GLOBAL ANTIMICROBIAL RESISTANCE SURVEILLANCE

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6th BARN Workshop
May 12, 2016
Uppsala
What is GLASS?

A global programme for AMR surveillance

• The data it collects will
  • inform decision-making and
  • drive action in support of local, national and global strategies
GLASS – guiding principles

- Strengthen national AMR surveillance systems
  - Coordinated within the national action plan on AMR
  - Build upon existing surveillance structures and networks
- Collect epidemiological, clinical and microbiological data
- Stepwise approach to meet local and global priorities
- GLASS early implementation focus on **bacterial pathogens**
  - Routine surveillance in humans
  - Progressive link to other types of AMR-related surveillance (e.g. food chain, veterinary, antimicrobial use, environment)
Key documents addressing the need for action

- WHO Global Action Plan on Antimicrobial Resistance
  - Adopted by 68th WHA 2015

- Antimicrobial resistance: Global report on surveillance 2014

- Worldwide country situation analysis: response to antimicrobial resistance 2015
Global Action Plan 2015-2025 strategic objectives

1. Improve awareness and understanding
2. Strengthen the knowledge and evidence base through surveillance and research
3. Reduce the incidence of infection
4. Optimize the use of antimicrobial medicines in human and animal
5. Develop the economic case for sustainable investment

Goal is to ensure continuity of successful prevention and treatment of infectious diseases
Key points

• The need for a global system of bacterial surveillance
• Significant gaps in surveillance, lack of standards regarding methodology, data sharing and coordination
• Few countries have a comprehensive national plan
• Need for improved laboratory capacity, infrastructure and data management
Available National Data* on Resistance for Nine Selected Bacteria/Antibacterial Drug Combinations, 2013

*National data means data obtained from official sources, but not that data necessarily are representative for the population or country.
GLASS manual
Guidance for national AMR surveillance system

- Proposed steps for setting up a national AMR surveillance system including core components
- Participation in global AMR surveillance, including
  - GLASS enrolment requirements
  - Collection and sharing of data
- Proposed indicators for monitoring and evaluation of a national surveillance system
NEXT STEP- implementation

The manual to explain and support steps in GLASS Data flow

Surveillance sites

National Reference Laboratory

National Coordinating Centre
GLASS Road Map

2014
- Draft global surveillance standards
- Consultation with MS

2015
- Tools: IT platform, surveillance software (WHONET), capacity building materials

2016
- Start country enrolment

2017 - 2018
- Incorporate other AMR data (e.g., foodborne AMR, AM use, environment)
- 1st GLASS Report

2019
- Review lessons from early implementation phase and adapt system
- 2nd GLASS Report

We are here
Development of GLASS

• Collaboration
  – WHO Collaborating Centres
  – International networks
  – Partners

• Consultation with Member States hosted by Sweden
  – International collaboration to build global AMR surveillance
  – Stockholm, 2-3 Dec 2014
Process of GLASS development

- **December 2012**, 1st Technical Meeting on Strategies for global surveillance of antimicrobial resistance
- **March 2014**, 2nd Technical Consultation on Global Surveillance of Antibacterial Resistance (ABR) in Humans
- **May 2014**, WHA resolution 67.25 requests for a Global Action Plan on AMR
- **December 2014**, Meeting on Surveillance of antimicrobial resistance for local and global action with representatives from 30 Member states from all WHO regions
- **May 2015**, Global action plan adopted by WHO (WHA 68.20)
- **2015** Manual for early implementation
What data will be collected in GLASS?

1. Resistance data
   Resistance in **8 priority bacteria** detected in **4 types of specimens** from humans.
   - Resistance in these bacteria is considered the greatest threat globally.
   - Core patient data

2. Progress report
   Data on how countries are progressing in establishing their national AMR surveillance programmes.
What data to will be collected in GLASS?

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Laboratory case definition</th>
<th>Surveillance type and sampling setting</th>
<th>Priority pathogens for surveillance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td>Isolation of pathogen from blood(^a)</td>
<td>Selected sites or national coverage&lt;br&gt;Continuous&lt;br&gt;Patients in hospital and in the community</td>
<td><em>E. coli</em>&lt;br&gt;<em>K. pneumoniae</em>&lt;br&gt;<em>A. baumannii</em>&lt;br&gt;<em>S. aureus</em>&lt;br&gt;<em>S. pneumoniae</em>&lt;br&gt;<em>Salmonella</em> spp.</td>
</tr>
<tr>
<td>Urine</td>
<td>Significant growth in urine specimen(^b)</td>
<td>Selected sites or national coverage&lt;br&gt;Continuous&lt;br&gt;Patients in hospital and in the community</td>
<td><em>E. coli</em>&lt;br&gt;<em>K. pneumoniae</em></td>
</tr>
<tr>
<td>Faeces</td>
<td>Isolation of <em>Salmonella</em> spp.(^c) or <em>Shigella</em> spp. from stools</td>
<td>Selected sites or national coverage&lt;br&gt;Continuous&lt;br&gt;Patients in hospital and in the community</td>
<td><em>Salmonella</em> spp.&lt;br&gt;<em>Shigella</em> spp.</td>
</tr>
<tr>
<td>Urethral and cervical swabs</td>
<td>Isolation of <em>N. gonorrhoeae</em></td>
<td>Selected sites or national coverage&lt;br&gt;Continuous&lt;br&gt;Patients in hospital and in the community</td>
<td><em>N. gonorrhoeae</em></td>
</tr>
</tbody>
</table>
Surveillance targets

Routine surveillance and case-finding based on routine clinical samples of priority specimen types

- All patients sampled for prioritized specimens
  - both positive and negative samples
- All patients sampled for prioritized specimens with growth of priority species
  - only positive samples
Surveillance targets

Routine surveillance and case-finding based on routine clinical samples of priority specimen types

- Based on routine clinical samples sent for antimicrobial susceptibility testing
- Case-based clinical, microbiological and epidemiological data collection
Surveillance methods

Routine surveillance and case-finding based on routine clinical samples of priority specimen types

Core patient data collected at surveillance site according to GLASS

- Age
- Gender
- Type of healthcare facility
  - Hospital/in-patient
    - patient admitted for >2 calendar days
  - Community/out-patient
    - patient at outpatient clinics or patient in hospital ≤ 2 calendar days
Participation in GLASS
3 core components needs to be established

- **A national coordinating centre**
  - defines the objectives and standards of the national AMR surveillance system,
  - coordinates data collection at the national level and reports to GLASS

- **A national reference laboratory**
  - promotes good laboratory practices
  - serves as a resource and coordination point for laboratories.

- **Surveillance site(s)**
  - collect and report laboratory, clinical and epidemiological data
Participation in GLASS

• An open call for participation to all Member States on the WHO website
  • http://www.who.int/drugresistance/surveillance/en/
• Countries can enrol in GLASS gradually, in a stepwise manner
• Participation can build on existing surveillance systems and networks
Enrolment and sharing of data

**Initial step: National Commitment**
- To develop national AMR surveillance system
- To share data with GLASS

- Share data on status of national surveillance system
- Share national data on AMR
WHO support for GLASS activities and capacity-building

- Capacity-building tools will be provided (e.g., IT tools)
- A manual for early implementation is available on the WHO website
  - Along with additional information, support and resources
- A manual for developing national action plans on antimicrobial resistance
  - In collaboration with OIE and FAO
- WHO will promote exchange and peer support between countries
Data for action
Global surveillance: a means to an end

• To know burden, prevalence, trends
  – Priorities, case for investment and action
  – Evidence of effectiveness of action
• Assess risk, drivers of resistance
  – Integration human-animal-agriculture
  – Connecting AMR with drug consumption in all sectors
• New resistance
  – Adjust methods, standards, priorities
  – Public Health response
• Local patterns, prevalence
  – Local treatment guidance
  – Patient treatment decisions
How large is the unknown?
The need for global surveillance

Thank you for your attention!
Guiding principles of GLASS

• A flexible stepwise approach
  – local and global priorities

• Support capacity building for national AMR surveillance

• Focus on priority specimens and pathogens from routine surveillance in humans
  – Early implementation

• Coordination with national action plan/strategy for AMR
  – Build upon existing surveillance structures and networks

• Collection of epidemiological, clinical and microbiological data
Global and regional initiatives on AMR surveillance

- WHO - GLASS
- GHSA - AMR action pack
- Regional networks:
  - EARSNet
  - CAESAR
  - ReLAVRA
  - ...

GLASS manual published 2015

A global programme for AMR surveillance with the objectives to

• Foster national AMR surveillance systems and harmonize global standards
• Estimate the extent and burden of AMR globally by selected indicators
• Analyse and report global data on a regular basis
• Detect emerging resistance and its international spread
• Inform implementation of targeted prevention and control programmes
• Assess the impact of intervention
Content of the manual

1. Introduction
2. Surveillance methods
3. Participation in GLASS
4. References
   a) Annexes

- Intended readership
  national public health professionals and national health authorities responsible for surveillance of antibacterial resistance in humans
The GLASS manual provides guidance for countries on

- Proposed steps for development of a national AMR surveillance system including core components
- Participation in global AMR surveillance in humans, including
  - GLASS enrolment requirements
  - Collection, compilation and sharing of AMR data and data on progress of national AMR surveillance system
- Proposed indicators for monitoring and evaluation of implementation of a national AMR surveillance system
The manual to explain and support steps in GLASS Data flow.
What is the use of the GLASS manual for national surveillance?

- provides guidance to those responsible for AMR surveillance nationally
  - on participation in global antibacterial resistance surveillance in humans, including
  - priority specimens, pathogens, and pathogen-antimicrobial combinations for GLASS surveillance and
  - the collection, compilation and sharing of data
- proposes steps for the development of national surveillance systems and adherence to GLASS
- provides indicators for measuring implementation progress of a national surveillance programme
- provides guidance on how to report harmonized national AMR data of assured quality to WHO
What is the use of the GLASS manual for local surveillance sites?

- Provides guidance to those responsible for AMR surveillance at surveillance sites
  - on participation in global antibacterial resistance surveillance in humans,
  - Including;
    - the collection, compilation and sharing of patient, population and AST data
    - Implementation/QA of AST methodology

- Provides guidance on how to report harmonized AMR data of assured quality to the national coordinating center
Surveillance methods

Routine surveillance and case-finding based on routine clinical samples of priority specimen types

- Priority specimen (infection proxy) types and priority pathogens and antimicrobials

Case-based surveillance of clinical syndromes

- Ultimate target in GLASS but more laborious and will not be primary target during early implementation

Laboratory-based surveillance

- This approach does not provide information on the extent of the problem in the population and is not promoted in GLASS.
2. Surveillance methods

1. Routine surveillance and case-finding based on routine clinical samples of priority specimen types

2. Priority pathogen-antibacterial combinations on which GLASS will gather data

3. Priority specimen types to be assessed
Routine surveillance and case-finding based on routine clinical samples of priority specimen types

**Key approach:**

- AST results will be combined with the patient data that (should) accompany every request for AST and related to population data from the surveillance site.

- Data will be stratified according to:
  - Specimen type
  - Core patient data
# Priority specimen (infection proxy) types

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Laboratory case definition</th>
<th>Surveillance type and sampling setting</th>
<th>Priority pathogens for surveillance</th>
</tr>
</thead>
</table>
| Blood                  | Isolation of pathogen from blood<sup>a</sup>                                                | Selected sites or national coverage Continuous Patients in hospital and in the community | *E. coli*  
*K. pneumoniae*  
*A. baumannii*  
*S. aureus*  
*S. pneumoniae*  
*Salmonella* spp. |
| Urine                  | Significant growth in urine specimen<sup>b</sup>                                            | Selected sites or national coverage Continuous Patients in hospital and in the community | *E. coli*  
*K. pneumoniae* |
| Faeces                 | Isolation of *Salmonella* spp.<sup>c</sup> or *Shigella* spp. from stools                    | Selected sites or national coverage Continuous Patients in hospital and in the community | *Salmonella* spp.  
*Shigella* spp. |
| Urethral and cervical swabs | Isolation of *N. gonorrhoeae*                                                              | Selected sites or national coverage Continuous Patients in hospital and in the community | *N. gonorrhoeae* |

- Any pathogen isolated from a blood culture may be significant for surveillance locally and nationally; only the prioritized pathogens for global surveillance are listed here.
- Pure culture according to local laboratory practice. Catheter samples should be excluded if possible.
- Diarrhoeal surveillance is for non-typhoid salmonella species; for local clinical purposes, typhoid and paratyphoid should be included.
### Priority pathogens and antimicrobials (I)

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Antibacterial class</th>
<th>Antibacterial agents that may be used for AST&lt;sup&gt;a,b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Escherichia coli</strong></td>
<td>Sulfonamides and trimethoprim</td>
<td>Co-trimoxazole</td>
</tr>
<tr>
<td></td>
<td>Fluoroquinolones</td>
<td>Ciprofloxacin or levofloxacin</td>
</tr>
<tr>
<td></td>
<td>Third-generation cephalosporins</td>
<td>Ceftriaxone or cefotaxime and ceftazidime</td>
</tr>
<tr>
<td></td>
<td>Fourth-generation cephalosporins</td>
<td>Cefepime</td>
</tr>
<tr>
<td></td>
<td>Carbapenems&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Imipenem, meropenem, ertapenem or doripenem</td>
</tr>
<tr>
<td></td>
<td>Polymyxins</td>
<td>Colistin</td>
</tr>
<tr>
<td></td>
<td>Penicillins</td>
<td>Ampicillin</td>
</tr>
<tr>
<td><strong>Klebsiella pneumoniae</strong></td>
<td>Sulfonamides and trimethoprim</td>
<td>Co-trimoxazole</td>
</tr>
<tr>
<td></td>
<td>Fluoroquinolones</td>
<td>Ciprofloxacin or levofloxacin</td>
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</tr>
<tr>
<td></td>
<td>Carbapenems&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Imipenem, meropenem, ertapenem or doripenem</td>
</tr>
<tr>
<td></td>
<td>Polymyxins</td>
<td>Colistin</td>
</tr>
<tr>
<td><strong>Acinetobacter baumannii</strong></td>
<td>Tetracyclines</td>
<td>Tigecycline or minocycline</td>
</tr>
<tr>
<td></td>
<td>Aminoglycosides</td>
<td>Gentamicin and amikacin</td>
</tr>
<tr>
<td></td>
<td>Carbapenems&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Imipenem, meropenem, ertapenem or doripenem</td>
</tr>
<tr>
<td></td>
<td>Polymyxins</td>
<td>Colistin</td>
</tr>
</tbody>
</table>
### Priority pathogens and antimicrobials (II)

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Antimicrobials</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>Penicillinase-stable beta-lactams</td>
</tr>
<tr>
<td></td>
<td>Cefoxitin&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Streptococcus pneumoniae</em></td>
<td>Penicillins</td>
</tr>
<tr>
<td></td>
<td>Oxacillin&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Penicillin G</td>
</tr>
<tr>
<td></td>
<td>Co-trimoxazole</td>
</tr>
<tr>
<td></td>
<td>Ceftriaxone or cefotaxime</td>
</tr>
<tr>
<td><em>Salmonella</em> spp.</td>
<td>Fluoroquinolones</td>
</tr>
<tr>
<td></td>
<td>Ciprofloxacin or levofloxacin</td>
</tr>
<tr>
<td></td>
<td>Ceftriaxone or cefotaxime and ceftazidime</td>
</tr>
<tr>
<td></td>
<td>Imipenem, meropenem, ertapenem or doripenem</td>
</tr>
<tr>
<td><em>Shigella</em> spp.</td>
<td>Fluoroquinolones</td>
</tr>
<tr>
<td></td>
<td>Ciprofloxacin or levofloxacin</td>
</tr>
<tr>
<td></td>
<td>Ceftriaxone or cefotaxime and ceftazidime</td>
</tr>
<tr>
<td></td>
<td>Azithromycin</td>
</tr>
<tr>
<td><em>Neisseria gonorrhoeae</em></td>
<td>Third-generation cephalosporins</td>
</tr>
<tr>
<td></td>
<td>Cefixime</td>
</tr>
<tr>
<td></td>
<td>Ceftriaxone</td>
</tr>
<tr>
<td></td>
<td>Azithromycin</td>
</tr>
<tr>
<td></td>
<td>Spectinomycin</td>
</tr>
<tr>
<td></td>
<td>Ciprofloxacin</td>
</tr>
<tr>
<td></td>
<td>Gentamicin</td>
</tr>
</tbody>
</table>
Participation in GLASS

- The manual informs on what data to be reported to WHO and how to report it

- WHO should be informed of
  - progress in implementing the core components of national AMR surveillance systems according to template (further described in Annex 4)
  - rates of AMR from the aggregated data required by GLASS (further described in Annex 3) and
  - unusual types of AMR.
Presence of the following core components for AMR surveillance:

- A national Coordinating Center (NCC) with mandate and capacity to
  - organize national surveillance and
  - share national data with WHO

- A National Reference Laboratory with capacity to
  - Provide EQA support and guidance to participating laboratories
  - Disseminate methodology for AST
  - Verify and report unusual resistance mechanisms

- At least one surveillance site with capacity to
  - Collect and merge core patient data with AST results according to manual and report to the NCC
Countries participating in GLASS will have access to

- a web-based platform for data sharing, management and reporting; and
- a support package that includes implementation tools, surveillance software (WHONET), capacity-building activities and assistance in monitoring and evaluation for low-income countries.

WHO is establishing a platform for international collaboration among WHO collaborating centers, national and regional networks and other institutions,

- to promote exchange and peer support between countries,
- to coordinate implementation and ensure respect for Member States’ laws on surveillance, data collection, storage and reporting, and patient confidentiality.
Suggested information and training package to support the manual

- **Target groups**
  - NCC, NRL, surveillance sites

- **Proposed components:**
  - **Slide set**
    - explaining the steps of the manual for the different target groups
    - What, how, when, by whom? And why
  - **Aide memoire;**
    - 2 pages with core components and key messages

- **Implementation plan**
  - for establishing NCC, NRL and selecting surveillance sites

- **Workshops and practical training**
Thank you for your attention!
Annexes

Annex 1.
Surveillance approaches

Annex 2.
Information to be collected routinely at points of care on all clinical samples sent for bacteriological culture and testing for susceptibility to antimicrobial agents

Annex 3.
Structure for reporting aggregated data by a surveillance coordinating centre
Proposed indicators for monitoring and evaluating implementation of GLASS

Annex 4. Document review group
Data to be collected with every request for AST (core patient data, Annex 2)

**Patient identification**

<table>
<thead>
<tr>
<th>a. Unique identification number</th>
<th>Gender:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male ☐</td>
</tr>
<tr>
<td></td>
<td>Female ☐</td>
</tr>
</tbody>
</table>

| b. Name: (family name, given name(s)) | |

| Date of birth: (yyyy/mm/dd) | |

<table>
<thead>
<tr>
<th>Years</th>
<th>Months (if &lt; 1 year)</th>
</tr>
</thead>
</table>

**Specimen information:**

- ☐ Blood
- ☐ Urine
- ☐ Faeces
- ☐ Urethral secretion
- ☐ Cervical secretion
- ☐ Other

<table>
<thead>
<tr>
<th>Date of specimen collection: (yyyy/mm/dd)</th>
<th>Had the patient been hospitalized for more than 2 calendar days at the time for sampling?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Yes  ☐ No</td>
</tr>
</tbody>
</table>

The same information could be collected in digital format. Collection forms and tools will be provided or made available (WHONET application, specification of digital export files from other systems) to collect data at surveillance sites.
Examples of data that can be generated (I)

**Frequency of patients sampled per specimen type per population covered**

- **Numerator:** Number of patients sampled per specimen type
- **Denominator:** Population covered
- **Example:** Number of urinary cultures per 100,000 inhabitants

**Frequency of patients with growth of non-susceptible bacteria per specimen type, species and antibiotic**

- **Numerator:** Number of sampled patients with growth of non-susceptible bacteria of the species and antibiotic under surveillance per specimen type
- **Denominator:** Total number of sampled patients per specimen type
- **Example:** Number of sampled patients with *E. coli* resistant to fluoroquinolones out of all patients sampled for blood culture
Examples of data that can be generated (II)

Proportion of sampled patients with positive culture of any (susceptible, intermediate or resistant) pathogenic bacteria per specimen type

Numerator: Number of patients sampled with positive culture per specimen type
Denominator: Number of patients sampled per specimen type.
Example: Number of patients sampled with positive blood cultures out of all patients sampled for blood culture

Proportion of samples with growth of non-susceptible bacteria of the species and antibiotic under surveillance per specimen type

Numerator: Number of samples with growth of non-susceptible bacteria of the species and antibiotic under surveillance
Denominator: Total number of samples with growth of bacteria of the species under surveillance and tested for susceptibility for the antibiotic in question.
Example: Proportion of *E. coli* non-susceptible to fluoroquinolones out of all tested.
Data to be reported to WHO:
Example 1 of national AMR data (Annex 3)

Contact information

Country: .................................................................
Total population: ..........................................................
Contact person: .......................................................... Alternative contact person: ........................................
Telephone: .............................................................. Telephone: ..............................................................
E-mail: ................................................................. E-mail: .................................................................
Address: ............................................................... Address: ...............................................................  

<table>
<thead>
<tr>
<th>Priority specimen*</th>
<th>Pathogens*</th>
</tr>
</thead>
</table>
| □ Bloodstream infections (Table A.3.2) | □ E. coli  
  □ K. pneumoniae  
  □ A. baumannii  
  □ S. aureus  
  □ S. pneumoniae  
  □ Salmonella spp. |
| □ Urinary tract infections (Table A.3.3) | □ E. coli  
  □ K. pneumoniae |
| □ Acute diarrhoea (Table A.3.4) | □ Salmonella spp.  
  □ Shigella spp. |
| □ Gonorrhoea, urethra, cervix (Table A.3.5) | □ N. gonorrhoeae |

* Tick the items included in national surveillance and reported to GLASS
Data to be reported to WHO:
Example 2 of national AMR data (Annex 3)

Period

yyyy/mm/dd to yyyy/mm/dd

Number of surveillance sites

Hospital(s): ................................................................. Outpatient department(s): ...........................................

Data stratified by age and gender

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>0</th>
<th>1–4</th>
<th>5–14</th>
<th>15–24</th>
<th>25–34</th>
<th>35–44</th>
<th>45–54</th>
<th>55–64</th>
<th>65–80</th>
<th>≥ 81</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
</tbody>
</table>

Total number of patients from whom a blood culture was taken:

Hospital origin:*  
Community origin:**

Total number of patients with positive blood culture, any species:

* Hospital origin: hospitalized for > 2 calendar days when the specimen was taken:
  - patient admitted to a health care facility for > 2 calendar days; or
  - patient admitted to a health care facility for < 2 calendar days but transferred from another health care facility where admitted for ≥ 2 calendar days

** Community origin:
  - patient being cared for at an outpatient clinics when the specimen was taken; or
  - patient hospitalized for ≤ 2 calendar days when the specimen was taken.
### Data to be reported to WHO:

**Example 3 of national AMR data (Annex 3)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Age group (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 1</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Hospital origin</td>
</tr>
<tr>
<td>E. coli</td>
<td></td>
</tr>
<tr>
<td>K. pneumoniae</td>
<td></td>
</tr>
<tr>
<td>A. baumannii</td>
<td></td>
</tr>
<tr>
<td>S. aureus</td>
<td></td>
</tr>
<tr>
<td>S. pneumonia</td>
<td></td>
</tr>
<tr>
<td>Salmonella spp.</td>
<td></td>
</tr>
<tr>
<td>Other spp.</td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td></td>
</tr>
</tbody>
</table>
Data to be reported to WHO: Example 4 of national AMR data (Annex 3)

<table>
<thead>
<tr>
<th>Species</th>
<th>Antibiotics</th>
<th>&lt;1</th>
<th>1-4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Age group (years)</strong></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Hospital origin</td>
<td>Community origin</td>
<td>Hospital origin</td>
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<tr>
<td>AST result</td>
<td>S</td>
<td>I</td>
<td>R</td>
</tr>
<tr>
<td>E. coli</td>
<td>Co-trimoxazole</td>
<td></td>
<td></td>
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<tr>
<td>E. coli</td>
<td>Fluoroquinolones R to any agent</td>
<td>No. of isolates tested:</td>
<td>No. of isolates tested:</td>
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<tr>
<td>E. coli</td>
<td>Ciprofloxacin</td>
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<td></td>
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<tr>
<td>E. coli</td>
<td>Levofloxacin</td>
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<td></td>
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<tr>
<td>E. coli</td>
<td>Third-generation cephalosporins I+R to any agent</td>
<td>No. of isolates tested:</td>
<td>No. of isolates tested:</td>
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<tr>
<td>E. coli</td>
<td>Ceftriaxone</td>
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<td>E. coli</td>
<td>Cefotaxime</td>
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<tr>
<td>E. coli</td>
<td>Ceftazidime</td>
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<td>E. coli</td>
<td>Fourth-generation cephalosporins</td>
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<tr>
<td>E. coli</td>
<td>Carbapenems I+R to any agent</td>
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<td>No. of isolates tested:</td>
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<td>E. coli</td>
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<td>Meropenem</td>
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<td>Ertapenem</td>
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<td>Doripenem</td>
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<td>Colistin</td>
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<td>E. coli</td>
<td>Ampicillin</td>
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</tbody>
</table>
Example of implementation progress indicators to be reported to WHO

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition</th>
<th>Type and purpose</th>
<th>Value (local level)</th>
<th>Value (national level)</th>
<th>Frequency of data collection (global level)</th>
<th>Data source</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Priority specimens</td>
<td>Number of prioritized specimens included in GLASS targets</td>
<td>Output Monitoring</td>
<td>Absolute number</td>
<td>Countries with n out of N GLASS targets included (%)</td>
<td>With submission of GLASS data</td>
<td>Key informant</td>
<td>Informant or evaluation report. Could be derived from the surveillance data submission</td>
</tr>
<tr>
<td>2. Priority pathogens</td>
<td>Number of prioritized pathogens included in GLASS targets</td>
<td>Output Monitoring</td>
<td>Absolute number</td>
<td>Countries with n out of N GLASS targets included (%)</td>
<td>With submission of GLASS data</td>
<td>Key informant</td>
<td>Informant or evaluation report. Could be derived from the surveillance data submission</td>
</tr>
<tr>
<td>3. Priority pathogen-antimicrobial combinations</td>
<td>Number of prioritized pathogen-antimicrobial combinations included in GLASS targets</td>
<td>Output Monitoring</td>
<td>Absolute number</td>
<td>Countries with n out of N GLASS targets included (%)</td>
<td>With submission of GLASS data</td>
<td>Key informant</td>
<td>Informant or evaluation report. Could be derived from the surveillance data submission</td>
</tr>
</tbody>
</table>

### Surveillance structure

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition</th>
<th>Type and purpose</th>
<th>Value (local level)</th>
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<th>Data source</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Presence of a national coordinating centre (NCC)</td>
<td>NCC with appropriate mandate, terms of reference and responsible person (focal point) is established</td>
<td>Input Evaluation</td>
<td>Yes / No</td>
<td>Countries with established NCCs meeting the GLASS requirements (%)</td>
<td>With submission of GLASS data</td>
<td>Key informant</td>
<td>Informant or evaluation report</td>
</tr>
<tr>
<td>5. Presence of a National Focal Point (NFP)</td>
<td>NFP is designated and communicating with GLASS</td>
<td>Input Evaluation</td>
<td>Yes / No</td>
<td>Countries with established NCCs meeting the GLASS requirements (%)</td>
<td>With submission of GLASS data</td>
<td>Key informant</td>
<td>Informant or evaluation report</td>
</tr>
<tr>
<td>6. Policy support for implementation of AMR surveillance</td>
<td>Authority both to implement national AMR surveillance and participate in GLASS has been delegated by the relevant institutional jurisdiction</td>
<td>Input Evaluation</td>
<td>Yes / No</td>
<td>Countries with NCCs having the mandate to participate in GLASS (%)</td>
<td>With submission of GLASS data</td>
<td>Key informant</td>
<td>Informant or evaluation report, existing regulation</td>
</tr>
</tbody>
</table>
Modern medicine

Maternal and child health

Basic healthcare

ANTIBIOTICS