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**

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
Interagency 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.”
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)
- Enhanced Gonorrhoeae surveillance (GLASS-EGASP)
- Candida spp. AMR surveillance (GLASS-Fungi)

**SURVEYS AND STUDIES**
- One Health AMR surveillance (GLASS-One Health)
- Point Prevalence Survey on AMU in hospital
- Assessment of AMR attributable mortality

All activities in **PILOT PHASE**
Countries enrolled in GLASS
As of 20 May 2020

92 countries, territories and areas
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
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

Oldest and largest global AMR surveillance project:
Representative data from 164 countries (99% of the world’s TB cases) since 1995
Sources of data: rifampicin-resistant TB

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
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

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

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/
Data Summary
What data does GLASS-AMR collects?

Status of national AMR surveillance system

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

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

- 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

<table>
<thead>
<tr>
<th>Infection site</th>
<th>Pathogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloodstream</td>
<td><em>Acinetobacter spp.</em></td>
</tr>
<tr>
<td></td>
<td><em>E. coli</em></td>
</tr>
<tr>
<td></td>
<td><em>K. pneumoniae</em></td>
</tr>
<tr>
<td>Urinary tract</td>
<td><em>Salmonella spp.</em></td>
</tr>
<tr>
<td></td>
<td><em>E. coli</em></td>
</tr>
<tr>
<td></td>
<td><em>K. pneumoniae</em></td>
</tr>
<tr>
<td>Gastroenteric</td>
<td><em>Salmonella spp.</em></td>
</tr>
<tr>
<td></td>
<td><em>Shigella spp.</em></td>
</tr>
<tr>
<td>Genital</td>
<td><em>N. gonorrhoeae</em></td>
</tr>
</tbody>
</table>
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
Reporting by Economic Status

![Graph showing the number of countries reporting by economic status (LIC, LMC, UMC, HIC) for AMR rates and surveillance system information from 2017 to 2019.](Image)
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
Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report

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

Data provided by countries are available with the online report’s supplementary material
AMR data: Progress in reporting

<table>
<thead>
<tr>
<th>Reported to GLASS - AMR</th>
<th>2017 (22 countries)</th>
<th>2018 (48 countries)</th>
<th>2019 (66 countries)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of sites</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitals</td>
<td>466</td>
<td>3,097</td>
<td>5,521</td>
</tr>
<tr>
<td>Outpatients clinics</td>
<td>139</td>
<td>2,358</td>
<td>56,818</td>
</tr>
<tr>
<td>In-out patients</td>
<td>N.A.</td>
<td>N.A.</td>
<td>1,998</td>
</tr>
<tr>
<td>Other institutions</td>
<td>124</td>
<td>560</td>
<td>424</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>729</td>
<td>6,015</td>
<td>64,761</td>
</tr>
<tr>
<td><strong>Number of patients with suspected infection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood stream</td>
<td>81,920</td>
<td>262,265</td>
<td>441,794</td>
</tr>
<tr>
<td>Urinary tract</td>
<td>415,679</td>
<td>1,424,011</td>
<td>1,888,545</td>
</tr>
<tr>
<td>Gastro-intestinal</td>
<td>7,477</td>
<td>10,735</td>
<td>17,061</td>
</tr>
<tr>
<td>Sexually transmitted</td>
<td>2,847</td>
<td>9,567</td>
<td>18,572</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>507,923</td>
<td>1,706,578</td>
<td>2,365,972</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Infection site</th>
<th>Total number of infected patients</th>
<th>Pathogen</th>
<th>Number of infected patients (by pathogen)</th>
<th>Number of patients with AST results (by pathogen)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Community</td>
<td>Hospital</td>
<td>Unknown</td>
</tr>
<tr>
<td>Bloodstream</td>
<td>441 794</td>
<td>Acinetobacter spp.</td>
<td>1 780</td>
<td>2 736</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E. coli</td>
<td>48 939</td>
<td>35 974</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K. pneumoniae</td>
<td>15 306</td>
<td>15 455</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Salmonella spp.</td>
<td>2 947</td>
<td>334</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. aureus</td>
<td>12 030</td>
<td>17 408</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. pneumoniae</td>
<td>3 627</td>
<td>1 274</td>
</tr>
<tr>
<td>Urinary tract</td>
<td>1 888 545</td>
<td><em>E. coli</em></td>
<td>405 942</td>
<td>164 385</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K. pneumoniae</td>
<td>64 571</td>
<td>42 206</td>
</tr>
<tr>
<td>Gastroenteric</td>
<td>17 061</td>
<td>Salmonella spp.</td>
<td>2 630</td>
<td>257</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shigella spp.</td>
<td>375</td>
<td>42</td>
</tr>
<tr>
<td>Genital</td>
<td>18 572</td>
<td>N. gonorrhoeae</td>
<td>16 336</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>2 365 972</td>
<td></td>
<td>574 483</td>
<td>280 072</td>
</tr>
</tbody>
</table>

*Note: Numbers in parentheses represent the number of patients with AST results.*
Global summaries of AMR rates

Bloodstream infections

*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.
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Global summaries of AMR rates

Gonorrhoea (genital infection)

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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
  - *Acinetobacter* 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

- Data completeness & representativeness
- Need for laboratory strengthening
- Need for Universal Health Coverage

GLASS Results

- Data recorded & analysed
- Quality microbiological test performed
- Patient specimen collected
- Infection suspected
- Access to health care
- 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 WHO network with partners’ support

- GLASS AMR Collaborative Platform with partner technical institutions
- WHO AMR Surveillance and Quality Assessment Collaborating Centres Network
- Key support
  - country capacity building to conduct AMR surveillance
  - foster the participation of countries in GLASS
  - GLASS development and dissemination
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
Thank you!

Contact: glass@who.int