Antimicrobial Resistance & Patient Safety Portal

Phenotype Definitions: Antimicrobial Resistance HAI Data

The following are definitions for the phenotypes listed in the Antimicrobial Resistance & Patient Safety Portal. For all pathogens included in the AR HAI dataset, there is a select group of antimicrobials for which susceptibility test results must be reported to the National Healthcare Safety Network (NHSN); these pathogen-antimicrobial combinations are then used to define the selected phenotypes. Susceptibility results for each pathogen were reported to NHSN using the final category interpretations (see key below). For more information about the AR Patient Safety Portal Antimicrobial Resistance HAI dataset, visit: http://www.cdc.gov/hai/surveillance.

Phenotype Analytical Definitions

Key
(S) Susceptible
(I) Intermediate
(R) Resistant
(NS) Non-Susceptible

Escherichia coli

Carbapenem-resistant (CRE)	Any isolate that tested (R) to at least 1 of these: imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam **NOTE: For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.
Cephalosporin-resistant	Any isolate that tested (I) or (R) to at least 1 of these: ceftriaxone, ceftazidime, cefepime, cefotaxime, ceftolozane/tazobactam, or ceftazidime/avibactam **NOTE: For data prior to 2021, ceftolozane/tazobactam and ceftazidime/avibactam were not included in the phenotype definition.
Fluoroquinolone-resistant	Any isolate that tested (I) or (R) to at least 1 of these: ciprofloxacin, levofloxacin, moxifloxacin

Multidrug-resistant (MDR)	Any isolate that tested either (I)* or (R) to at least 1 drug in at least 3 of these categories: 1. Extended-spectrum cephalosporins (ceftriaxone, ceftazidime, cefepime, cefotaxime, ceftolozane/tazobactam, ceftazidime/avibactam) 2. Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin) 3. Aminoglycosides (amikacin, gentamicin, tobramycin) 4. *Carbapenems (isolate must have tested (R) to imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam) 5. Piperacillin/tazobactam **NOTE: For data prior to 2021, the following antibiotics were not included in the phenotype definition: • Ceftolozane/tazobactam and ceftazidime/avibactam • Meropenem/vaborbactam and imipenem/relebactam

Enterobacter (*E. aerogenes* removed for 2020 data and forward)

Carbapenem-resistant (CRE)	Any isolate that tested (R) to at least 1 of these: imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam **NOTE: For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.
Cefepime-resistant	Any isolate that tested (I) or (R) to cefepime
Multidrug-resistant (MDR)	Any isolate that tested either (I)* or (R) to at least 1 drug in at least 3 of these categories: 1. Cefepime 2. Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin) 3. Aminoglycosides (amikacin, gentamicin, tobramycin) 4. *Carbapenems (isolate must have tested (R) to imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam) 5. Piperacillin/tazobactam **NOTE: For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.

Klebsiella (limited to *K. oxytoca* and *K. pneumoniae*, unless otherwise specified below)

Carbapenem-resistant (CRE) **(*K. aerogenes* added for 2020 data and forward)**	Any isolate that tested (R) to at least 1 of these: imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam **NOTE: For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.
Cephalosporin-resistant	Any isolate that tested (I) or (R) to at least 1 of these: ceftriaxone, ceftazidime, cefepime, cefotaxime, ceftolozane/tazobactam, or ceftazidime/avibactam **NOTE: For data prior to 2021, ceftolozane/tazobactam and ceftazidime/avibactam were not included in the phenotype definition.
Multidrug-resistant (MDR)	Any isolate that tested either (I)* or (R) to at least 1 drug in at least 3 of these categories: 1. Extended-spectrum cephalosporins (ceftriaxone, ceftazidime, cefepime, cefotaxime, ceftolozane/tazobactam, ceftazidime/avibactam) 2. Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin) 3. Aminoglycosides (amikacin, gentamicin, tobramycin) 4. *Carbapenems (isolate must have tested (R) to imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam) 5. Piperacillin/tazobactam **NOTE: For data prior to 2021, the following antibiotics were not included in the phenotype definition: • Ceftolozane/tazobactam and ceftazidime/avibactam • Meropenem/vaborbactam and imipenem/relebactam

Pseudomonas aeruginosa

Carbapenem-resistant	Any isolate that tested (I) or (R) to at least 1 of these: imipenem, meropenem, doripenem
Cephalosporin-resistant	Any isolate that tested (I) or (R) to at least 1 of these: ceftazidime, cefepime, ceftolozane/tazobactam, ceftazidime/avibactam **NOTE: For data prior to 2021, ceftolozane/tazobactam and ceftazidime/avibactam were not included in the phenotype definition.

Fluoroquinolone-resistant	Any isolate that tested (I) or (R) to at least 1 of these: ciprofloxacin, levofloxacin
Aminoglycoside-resistant	Any isolate that tested (I) or (R) to at least 1 of these: amikacin, gentamicin, tobramycin
Piperacillin/Tazobactam-resistant	Any isolate that tested (I) or (R) to piperacillin/tazobactam **NOTE: For data prior to 2021, piperacillin was included in the phenotype definition.
Multidrug-resistant (MDR)	Any isolate that tested either (I) or (R) to at least 1 drug in at least 3 of these categories: 1. Extended-spectrum cephalosporins (ceftazidime, cefepime, ceftolozane/tazobactam, ceftazidime/avibactam) 2. Fluoroquinolones (ciprofloxacin, levofloxacin) 3. Aminoglycosides (amikacin, gentamicin, tobramycin) 4. Carbapenems (imipenem, meropenem, doripenem) 5. Piperacillin/tazobactam **NOTE: For data prior to 2021: • Ceftolozane/tazobactam and ceftazidime/avibactam were not included in the phenotype definition • Piperacillin was included in the phenotype definition

Enterococcus faecium

Vancomycin-resistant (VRE)	Any isolate that tested (R) to vancomycin
Daptomycin-resistant	Any isolate that tested (NS) or (R) to daptomycin **NOTE: For data prior to 2021, daptomycin was not included in the phenotype definition

Enterococcus faecalis

Vancomycin-resistant (VRE)	Any isolate that tested (R) to vancomycin
Daptomycin-resistant	Any isolate that tested (NS) or (R) to daptomycin **NOTE: For data prior to 2021, daptomycin was not included in the phenotype definition

Coagulase-negative *Staphylococci*

Vancomycin-resistant	Any isolate that tested (I) or (R) to vancomycin

Enterobacterales (limited to *E. coli, Enterobacter, K. oxytoca, K. pneumoniae,* and *K. aerogenes*)
Referred to as *Enterobacteriaceae* prior to 2020

Carbapenem-resistant (CRE)	Any isolate that tested (R) to at least 1 of these: imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam **NOTE: For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.

Staphylococcus aureus

Methicillin-resistant (MRSA)	Any *Staphylococcus aureus* isolate that tested (R) to at least 1 of these: methicillin, oxacillin, cefoxitin
Linezolid-resistant MRSA	MRSA that tested (R) to linezolid
Fluoroquinolone-resistant MRSA	MRSA that tested (I) or (R) to at least 1 of these: ciprofloxacin, levofloxacin, moxifloxacin **NOTE: For data prior to 2021, moxifloxacin was not included in the phenotype definition.
Vancomycin-resistant MRSA	MRSA that tested (I) or (R) to vancomycin
Daptomycin-resistant MRSA	MRSA that tested (NS) to daptomycin

Acinetobacter

Carbapenem-resistant	Any isolate that tested either (I) or (R) to at least 1 of these: imipenem, meropenem, doripenem
Multidrug-resistant (MDR)	Any isolate that tested either (I) or (R) to at least 1 drug in at least 3 of these categories: 1. Extended-spectrum cephalosporins (ceftazidime, cefepime, ceftolozane/tazobactam, ceftazidime/avibactam) 2. Fluoroquinolones (ciprofloxacin, levofloxacin) 3. Aminoglycosides (amikacin, gentamicin, tobramycin) 4. Carbapenems (imipenem, meropenem, doripenem) 5. Piperacillin/tazobactam 6. Ampicillin/sulbactam **NOTE: For data prior to 2021: • Ceftolozane/tazobactam and ceftazidime/avibactam were not included in the phenotype definition • Piperacillin was included in the phenotype definition