Supplementary Table 1. Major antibiotic resistant bacteria, clinical manifestation, associated and available antibiotics for treatment (only examples are given).

Resistant Bacteria/Type/Region of High Prevalence	Symptoms/Representative Clinical Infections	Antibiotics Associated with Resistance	Available Treatments	Ref
Staphylococcus aureus (S. aureus) **(MRSA)/ gram-positive, cocci, Eastern Mediterranean Region (0-92%)**	Skin and soft tissue infections, toxic shock syndrome, osteomyelitis pneumonia/lung infection, endocarditis, meningitis, urinary tract infection (UTI)	beta-lactam antibiotics (e.g., penicillin, oxacillin, monobactams, nafcillin, amoxicillin, and most cephalosporins) erythromycin	Tedizolid, tigecycline, vancomycin or daptomycin, ceftaroline, telavancin; linezolid; dalbavancin, oritavancin, clindamycin, minocycline, doxycycline, linezolid	[1-5]
S. aureus **(VISA/hVISA/VRSA)/ gram-positive, cocci, South-East Asia Region (3.42–6.81%)**	Skin and soft tissue infections, UTI, bacteraemia, pneumonia/ lung infection, osteomyelitis, endocarditis, meningitis	beta-lactam antibiotics, vancomycin, erythromycin	Minocycline, or quinupristin-dalfopristin, daptomycin, linezolid, telavancin, ceftaroline	[2,6-9]
Streptococcus pyogenes **/ gram positive, cocci, Europe region (4–40%)**	Pharyngitis, necrotizing fasciitis, toxic shock syndrome, autoimmune diseases	macrolides, clindamycin, and lincosamide	Penicillin, cephalosporins, macrolides, and clindamycin	[10-14]
Streptococcus pneumoniae **/ gram-positive, diplococcus, African Region (1-100%)**	Pneumonia/ lung infection, otitis media, sinusitis, bronchitis, bacteraemia, peritonitis, cellulitis, arthritis, meningitis	optochin, ceftriaxone, cefotaxime, penicillin, Cefuroxime, cephalosporins, erythromycin, tetracycline, doxycycline	Vancomycin +/- rifampin; gemifloxacin, moxifloxacin, levofloxacin) linezolid; clindamycin; imipenem/cilastatin, ceftriaxone plus	[2,5,15-17]
Escherichia coli **- CTX-M extended spectrum beta-lactamases (ESBL)/ gram- negative, rod, South-East Asia Region 19-95% ()**	UTI, diarrhoea, colitis	Penicillin, cephalosporins, fluoroquinolones, aztreonam	Meropenem, carbapenems (ertapenem, doripenem), imipenem, cilastatin, fosfomycin, trimethoprim-sulfamethoxazole, cefepime	[5,18-22]
Enterococcus faecium **(VRE)/ gram- positive, oval cocci Latin America (0-48%)**	Pelvic infections, endocarditis, neonatal infections and UTI	Vancomycin, gentamicin, ampicillin, beta lactams and aminoglycosides, streptomycin	Linezolid, daptomycin, streptogramins tigecycline, quinupristin-dalfopristin, sultamicillin	[23-30]
Pseudomonas aeruginosa **(MDR)/gram-negative, rod Latin America (0-48%)**	Skin and soft-tissue infections, UTIs, bloodstream infections, pneumonia/lung infection, endocarditis, meningitis	Imipenem/cila-statin, mero-penem, non-antipseudo-monal penicillins, cephalosporins	Colistin, ceftazidime-avibactam or ceftolozane-tazobactam, polymyxin B	[31-37]
Klebsiella pneumoniae **(ESBL)/ gram- negative, rod South-East Asia Region (20-72%)**	Bacteraemia, sepsis, pneumonia, UTIs, conjunctivitis, and surgical site infections	Beta-lactam, ciprofloxacin, cephalosporins; aztreonam; aminoglycosides and norfloxacin	Carbapenems, doripenem, flomoxef, Piperacillin ceftolozane-tazobactam, ceftazidime-avibactam	[5,38-42]

Mycobacterium tuberculosis **(MDR-TB)/ acid-fast Indo-Pak Region (1.6-21.6%)**	Tuberculosis (lung infection), osseous tuberculosis, night sweats, fever, weight loss	Isoniazid; rifampin; streptomycin	Pyrazinamide, a fluoroquinolone, an injectable agent (i.e., amikacin), ethionamide, cyclomerize, linezolid, clofazimine	[43-48]
Acinetobacter baumannii **/ gram-negative, coccobacillus South-East Asia Region (25-95%)**	Pneumonia, UTI, septicaemia, Meningitis, Wound and surgical site infections	Beta-lactams, imipenem, meropenem, antipseudomonal agents, and fluoroquinolones,	Polymyxins, Polymyxins + carbapenem, minocycline, tigecycline, or rifampin,	[49-53]
S. epidermidis **/gram- positive, cocci Africa (0-34%)**	Bacteraemia and sepsis, catheter, implant, endocarditis and prostheses-related infection	Methicillin, penicillin, amoxicillin rifamycin, flouroquinolones, chloramphenicol, erythromycin, clindamycin, and sulfonamides	Vancomycin, vancomycin +/- (rifampin + gentamicin) daptomycin, linezolid, quinupristin-dalfopristin	[54-57]
Burkholderia cepacia **/ gram-negative, rod USA (0-40%)**	Necrotizing pneumonia, peritonitis, liver abscesses	Chloramphenicol, Polymyxins, ciprofloxacin, moxifloxacin, colomycin, and aminoglycoside	Clinafloxacin, meropenem, ceftazidime and high-dose tobramycin (multiple combination is preferred)	[58-64]
Neisseria gonorrhoeae **/ gram-negative, diplococci European Region**	Pelvic inflammatory disease, chronic pelvic pain, ectopic pregnancy, neonatal conjunctivitis, and infertility	Penicillin, ceftriaxone	Ciprofloxacin, spectinomycin and third-generation cephalosporins such as ceftriaxone and cefixime	[5,65,66]
Clostridioides difficile **/ gram-positive, rod shaped North America (0-10%)**	Diarrhoea, colitis	Cefotaxime, levofloxacin, erythromycin, Cephalosporins	Rifampicin, meropenem, rifaximin	[67-70]

Supplementary Table 2. Principal AST methods, associated advantages and disadvantages (only examples are given).

Methods	Technique	Major advantages	Major disadvantages	References
Phenotypic	Disk diffusion	Simple, cost effective, flexible & well standardized	Lacks qualitative test & full- automation, risk of contamination, time consuming (minimum of 10 hours), no MIC determination, needs at least cells (~10^5)	[71]
	Microdilution	Miniaturized, time feasible, allows MIC determination with multiple sampling	Inflexibility of drug selections available in standard commercial panels, time consuming (minimum of 10 hours), needs at least cells (~10^5)	[72-75]
	Macrodilution	Simple, cost effective, allows MIC determination	Tedious sample preparation, risk of contamination, time consuming (minimum of 10 hours), needs at least cells (~10^5) and expensive technique.	[76,77]
	Epsilometer test	Detection of fastedious bacteria, easy to perform	High rate of false positive results, proper storage of Etest strip, (minimum of 10 hours), needs at least cells (~10^5)	[78-82]
	MALDI-TOF MS	High throughput quick sample preparation automation possible	Expensive (), needs at least cells (~10^5) expensive, different genetic markers	[83-85]
Genotypic	PCR	Quick (2-4 hours), simple and cost-effective, highly reproducible, high specificity, low sample requirement, Multiplexing,	Unknown parameters (mutation, G and C content, porosity of gel matrix, ionic strength and pH) can affect analysis, false positive results, expertise is required for analyses	[86,87]

Automated	DNA microarrays/chips	high sensitivity (picogram of nucleic acid) Multiplex detection, automated specific and high sensitivity (picogram of nucleic acid)	Labor intensive procedure to synthesize, purify, and store DNA before microarray fabrication, problem of cross hybridization	[88-90]
	Vitek	Easy and fast data management, reproducible	Narrow antibiotic range requires more cells (~10^5)	[91,92]
	Sensititre	Automated, rapid and simple operation	Narrow antibiotic range, limited panel capacity, expensive, needs at least cells (~10^5)	[93-95]
	MicroScan Walkaway	Validate susceptibility with expert software system, accurate & data sharing	long incubation (minimum of 12 hours), expensive, needs at least cells (~10^5)	[96-98]
	Micronaut	Direct susceptibility test	High false positive, needs at least cells (~10^5)	[99]
	AvantagEtest	Effortless, direct test	Discrepancies in results with some antibiotic combinations	[100-102]
Emerging AST	Optical	Real-time quantification of bacterial growth dynamics, time efficient (1-4 hours), morphological analysis, single cell detection	Requires microscope, cloning, genetic modifications may affect the growth dynamics	[103-105]
	Electrochemical	High sensitivity (10^3 cells), economical, time efficient time efficient (1-4 hours)	Narrow temperature range Short life time of sensors interference with electroactive agents of sample	[106-108]

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