2017

National Institute of Health, Pakistan

# ANNUAL ANTIMICROBIAL RESISTANCE SURVEILLANCE REPORT PAKISTAN

# Contents

# ABBREVIATIONS

| | |
|---|---|
| **AMR** | Antimicrobial resistance |
| **AST** | Antimicrobial susceptibility testing |
| **LIMS** | Laboratory information management system |
| **LQMS** | Laboratory quality management system |
| **NEQAS** | National external quality assurance system |
| **NCC** | National Coordination Center |

## 1. Global Antimicrobial Resistance Surveillance System (GLASS)

The Global Antimicrobial Resistance Surveillance System (GLASS) has been developed to support the Global Action Plan on Antimicrobial Resistance (https://www.who.int/glass/en/). GLASS is aimed to establish standardized, comparable and validated data collection system on AMR to inform decision-making for local, national and regional actions and to provide evidence base for action and advocacy on AMR. GLASS combines patient, laboratory and epidemiological surveillance data for planning and implementation of AMR activities.

## 2. AMR surveillance in Pakistan using GLASS Protocol

***Goals:***

Generate evidence on the burden of AMR among priority pathogens referred for laboratory testing

***Objectives:***

- Conduct routine and standardized AST on priority pathogens isolated from priority specimens of patients with clinical infection at surveillance hospitals
- Establish regular and systematic reporting of AST results and patient-level data from surveillance hospitals (sentinel sites) using prescribed tools
- Establish regular and systematic communication of AST results from testing laboratories to clinical providers
- Analyze, interpret, and report AMR surveillance data annually

## 3. Dataflow system

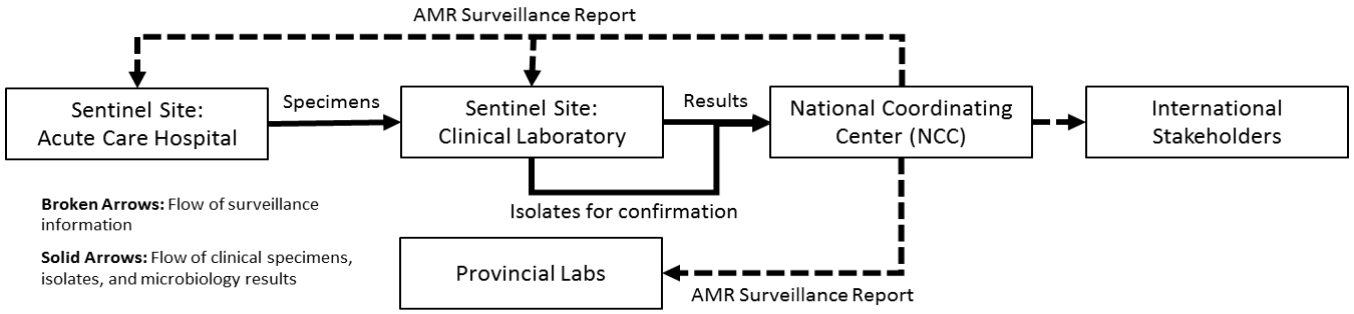


**Figure 1:** Simplified diagram of clinical specimen, microbiology test results, confirmation isolates, and AMR surveillance report flow in the Pakistan Antimicrobial Resistance Surveillance System

## 4. Surveillance sites submitting data to NCC in Phase 1 GLASS

| Sr. No. | AMR Surveillance Sites | Location |
|---|---|---|
| **1** | Dr Ruth K. M. Pfau Civil Hospital | Karachi |
| **2** | Jinnah Postgraduate Medical Center (JPMC) | Karachi |
| **3** | Agha Khan University Hospital (AKU) | Karachi |
| **4** | Sheikh Zayed Medical Center (SKMC) | Lahore |
| **5** | Armed Forces Institute of Pathology (AFIP) | Rawalpindi |
| **6** | National Institute of Health (NIH) | Islamabad |

## 5. Data elements submitted

Following data was collected from each surveillance site:

- Medical record number
- Sample collection date
- Age of patient
- Gender of patient
- Location (Outpatient, ICU, Wards)
- Sample type
- Organism isolated
- Antibiotic tested

## 6. Priority samples/pathogens included in surveillance

| Specimen | Basic laboratory case definition | Priority surveillance Pathogens |
|---|---|---|
| **Blood** | Isolation of Pathogens from blood | *Escherchia coli*<br>*Klebsiella pneumoniae*<br>*Acinetobacter baumannii*<br>*Staphylococcus aureus*<br>*Streptococcus pneumoniae*<br>*Salmonella species* |
| **Urine** | Significant Growth in urine specimen | *Escherchia coli*<br>*Klebsiella pneumoniae* |
| **Stool** | Isolation of *Salmonella spp.* Or *Shigella spp.* from stools | *Salmonella spp.*<br>*Shigella spp* |
| **Urethral and cervical swab** | Isolation of *N. gonorrhoeae* | *Neisseria gonorrhaoeae* |

## 7. Total count of submitted specimens by type and surveillance site

| Specimen | Surveillance Sites (Jan- Dec 2017)<br>No. of isolates | | | | | |
|---|---|---|---|---|---|---|
| | Dr Ruth K M Pfau Civil Hospital,<br>Karachi | JMPC, Karachi | SKMC, Lahore | NIH, Islamabad | AKU, Karachi | AFIP, Rawalpindi |
| **Blood** | 1815 | 175 | 231 | 3 | 1283 | 291 |
| **Urine** | 1914 | 1108 | 893 | 74 | 4370 | 1740 |
| **Stool** | 82 | 0 | 1 | 1 | 44 | 55 |
| **Genital** | 0 | 0 | 0 | 0 | 33 | 1 |
| **Total** | **3811** | **1283** | **1125** | **78** | **5730** | **2087** |

## 8. Percent susceptible (antibiogram) for organism/antibiotic pairs for each site

| Antibiotic Susceptibility Pattern of Dr Ruth K.M. Pfau Civil hospital Karachi 2017 | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Susceptibility of antibiotics against isolates are represented by %S | | | | | | | | | | | | | | | | | | | |
| | **Organism** | **Number of isolates** | Ampicillin | Amoxicillin clavulanate | Fosfomycin | Chloramphenicol | Levofloxacin | Meropenem | Imipenem | Cefixime | Cefotaxime | Ceftriaxone | Oxacillin | Ciprofloxacin | Ertapenem | Gentamicin | Amikacin | Linezolid | Vancomycin | Teicoplanin |
| **Gram-Negative** | **GRAM-NEGATIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Escherichia coli* | **1923** | | | | | 35 | | 95 | 84 | | | | 35 | | 75.6 | 85 | | | |
| | *Salmonella sp.* | **303** | | | | | | | | 100 | | | 66 | 61 | | 74 | | | | |
| | *Klebsiella pneumoniae* | **1498** | R | | | | 63.9 | | 86 | 85 | | | | 64 | | 75.6 | 80.8 | | | |
| **Gram-Positive** | **GRAM-POSITIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Staphyloccocus aureus* | **76** | | | | 100 | 46.1 | | | | | | 1.3 | 44 | | 48.7 | | 100 | 100 | 100 |
| | **General Notes:** | In above table 'R' represent Intrinsic Resistance. | | | | | | | | | | | | | | | | | | |

# Antibiotic Susceptibility Pattern of Agha Khan University Hospital Karachi 2017

Susceptibility of antibiotics against isolates are represented by %S

| | Organism | Number of isolates | Ampicillin | Amoxicillin clavulanate | Fosfomycin | Chloramphenicol | Penicillin G | Spectinomycin | Azithromycin | Levofloxacin | Meropenem | Imipenem | Cefixime | Cefotaxime | Ceftriaxone | Oxacillin | Trimethoprim/Sulfamethoxazole | Ciprofloxacin | Ertapenem | Gentamicin | Amikacin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gram-Negative | **GRAM-NEGATIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Escherichia coli* | **3947** | 8 | | | | | | | | 82 | 93 | | | 25.1 | | 28.8 | 30 | 92.4 | 65.9 | 96 |
| | *Neisseria gonorrhoeae* | **32** | | | | | | 80.6 | 100 | | | | | | 100 | | | 6.2 | | | |
| | *Salmonella sp.* | **552** | 47.4 | | | | | | 100 | | 100 | 100 | | | 77.4 | | 47 | 2.2 | | | |
| | *Shigella sp.* | **39** | 20.5 | | | | | | | | 100 | 100 | | | 51.3 | | 23.1 | 67 | | | |
| | *Klebsiella pneumoniae* | **845** | R | | | | | | | | 62 | 80 | | | 43.1 | | 45.7 | 63 | 87.8 | 72.7 | 82.9 |
| Gram-Positive | **GRAM-POSITIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Staphyloccocus aureus* | **281** | | | | | | | | 49.8 | | | | | | 42.5 | 58.4 | 57 | | 77.9 | 94.3 |
| | *Streptococcus pneumoniae* | **32** | | | | | 63.2 | | | 100 | | | | | 100 | | 26.7 | | | | |

# Antibiotic Susceptibility Pattern of Jinnah Postgraduate Medical Centre Karachi 2017

Susceptibility of antibiotics against isolates are represented by %S

| | Organism | Number of isolates | Ampicillin | Amoxicillin clavulanate | Fosfomycin | Chloramphenicol | Levofloxacin | Meropenem | Imipenem | Cefixime | Cefotaxime | Ceftriaxone | Tigecycline | Trimethoprim/Sulfamethoxazole | Ciprofloxacin | Ertapenem | Gentamicin | Amikacin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gram-Negative | **GRAM-NEGATIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Escherichia coli* | **871** | | | | | | 88 | 95 | 14 | | 29.8 | 97.7 | | | | | |
| | *Salmonella sp.* | **25** | | | | | | | | 84 | | 84 | | 33.3 | | | | |
| | *Klebsiella pneumoniae* | **230** | R | | | | | 87 | 91 | 7.4 | | 32 | 90.9 | | | | | |
| | *Acinetobacter sp.* | **89** | R | R | R | R | | | 63 | 0 | 21 | 15.9 | 82.7 | 26.7 | | | | |
| | **GRAM-POSITIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| Gram-Positive | *Staphyloccocus aureus* | **60** | | | | | | | | | | 62.7 | | | | | | |
| | | | | | | | | | | | | | | | | | | |

# Antibiotic Susceptibility Pattern of Sheikh Zayed Hospital Lahore 2017

Susceptibility of antibiotics against isolates are represented by %S

| | Organism | Number of isolates | Ampicillin | Amoxicillin clavulanate | Fosfomycin | Chloramphenicol | Meropenem | Imipenem | Cefotaxime | Ceftriaxone | Ceftazidime | Cefoxitin | Ciprofloxacin | Ertapenem | Gentamicin | Amikacin | Colistin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gram-Negative | **GRAM-NEGATIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Escherichia coli* | **812** | 4.9 | | | | 85 | 84 | 11 | 11.6 | 11 | | 11 | 72.5 | | | 99.7 |
| | *Neisseria gonorrhoeae* | | | | | | | | | | | | | | | | |
| | *Salmonella sp.* | **105** | | | | | 97 | 99 | 92 | 95.5 | 97 | | 6.3 | 94.7 | | | |
| | *Klebsiella pneumoniae* | **41** | R | | | | 66 | 63 | 20 | 28.6 | 19 | | 29 | 59.3 | | 12 | 100 |
| | *Acinetobacter sp.* | **60** | R | R | R | R | 28 | 33 | | | | | | | 26.7 | 26 | 80 |
| | **GRAM-POSITIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| Gram-Positiv | *Staphyloccocus aureus* | **97** | | | | | | | | | | 25 | | | | | |

# Antibiotic Susceptibility Pattern of Microbiology Lab, National Institute of Health Islamabad 2017

Susceptibility of antibiotics against isolates are represented by %S

| | Organism | Number of isolates | Ampicillin | Amoxicillin clavulanate | Fosfomycin | Chloramphenicol | Nitrofurantoin | Piperacillin-Tazobactam | Meropenem | Imipenem | Tetracyclines | Cefazolin | Ceftriaxone | Ceftazidime | Clindamycin | Erythromycin | Trimethoprim-Sulfamethoxazole | Doxycycline | Ciprofloxacin | Moxifloxacin | Gentamicin | Amikacin | Vancomycine | Linezolid |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gram-Negative | **GRAM-NEGATIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Escherichia coli* | **53** | 11.1 | 20.4 | 94.9 | 100 | 93.5 | 50 | 95 | 100 | 40 | | 28.9 | 44 | | | 33.3 | 50 | 85 | 66.7 | 77.8 | 88.9 | | |
| | *Klebsiella pneumoniae* | **20** | R | 27.8 | 81.2 | 50 | 75 | 81.2 | 88 | 100 | 50 | | 47.1 | 57 | | | 33.3 | 50 | 85 | 66.7 | 77.8 | 88.9 | | |
| | **GRAM-POSITIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| Gram-Positive | *Staphyloccocus aureus* | **71** | 6.8 | 43.2 | 92.7 | 93.9 | | 48.5 | 46 | 40 | 99 | | 13.9 | | 89 | 30.5 | 50 | 92 | 42 | 68.2 | 68.4 | 87.1 | 100 | 100 |
| | **General Notes:** | In above table 'R' represent Intrinsic Resistance. | | | | | | | | | | | | | | | | | | | | | | |

# Antibiotic Susceptibility Pattern of Armed Forces Institute of Pathology 2017

Susceptibility of antibiotics against isolates are represented by %S

| | Organism | Number of isolates | Ampicillin | Amoxicillin clavulanate | Fosfomycin | Chloramphenicol | Penicillin G | Ceftazidime | Azithromycin | Levofloxacin | Meropenem | Imipenem | Cefixime | Cefotaxime | Ceftriaxone | Colistin | Tigecycline | Ciprofloxacin | Ertapenem | Gentamicin | Amikacin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gram-Negative | **GRAM-NEGATIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Escherichia coli* | **1519** | 9.4 | | | | | 10.6 | | 24.9 | 94 | 95 | 37 | | 33 | 29.8 | 94.8 | 24 | | 64.1 | 92.2 |
| | *Salmonella sp.* | **70** | 58.2 | | | | | | 81.6 | | 10 | | | | 98.6 | 62.3 | | 10 | | | |
| | *Klebsiella pneumoniae* | **324** | R | 20.1 | 87.2 | 100 | | 9.1 | | 45.3 | 61.2 | 60.3 | | | 29.9 | 29.9 | 69.2 | 31.1 | | 51.5 | 60.4 |
| | *Acinetobacter sp.* | **76** | R | R | R | R | | | 16.7 | | 38 | 41 | | | 17.5 | 45.6 | 48.8 | 29 | | 38.1 | 41.5 |
| Gram- Positive | **GRAM-POSITIVE ORGANISMS** | | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S | %S |
| | *Staphylococcus aureus* | **73** | | | | | | | | | | | | | 13.5 | 57.6 | 100 | 29 | | 53.2 | 90.9 |

# 9. Discussion

***a. Data Analysis:***

Overall 4 hospitals and two outpatients laboratories reported AMR data (Jan- Dec 2017) to GLASS. Highest number of isolates being reported from urine, followed by blood, stool and cervical/urethral specimens collectively from all the sites. The most frequently reported pathogens were *Escherichia coli, followed by Klebsiella pneumoniae, Salmonella species, Staphylococcus aureus, Acinetobacter baumannii, Neisseria gonorrhaoeae, Streptococcus pneumoniae.* Antimicrobial susceptibility testing varied among sites and specimen pathogen-antibiotic combination. Enterobacteriaceae (*E. coli, K. pneumoniae*) were mainly resistant to ciprofloxacin, levofloxacin, cefixime and imipenem. *Acinetobacter spp*. were mainly resistant to tigecylcine, meropenem, gentamicin.

***b. Observations:***

**Trained IT/ Data entry persons/ Laboratory Information Management System**: There is need of trained IT persons/ Data entry persons at the surveillance sites, and this will help to overcome the problems of software up gradation, backing up of data etc. Few laboratories in Pakistan are not using LIMS or Hospital Management Information System, which leads to difficulty in accessing data in systematic way.

**Whonet installation:** The surveillance sites need to be trained on rational use of whonet for data entry/ QC data entry, data analysis and baclink software for data conversion in required formats.

***c. Recommendations***

- **Expansion of GLASS program:** More sentinel surveillance sites from the country should be included in GLASS program, based on recommendations of criteria mentioned in AMR surveillance plan that includes laboratory assessments and quality data generation.

- **Addition of priority pathogens in surveillance program**: e.g., extremely drug resistant *S. typhi*, carbapenem resistant Enterobactericeae
- **Quality data:** Quality data need to assured from the participating labs. National External Quality Assurance System (NEQAS). helps in assessing the quality data production of the laboratories. The participating laboratories should be enrolled in NEQAS program as minimal criteria to be part of GLASS.
- **Laboratory Quality Management System (LQMS) training:** AMR surveillance sites should be trained on LQMS; to strengthen all aspects of the laboratory operations, including the organizational structure, processes, and procedures, in order to assure quality.