Indian Priority Pathogen List

TO GUIDE RESEARCH, DISCOVERY AND DEVELOPMENT OF NEW ANTIBIOTICS IN INDIA

Developed by
WHO Country Office for India
in collaboration with
Department of Biotechnology, Government of India
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Antimicrobial resistance (AMR) is one of the top 10 global health threat faced by the world today and can have a major impact on the economy, society, food safety and public health. Infections caused by antibiotic-resistant pathogens substantially amplify the burden of both healthcare-associated and community-acquired infections. To minimize the emergence and spread of AMR, coordinated actions are required at the global, national and sub-national levels.

**AMR – a national priority**

The National Health Policy 2017 highlights the problem of antimicrobial resistance and calls for a rapid standardization of guidelines regarding antibiotic use, limiting the use of antibiotics as over-the-counter medications, banning or restricting the use of antibiotics as growth promoters in animal livestock, and pharmacovigilance including prescription audits inclusive of antibiotic usage – in the hospital and community. The Ministry of Health & Family Welfare (MoHFW), Government of India notified the governance mechanisms to address the challenge of AMR – the intersectoral coordination committee, Technical Advisory Group and the Core Working Group on AMR, who jointly developed the National Action Plan on Antimicrobial Resistance (NAP-AMR).

Delhi Declaration on Antimicrobial Resistance is an inter-ministerial consensus by ministers and policy-makers from the Government of India, who also endorsed the NAP-AMR at the Inter-Ministerial Consultation on AMR on 19 April 2017. The strategic priority 5 of NAP-AMR aims to promote investments for AMR activities, research and innovations through new medicines and diagnostics, innovations to develop alternative approaches to manage infectious diseases, and sustainable financing to ensure adequate resources for containment of AMR.
**DBT—Mission AMR**

Considering AMR as a national priority, under NAP-AMR endorsed by Government of India, the Department of Biotechnology (DBT) initiated a major mission program on antimicrobial resistance with the vision to develop indigenous and cost-effective therapies against antimicrobial resistance, categorization of AMR specific pathogen priority list of India, establishment of bio-repository for AMR-specific pathogens, and development of rapid and cost-effective diagnostic kits to identify AMR-specific pathogens.

**WHO—AMR is a priority**

WHO declared AMR to be one of the top ten global public health threats facing humanity in 2019. Currently, 143 countries (with 90% of the world population) including the 11 Member States of WHO South East Asia Region have developed a National Action Plan to address AMR. The WHO India Country Cooperation Strategy 2019-2023 recognizes containment of antimicrobial resistance as a priority. WHO headquarters and the WHO Regional Office for South-East Asia also identify containment of AMR as a flagship priority.

The WHO Country Office for India collaborated with the Department of Biotechnology to develop the list of drug resistant microbial pathogens of national relevance, in alignment with the global priority list of antibiotic-resistant bacteria to guide research, discovery and development of new antibiotics (WHO, 2017). This list shall help to facilitate prioritization of research and development of new and effective antibiotics from Indian perspective.

**Objectives**

The objectives of the IPPL are to

- guide the prioritization of research on AMR, including incentives and funding;
- help align R&D priorities with Indian public health needs; and
- support India’s leadership in containment of antibiotic resistant bacteria.

The IPPL shall be useful for policy initiatives to incentivise basic science and advanced R&D by both public funding agencies and the private sector investing in new antibiotics.
**Scope**

The scope of IPPL is to identify the most important resistant bacteria at the national level in India for which there is an urgent need to develop novel drugs and treatments. Mycobacteria (including *Mycobacterium tuberculosis*) were not included in this prioritization exercise as it is a well-established global and national priority for which innovative new treatments are urgently needed and being developed. The IPPL shall be reviewed and revised periodically to broaden the scope to include other priority pathogens in future.

**Methodology**

The following steps were followed for developing the IPPL:

1. Desk review of biomedical literature on key antibiotic resistant bacteria in the Indian context;
2. Analysis of available data and information on bacterial drug resistance mechanisms;
3. Prepare draft list of prioritized antibiotic-resistant bacteria and key resistance mechanisms; and
4. Review and finalization of the list of top-10 bacterial drug-resistant pathogens.

**Literature search and analyses**

Evidence for each criterion were obtained from multiple sources, including

- Systematic reviews and articles in published literature.
- Reports from AMR surveillance networks (coordinated by National Centre for Disease Control and Indian Council of Medical Research) for antibiotic resistant bacteria in India, and
- Databases of Indian biomedical literature (IndMed/MedInd).

In alignment with global priority pathogen list, data was collated for the following criteria, subject to availability of information – all-cause mortality, healthcare and community burden, prevalence of resistance, 10-year trend of resistance, transmissibility, preventability in hospital and community settings, treatability and current pipeline – with an Indian perspective.
Based on the literature search, data was analysed to define the list of common bacterial species and resistance mechanisms. The information obtained from literature search was used to prioritize the drug resistance in key organisms by a scoring system. This information was further used to develop a questionnaire (annex 1), which was sent to an identified list of national experts, based on their expertise and publications. More than 60 experts having varied backgrounds – infectious diseases, clinical microbiology, R&D, Infection prevention and control (healthcare associated infections), public health, paediatric and intensive care – were engaged in the criteria weighting process through an online questionnaire using SurveyMonkey.

**Finalization of the ranking of pathogens in IPPL**

The results of the prioritization exercise were reviewed by an invited group of experts with expertise across various domains, with geographical representation, at the Informal Consultation to Finalise the Indian Priority Pathogen List (IPPL) organized by WHO Country Office for India on 15 July 2019.

In alignment with Global PPL, the experts grouped the bacterial pathogens according to the species and resistance, further stratified into three priority tiers – critical, high and medium.
## INDIAN PRIORITY PATHOGEN LIST

### CRITICAL PRIORITY

<table>
<thead>
<tr>
<th>Enterobacteriaceae</th>
<th>Carbapenem – R</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Klebsiella pneumoniae and Escherichia coli)</td>
<td>Tigecycline – R</td>
</tr>
<tr>
<td></td>
<td>Colistin – R</td>
</tr>
<tr>
<td>Non-fermenting bacteria</td>
<td>Carbapenem – R</td>
</tr>
<tr>
<td>(Acinetobacter baumannii and Pseudomonas aeruginosa)</td>
<td>Colistin – R</td>
</tr>
</tbody>
</table>

### HIGH PRIORITY

<table>
<thead>
<tr>
<th>Staphylococcus aureus</th>
<th>MRSA, hVISA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daptomycin – NS</td>
</tr>
<tr>
<td></td>
<td>Linezolid – R</td>
</tr>
<tr>
<td>Enterococcus species</td>
<td>Vancomycin – R</td>
</tr>
<tr>
<td></td>
<td>Linezolid – R</td>
</tr>
<tr>
<td></td>
<td>Daptomycin – NS</td>
</tr>
<tr>
<td>Salmonella species</td>
<td>Azithromycin – NS</td>
</tr>
<tr>
<td>(Typhoidal and Non-typhoidal)</td>
<td>Third generation cephalosporins – NS</td>
</tr>
<tr>
<td></td>
<td>Carbapenem – NS</td>
</tr>
</tbody>
</table>

### MEDIUM PRIORITY

<table>
<thead>
<tr>
<th>Streptococcus pneumoniae</th>
<th>Cephalosporin – R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fluoroquinolones – R</td>
</tr>
<tr>
<td></td>
<td>Linezolid – R</td>
</tr>
<tr>
<td>Staphylococcus, coagulase-negative</td>
<td>Vancomycin – R</td>
</tr>
<tr>
<td></td>
<td>Linezolid – R</td>
</tr>
<tr>
<td>Shigella species</td>
<td>Third generation cephalosporins – R</td>
</tr>
<tr>
<td></td>
<td>Azithromycin – R</td>
</tr>
<tr>
<td>Haemophilus influenzae</td>
<td>Third generation cephalosporin – NS</td>
</tr>
<tr>
<td></td>
<td>Carbapenem – NS</td>
</tr>
<tr>
<td>Neisseria meningitidis</td>
<td>Fluoroquinolones – NS</td>
</tr>
<tr>
<td></td>
<td>Third generation cephalosporins – NS</td>
</tr>
</tbody>
</table>

R: resistant, NS: non-susceptible; MRSA: methicillin resistant Staph. aureus; hVISA: heterogeneous vancomycin-intermediate Staph. aureus

Mycobacteria (including Mycobacterium tuberculosis) were not included in this prioritization exercise as it is a well-established global and national priority for which innovative new treatments are urgently needed and being developed.
Limitations

The incidence and future burden of diseases assessment was not calculated or estimated. The national surveillance systems are currently unable to calculate the real burden and mortality associated with drug resistant infections, and mortality data based on drug-bug combinations is currently not available for the country. The IPPL was constrained by the lack of sufficient data or publications in the Indian context on burden of disease and antibiograms for bacteria like *Clostridium difficile*, Bacteroides species, Campylobacter species and *Helicobacter pylori*. There is relatively limited data on transmission of bacteria through food, livestock, bacterial spectrum, and antimicrobial susceptibility pattern of infections in animals in India.

Conclusion

AMR is a multifactorial and cross-sectorial issue, affecting human beings, animals, food, and environment. The IPPL proposes prioritizing research and development for discovering and developing new antibiotics which are important for public health and specifically active against multidrug and extensively drug-resistant Gram-negative bacteria. Strengthening of microbiology laboratories and prioritization of AMR surveillance is needed to monitor AMR trends at the community and hospital level. The IPPL categorizes bacterial pathogens according to the species and resistance into three priority tiers – critical, high and medium – to encourage efforts towards investments in containing AMR.
Acknowledgements

The World Health Organization Country Office for India and the Department of Biotechnology, Government of India thank the following experts for sharing their expertise to develop the IPPL.

Experts who answered the questionnaire

Aakansha P, BJWC Parel; Ajanta Sharma, GMC Guwahati; Amit KM, Fortis Mohali; Anil Kumar MD, AIIMS Kochi; Anita Arora, Fortis Gurugram; Anita Sharma, Fortis Mohali; Anuj Sharma, WHO Delhi; Amandeep Kaur, AIIMSR Bathinda; Apurba Sankar S, JIPMER Puducherry; Arvind MV, BJWH Parel; Arunasree M Kalle, SLS Hyderabad; Asad U Khan, AMU Aligarh; Balaji V, CMC Vellore; Barnali K, HIMS Dehradun; Bhabhatosh Dash, KMC Manipal; Bibhuti Bhusan P, RMRC Bhubaneshwar; Chanaveerappa B, JIPMER Puducherry; Chandradipa G, VU Medinipur; Chand Wattal, GRIPMER New Delhi; Camilla R, PDHH Mumbai; Bharat S, AIIMS New Delhi; Daman Saluja, BRACMR New Delhi; Dhanya D, ICH Kolkata; Dipankar Ghosh, JNU New Delhi; G Balakrish Nair, RGCB Thiruvananthapuram; Gulnaz B, SKIMS Srinagar; Inam Danish Khan, ACMS New Delhi; Ira Shah, SRCC Mumbai; J Madhukara, SJMCH Bangalore; JJ Jain, CDDEP New Delhi; Jesinth M, CMC Vellore; Jovita S, BJWH Parel; Lathamani K, KVGMC Sullia; Lata Kapoor, NCDC Delhi; Madhusmita M, JIPMER Puducherry; Madhur Verma, GMC Karnal; Malavalli VB, MH Bengaluru; Manas Pratim R, VMCM New Delhi; Manish Kumar, CMC Vellore; Manish Soneja, AIIMS New Delhi; M Jeeva Sankar, AIIMS New Delhi; Neeraj KT, Hirananandani Mumbai; Neha Gupta, Medanta Gurugram; PA Mahesh, JSSMC Mysore; Padmaja K, NIMS Hyderabad; Poothakuzhiyil R, SRMCRI Chennai; Purva Mathur, AIIMS-TC New Delhi; Rakesh KM, NRSMC Kolkatta; Rajni Gaind, VMMC New Delhi; Rajeev Soman, Jupiter Pune; Ramesh S, IAH Delhi; Ramesh V, Apollo Chennai; Roshan Rai, SSSIHL Puttaparthi; Saibal C, Metro NOIDA; Sangeeta Sharma, IHBAS Delhi; Seema Sood, AIIMS New Delhi; Shankar S, BJWH Parel; Shinvini B, THSTI Faridabad; Shrikanth Pawar, NCMR Pune; Shruti Asati, BSDPGIMS Rohtak; Sidhart Chopra, CSIR-CDRI Lucknow; Sonia Jain, CSIR-IICB Kolkata; Sourabh Sharma, R&R New Delhi; Suhas A, BJWH Parel; Sumit Rai, PSSH NOIDA; Sunil Gupta, SJH New Delhi; Sushil Kabra, AIIMS New Delhi; Tanu Singhal, KDAHMRI Mumbai; Tuhina Banerjee, IMSBHU Varanasi; Udhayvir SG, GMC Patiala; Ujjwalyini R, Apollo Kolkata; Vandana R, MAMC Delhi; Varsha Gupta, GMC Chandigarh; Vibhor Tak, CNBC New Delhi; Vijay Y, Apollo Mumbai; Vikas Gautam, PGIMER Chandigarh; Vikas Khililan, ILBS New Delhi; Vikas Manchanda, MAMC New Delhi; VK Chaudhary, SC New Delhi; Winsley R, CMC Vellore.

Participants of the Informal Consultation to Finalise the Indian Priority Pathogen List (IPPL)

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Overall coordination and writing

Anuj Sharma, WHO India; Sandeep Sarin, DBT; Rajan Kumar, WHO India; Vikas Manchanda, MAMC New Delhi; Vinita Chaudhary, DBT.
Annex I
Questionnaire – Indian Priority Pathogen List (IPPL)

Based on the literature search, data collated for the following criteria (in alignment with global PPL), subject to availability of information: (all-cause mortality, healthcare and community burden, prevalence of resistance, 10-year trend of resistance, transmissibility, preventability in hospital and community settings, treatability and current pipeline) was analysed to define the list of common bacterial species and resistance mechanisms. This information was used to develop a questionnaire that was sent to an identified list of experts based on their expertise.

A group of more than 60 experts with different backgrounds – infectious diseases, clinical microbiology, R&D, Infection prevention and control healthcare associated infections, public health, paediatric and intensive care were involved in the criteria weighting process through an online web-survey using SurveyMonkey.

Part 1

1. Introduction

The aim of this exercise is to define the Indian Priority Pathogen List (IPPL) of antibiotic-resistant bacteria to support and incentivize research and development (R&D) for new antibiotics. We request you to participate in this online survey to provide your expert opinion regarding antibiotic-resistant bacteria in India based on your experience and local data.

About yourself
1. First/given name: 7. City:
2. Last/family name: 8. State/UT:
3. Present job title: 9. Email:
4. Organization: 10. Phone:
5. Department: 11. Mobile:
6. Address:
12. Specialty of expertise:
   - Infectious diseases
   - Clinical microbiology
   - Scientific research & development
   - Public health
   - Infection control
   - Other medical disciplines (please specify)

2. AMR Experience

13. Approximate number of peer-reviewed publications on AMR authored or co-authored by you in last 10 years:
   - < 5 publications
   - 6-10 publications
   - 11-20 publications
   - > 20 publications

14. Are you involved in preparing or analysing antibiograms?
   - Yes
   - No

3. Priority pathogens in India

Note: Instructions for question no. 15–19
Step 1: Please mark “N/A” to exclude options you consider unimportant or not a priority.
Step 2: Kindly rank your choices in order of priority. To change the ranking, you can drag your choices up and down.
Alternatively, you can choose the drop-down menu at the beginning of each option to assign a rank. Please rank 1 as highest priority, higher the numbers, lower the priority.
• Enterobacteriaceae includes: *Escherichia coli*, Klebsiella species, Enterobacter species, Serratia species, Proteus species, and Providencia species, Morganella species, etc.
• Mycobacteria (including *Mycobacterium tuberculosis*), have not been included in this prioritization exercise as it is an identified global and national priority for which innovative new treatments are being developed.
• Non-fermenting bacteria include *Pseudomonas aeruginosa*, Acinetobacter species, etc.
• R=Resistant, S=Susceptible, NS=Non-susceptible

15. Kindly prioritize the following bacteria-drug resistance combinations based on your experience

- **Acinetobacter baumannii**, carbapenem-resistant
- **Pseudomonas aeruginosa**, carbapenem-resistant
- Enterobacteriaceae, carbapenem-resistant
- Enterococcus species, vancomycin-resistant
- *Staphylococcus aureus*, methicillin-resistant
- *Staphylococcus aureus*, vancomycin intermediate and resistant
- Shigella species, fluoroquinolone-resistant
- Salmonella species, fluoroquinolone-resistant
- Salmonella species, 3rd generation cephalosporin-resistant
- *Neisseria gonorrhoeae*, 3rd generation cephalosporin-resistant, fluoroquinolone-resistant
- *Streptococcus pneumoniae*, penicillin non-susceptible
- *Haemophilus influenzae*, ampicillin-resistant
- *Helicobacter pylori*, clarithromycin-resistant
- Campylobacter species, fluoroquinolone-resistant
- *C. difficile*, vancomycin/metronidazole-resistant

16. Prioritize the following bacteria-drug resistance combinations, based on your experience.

- Enterobacteriaceae, carbapenem resistant, XDR and/or colistin-R
- Non-fermenting bacteria, XDR and/or colistin-R
- *Staphylococcus aureus*, vancomycin-R OR tigecycline-R OR daptomycin-R
- *Staphylococcus aureus*, linezolid-R
- Salmonella species (typhoidal), fluoroquinolone-R AND 3rd generation cephalosporin-R AND azithromycin-R OR carbapenem-R
- Salmonella species (non-typhoidal), fluoroquinolone-R AND 3rd generation cephalosporin-R AND azithromycin-R OR carbapenem-R
- Shigella species, 3rd generation cephalosporin-R OR carbapenem-R
- Enterococcus species, vancomycin-R OR daptomycin-R OR linezolid-R
- *Neisseria gonorrhoeae*, ceftriaxone-NS OR high-level azithromycin-R
- *Neisseria meningitidis*, ampicillin or penicillin-R OR 3rd generation cephalosporin-NS OR Fluoroquinolone-R
- *Haemophilus influenzae*, 3rd generation cephalosporin-R OR carbapenem-NS
- *Streptococcus pneumoniae*, linezolid-R OR vancomycin-NS
- *Streptococcus*, β-haemolytic group, ampicillin or penicillin-NS OR 3rd generation cephalosporin-NS
- *Staphylococcus*, coagulase-negative, Vancomycin-R OR daptomycin-R OR Linezolid-R
- *C. difficile*, vancomycin-R or metronidazole-R

17. Based on your experience, please prioritize carbapenem resistant gram-negative bacteria in order of their importance in India

- Acinetobacter species
- *Pseudomonas aeruginosa*
- *Escherichia coli*
- Klebsiella pneumoniae
- Enterobacter species
- Citrobacter species
- *Serratia marcescens*

18. Based on your experience, please prioritize colistin resistant gram-negative bacteria in order of their importance in India

- *Pseudomonas aeruginosa*
- Acinetobacter species
Escherichia coli
Klebsiella species
Enterobacter species
Serratia marcescens

19. Based on your experience, please prioritize the following vancomycin resistant gram-positive bacteria in order of their importance in India

- Staphylococcus aureus
- Coagulase Negative Staphylococci
- Enterococcus faecalis
- Enterococcus faecium
- Streptococcus pneumoniae
- C. difficile

Part 2

4. Detailed questionnaire for IPPL

20. Based on your experience, please prioritize following bacteria in order of their magnitude of AMR problem (high percentage of resistant isolates against many antimicrobials).

Mark “N/A” to exclude options that are not considered a priority.
Please rank 1 as highest priority; higher the numbers, lower the priority.

Escherichia coli
Klebsiella pneumoniae
Enterobacter species
Citrobacter species
Serratia marcescens
Proteus species
Providencia species
Morganella species
Salmonella Typhi
Salmonella Paratyphi A
Non-typhoidal Salmonellae
Shigella species
Vibrio cholerae
Pseudomonas aeruginosa
Stenotrophomonas maltophilia
Burkholderia cepacia
Acinetobacter species
Campylobacter jejuni
Neisseria meningitidis
Haemophilus influenzae
Neisseria gonorrhoeae
Helicobacter pylori
Staphylococcus aureus
Coagulase Negative Staphylococci
Enterococcus species
Streptococcus pneumoniae
Beta-hemolytic Streptococci
Viridans group Streptococci
Clostridium difficile

5. Prioritization of pathogens

Note: Instructions for question no. 22–48
Mark “N/A” to exclude options that are not considered a priority.
Please rank 1 as highest priority; higher the numbers, lower the priority.
21. Based on your experience, please prioritize following antimicrobial resistant bacterial infections in order of their magnitude/burden of healthcare associated infections (HAI)

- Escherichia coli
- Klebsiella pneumoniae
- Enterobacter species
- Citrobacter species
- Serratia marcescens
- Proteus species
- Providencia species
- Morganella species
- Salmonella Typhi
- Salmonella Paratyphi A
- Non-typhoidal Salmonellae
- Shigella species
- Vibrio cholerae
- Pseudomonas aeruginosa
- Stenotrophomonas maltophilia
- Burkholderia cepacia
- Acinetobacter species
- Campylobacter jejuni
- Helicobacter pylori
- Clostridium difficile
- Neisseria meningitidis
- Haemophilus influenzae
- Neisseria gonorrhoeae
- Staphylococcus aureus
- Coagulase Negative Staphylococci
- Enterococcus species
- Streptococcus pneumoniae
- Beta-hemolytic Streptococci
- Viridans Group Streptococci
- Clostridium difficile

22. Based on your experience, please prioritize following antimicrobial resistant bacterial infections in order of their ability to increase risk of mortality among infected patients

- Escherichia coli
- Klebsiella pneumoniae
- Enterobacter species
- Citrobacter species
- Serratia marcescens
- Proteus species
- Providencia species
- Morganella species
- Salmonella Typhi
- Salmonella Paratyphi A
- Non-typhoidal Salmonellae
- Shigella species
- Vibrio cholerae
- Pseudomonas aeruginosa
- Stenotrophomonas maltophilia
- Burkholderia cepacia
- Acinetobacter species
- Campylobacter jejuni
- Neisseria meningitidis
- Haemophilus influenzae
- Neisseria gonorrhoeae
23. Based on your experience, please prioritize following bacterial infections in order of their trends of emerging resistance in community

- Pneumonia
- Meningitis
- Skin and soft tissue infections (SSTI)
- Sepsis (blood stream infections)
- Urinary tract infections
- Diarrhoea & dysentery

24. Based on your experience, please prioritize following bacterial infections in order of their transmissibility

- Pneumonia
- Meningitis
- Skin and soft tissue infections (SSTI)
- Sepsis (blood stream infections)
- Urinary tract infections
- Diarrhoea & enteric infections

25. Based on your experience, please prioritize following bacterial infections in order of their preventability in healthcare setting

- Pneumonia
- Meningitis
- Skin and soft tissue infections (SSTI)
- Sepsis (blood stream infections)
- Urinary tract infections
- Diarrhoea & enteric infections

26. Based on your experience, please prioritize following bacterial infections in order of their treatability

- Pneumonia
- Meningitis
- Skin and soft tissue infections (SSTI)
- Sepsis (blood stream infections)
- Urinary tract infections
- Diarrhoea & enteric infections

27. Based on your experience, please prioritize following bacterial infections in order of availability of newer antimicrobials in pipeline for their treatment

- Pneumonia
- Meningitis
- Skin and soft tissue infections (SSTI)
- Sepsis (blood stream infections)
- Urinary tract infections
- Diarrhoea & enteric infections

8. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Staphylococcus aureus*

- Penicillin
- Methicillin/oxacillin/cefoxitin
29. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Enterococcus species

- Penicillin
- Aminoglycosides
- Macrolides
- Vancomycin
- Linezolid
- Fluoroquinolones

30. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Streptococcus pneumoniae

- Amoxicillin
- Amoxicillin-clavulanate
- Third generation cephalosporins
- Carbapenems
- Vancomycin
- Erythromycin
- Azithromycin
- Clindamycin
- Tetracycline
- Fluoroquinolones
- Cotrimoxazole
- Chloramphenicol

31. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Neisseria meningitidis

- Penicillin
- Third generation cephalosporins
- Carbapenems
- Azithromycin
- Minocycline
- Fluoroquinolones
- Cotrimoxazole
- Chloramphenicol

32. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Hemophilus influenzae

- Ampicillin
- Amoxicillin-clavulanate
- Third generation cephalosporins
- Carbapenems
- Azithromycin
- Fluoroquinolones
- Tetracycline
- Cotrimoxazole
- Chloramphenicol
33. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Escherichia coli*.

- Gentamicin
- Amikacin
- Amoxicillin-clavulanate
- Ampicillin–sulbactam
- Piperacillin-tazobactam
- 3rd generation cephalosporins
- Aztreonam
- Carbapenems
- Fluoroquinolones
- Chloramphenicol
- Tetracycline
- Minocycline
- Fosfomycin
- Nitrofurantoin
- Polymyxins (e.g. colistin)

34. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Klebsiella pneumoniae*.

- Gentamicin
- Amikacin
- Amoxicillin-clavulanate
- Ampicillin–sulbactam
- Piperacillin-tazobactam
- 3rd generation cephalosporins
- Aztreonam
- Carbapenems
- Fluoroquinolones
- Chloramphenicol
- Tetracycline
- Minocycline
- Fosfomycin
- Nitrofurantoin
- Polymyxins (e.g. colistin)

35. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Enterobacter species.

- Gentamicin
- Amikacin
- Amoxicillin-clavulanate
- Ampicillin–sulbactam
- Piperacillin-tazobactam
- 3rd generation cephalosporins
- Aztreonam
- Carbapenems
- Fluoroquinolones
- Chloramphenicol
- Tetracycline
- Minocycline
- Fosfomycin
- Nitrofurantoin
- Polymyxins (e.g. colistin)
36. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Proteus mirabilis*
   - Gentamicin
   - Amikacin
   - Amoxicillin-clavulanate
   - Ampicillin–sulbactam
   - Piperacillin–tazobactam
   - 3rd generation cephalosporins
   - Aztreonam
   - Carbapenems
   - Fluoroquinolones
   - Chloramphenicol
   - Tetracycline
   - Minocycline
   - Fosfomycin
   - Nitrofurantoin

37. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Morganella morganii*
   - Gentamicin
   - Amikacin
   - Amoxicillin-clavulanate
   - Ampicillin–sulbactam
   - Piperacillin–tazobactam
   - 3rd generation cephalosporins
   - Aztreonam
   - Carbapenems
   - Fluoroquinolones
   - Chloramphenicol
   - Tetracycline
   - Minocycline
   - Fosfomycin
   - Nitrofurantoin

38. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Shigella* species
   - Ampicillin
   - Piperacillin–tazobactam
   - 3rd generation cephalosporins
   - Carbapenems
   - Fluoroquinolones
   - Chloramphenicol
   - Tetracycline
   - Azithromycin

39. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Salmonella Typhi*
   - Ampicillin
   - Piperacillin–tazobactam
   - 3rd generation cephalosporins
   - Carbapenems
   - Fluoroquinolones
   - Chloramphenicol
   - Cotrimoxazole
   - Tetracycline
   - Azithromycin
40. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Salmonella Paratyphi A
- Ampicillin
- Piperacillin-tazobactam
- 3rd generation cephalosporins
- Carbapenems
- Fluoroquinolones
- Chloramphenicol
- Cotrimoxazole
- Tetracycline
- Azithromycin

41. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in non-typhoidal Salmonella
- Ampicillin
- Piperacillin-tazobactam
- 3rd generation cephalosporins
- Carbapenems
- Fluoroquinolones
- Chloramphenicol
- Cotrimoxazole
- Tetracycline
- Azithromycin

42. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Vibrio cholerae
- Ampicillin
- 3rd generation cephalosporins
- Carbapenems
- Fluoroquinolones
- Azithromycin Chloramphenicol
- Amikacin
- Tetracycline
- Gentamicin
- Cotrimoxazole
- Chloramphenicol
- Tetracycline

43. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Campylobacter jejuni / Helicobacter species
- Ampicillin/amoxicillin
- Metronidazole
- Azithromycin
- Clarithromycin
- Cotrimoxazole
- Fluoroquinolones

44. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in Acinetobacter species
- Piperacillin
- Gentamicin
- Amikacin
- Tobramycin
- Netilmicin
- Ticarcillin-clavulanate
45. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Pseudomonas aeruginosa*

- Gentamicin
- Amikacin
- Tobramycin
- Piperacillin-tazobactam
- 3rd generation cephalosporins
- Aztrenam
- Carbapenems
- Fluoroquinolones
- Chloramphenicol
- Tetracycline
- Minocycline
- Fosfomycin
- Nitrofurantoin
- Polymyxins (e.g. colistin)

46. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Burkholderia cepacia*

- Ticarcillin-clavulanate
- 3rd generation cephalosporins
- Carbapenems
- Fluoroquinolones
- Chloramphenicol
- Minocycline
- Cotrimoxazole

47. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Stenotrophomonas maltophilia*

- Ticarcillin-clavulanate
- 3rd generation cephalosporins
- Aztrenam
- Fluoroquinolones
- Chloramphenicol
- Minocycline
- Cotrimoxazole

48. Based on your experience, please prioritize following antimicrobials in order of their magnitude of AMR problem in *Neisseria gonorrhoeae*

- Ampicillin
- 3rd generation cephalosporins
- Fluoroquinolones
- Azithromycin
- Spectinomycin
- Tetracycline