World Health Organization India

जैवप्रौद्योगिकी विभाग
DEPARTMENT OF BIOTECHNOLOGY
सत्यमेव जयते

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	
Enterobacteriaceae *(Klebsiella pneumoniae* and *Escherichia coli)*	Carbapenem – R Tigecycline – R Colistin – R
Non-fermenting bacteria *(Acinetobacter baumannii* and *Pseudomonas aeruginosa)*	Carbapenem – R Colistin – R
HIGH PRIORITY	
Staphylococcus aureus	MRSA, hVISA Daptomycin – NS Linezolid – R
Enterococcus species	Vancomycin – R Linezolid – R Daptomycin – NS
Salmonella species (Typhoidal and Non-typhoidal)	Azithromycin – NS Third generation cephalosporins – NS Carbapenem – NS
MEDIUM PRIORITY	
Streptococcus pneumoniae	Cephalosporin – R Fluoroquinolones – R Linezolid – R
Staphylococcus, coagulase-negative	Vancomycin – R Linezolid – R
Shigella species	Third generation cephalosporins – R Azithromycin – R
Haemophilus influenzae	Third generation cephalosporin – NS Carbapenem – NS
Neisseria meningitidis	Fluoroquinolones – NS Third generation cephalosporins – NS

R: resistant; NS: non-susceptible; MRSA: methicillin resistant *Staph. aureus*; hVISA: heterogenous 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.

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Experts who answered the questionnaire

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

Anuj Sharma, WHO Delhi; Neelam Taneja, PGIMER Chandigarh; Priscilla Rupali, CMC Vellore; Purva Mathur, AIIMS-TC New Delhi; Sanjay Bhattacharya, TMC Kolkata; Sanjeev K Singh, AIMS Kochi; Vinita Chaudhary, DBT New Delhi; V. Balaji, CMC Vellore; Varinder Singh, KSCH New Delhi; Vikash Manchanda, MAMC New Delhi, Yogesh Shouche, NCMR Pune.

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:
2. Last/family name:
3. Present job title:
4. Organization:
5. Department:
6. Address:
7. City:
8. State/UT:
9. Email:
10. Phone:
11. Mobile:
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 following 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*

- ☐ *Helicobacter pylori*
- ☐ *Staphylococcus aureus*
- ☐ Coagulase Negative Staphylococci
- ☐ Enterococcus species
- ☐ *Streptococcus pneumoniae*
- ☐ Beta-hemolytic Streptococci
- ☐ Viridans group Streptococci

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

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

- ☐ Penicillin
- ☐ Methicillin/oxacillin/cefoxitin

- ☐ Erythromycin
- ☐ Clindamycin
- ☐ Ciprofloxacin
- ☐ Gentamicin
- ☐ Amikacin
- ☐ Vancomycin
- ☐ Teicoplanin
- ☐ Linezolid
- ☐ Daptomycin

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
- ☐ Amoxycillin-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 jejunii* / 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

- ☐ Ampicillin-sulbactum
- ☐ Piperacillin-tazobactam
- ☐ 3rd generation cephalosporins
- ☐ Carbapenems
- ☐ Fluoroquinolones
- ☐ Chloramphenicol
- ☐ Doxycycline
- ☐ Minocycline
- ☐ Polymyxins (e.g. colistin)

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
- ☐ Aztreonam
- ☐ 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
- ☐ Aztreonam
- ☐ 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