pathogen–antibiotic combinations with > 10 AST results and < 30% unknown results. Single antibiotic results are shown only if data were submitted by at least 50% of the countries reporting on the specimen-pathogen combination.
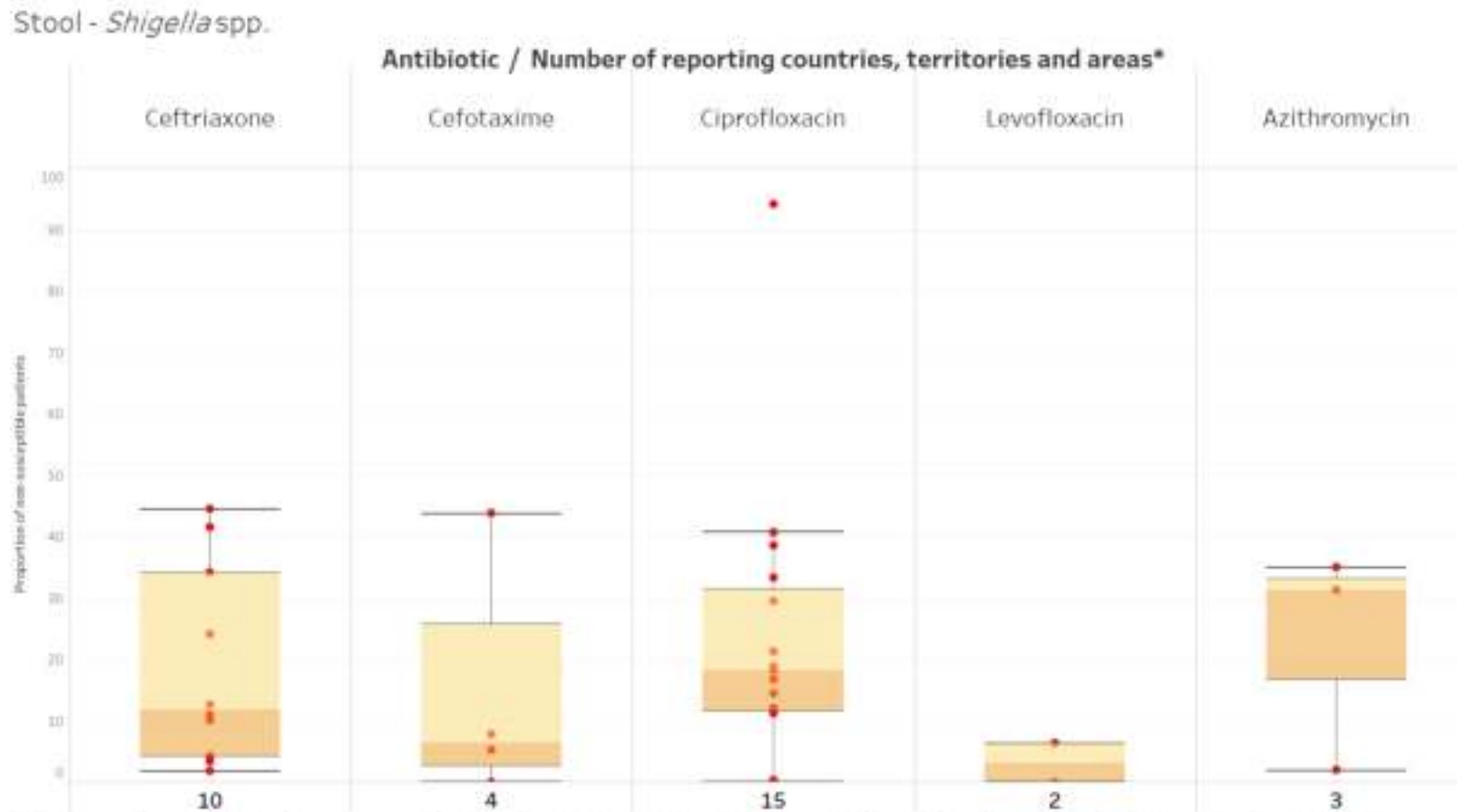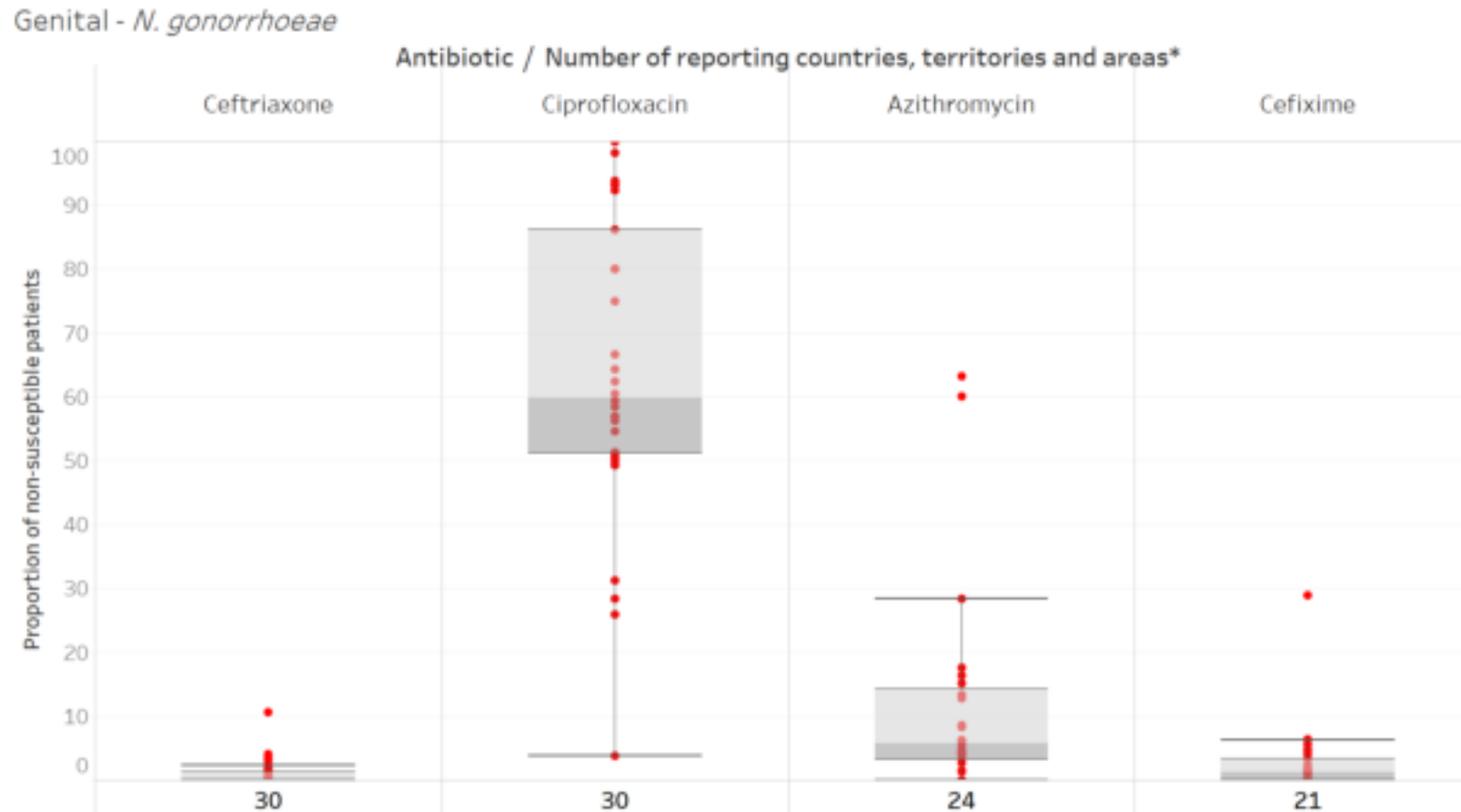
National frequencies of infections and resistant infections for community and hospital infection origin

Highlights of reported resistance

While the data still need to improve national representativeness, some alarming rates have been reported.

- Median frequency of resistance in pathogens isolated from patients with bloodstream infections

  - methicillin-resistant *S. aureus* (MRSA): 12.11% (IQR 6.4–26.4)

  - *E. coli* resistant to third-generation cephalosporins: 36.0% (IQR 15.2–63.0)

  - *K. pneumoniae* resistant to third-generation cephalosporins 57.6% (IQR 33.4-77.8), with 12 countries reporting 80-100% resistance

  - *Acinetobacte*r spp.: aminoglycosides 41.2% (IQR 5.20–83.31); carbapenems 63.2% (IQR 19.78 -81.63)

- Median resistance to ciprofloxacin in urinary tract infections

  - 43.29% (IQR 23.8 – 46.4)) for *E. coli* in 33 reporting countries, territories and areas

  - 38.1% (IQR 8.41 – 63.53) for *K. pneumoniae* in 34 reporting countries, territories and areas

Limitations &
The way forward

Limitations and challenges

GLASS Results

Data recorded & analysed ← **Data completeness & representativeness**

Quality microbiological test performed ← **Need for laboratory strengthening**

Patient specimen collected

Infection suspected

Access to health care ← **Need for Universal Health Coverage**

Population at risk

Diagnostic stewardship
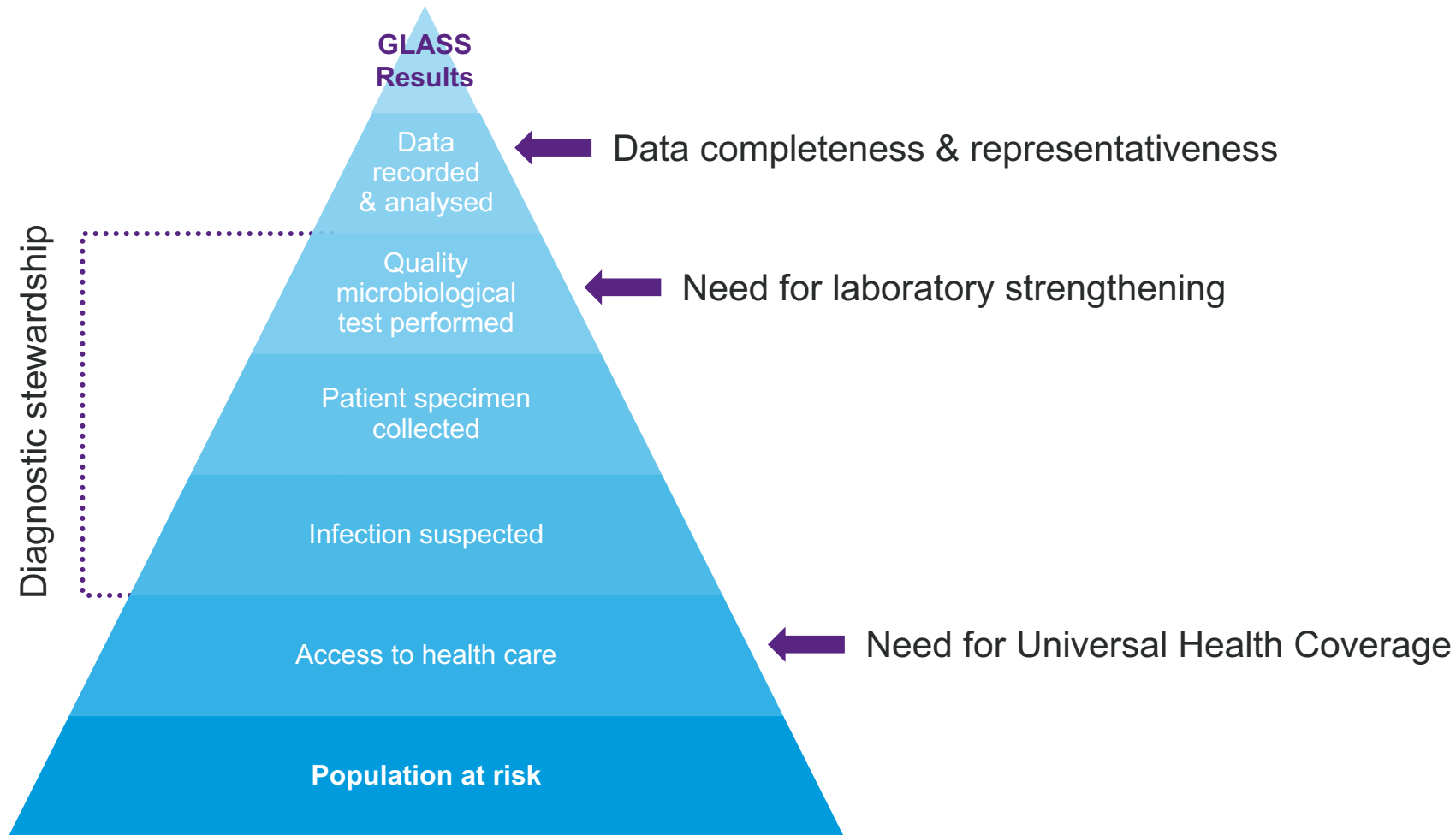
Steps towards a global system

2014
Summarise *status of AMR surveillance globally*

2015
Develop *global standards* for surveillance

2016
Establish a *global surveillance system*

2017-18
GLASS **data call and reporting**

2019
Incorporation of **AMC and focused surveillance** activities, **studies and surveys**

2020
GLASS revision

Stockholm, April 2021:

- 3rd High Level Technical Consultation and Meeting on Surveillance of Antimicrobial Resistance and Use for Concerted Actions
- Supported by Republic of Korea and Sweden

Partners

Work through <u>WHO</u> network with partners' support

- GLASS AMR Collaborative Platform with partner technical institutions

- <u>WHO AMR Surveillance and Quality Assessment Collaborating Centres Network</u>

- Key support

  − country capacity building to conduct AMR surveillance

  − foster the participation of countries in GLASS

  − GLASS development and dissemination

WHO AMR Surveillance and Quality Assessment Collaborating Centres Network
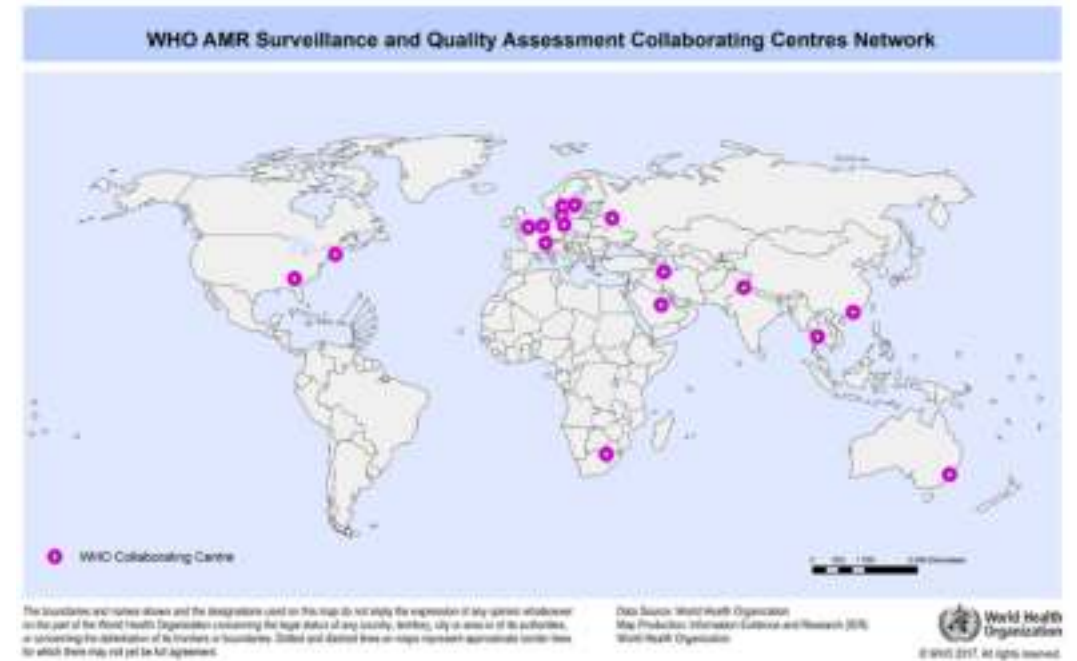
Conclusions

Conclusion

- GLASS relies on continued data sharing as well as global collaboration, harmonisation, and coordination between all partners involved in the implementation of AMR surveillance.

- Some countries still face huge challenges to building their national surveillance systems and partners play a key role in assisting WHO support countries.

- Data limitations should not impede the surveillance, but rather be used to improve it!

- Regional surveillance networks and other AMR surveillance initiatives play a key role

- Country full ownership of data is paramount

_____

We are at the initial steps of the global system!

For more information on GLASS

- More information on GLASS and synergies, enrolment procedures, links to the GLASS manuals, the yearly report, and data visualization can be found on the GLASS website http://www.who.int/glass/en/

- Other WHO AMR surveillance initiatives
  - HIV Drug Resistance http://www.who.int/hiv/pub/drugresistance/hivdr-action-plan-2017-2021/en/
  - MDR-TB Surveillance http://www.who.int/tb/areas-of-work/monitoring-evaluation/mdr-tb-surveillance/en/
  - Malaria drug resistance and response http://www.who.int/malaria/areas/drug_resistance/en/
  - Influenza virus resistance http://www.who.int/influenza/patient_care/antivirals/oseltamivir_summary/en/

Thank you!

Contact: **glass@who.int**