

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](https://arpsp.cdc.gov/about?tab=antibiotic-resistance). 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 phenotypes below. Susceptibility results for each pathogen were reported to NHSN using the final category interpretations (see key below). Phenotype definitions are regularly updated to maintain consistency with the NHSN data entry requirements. For more information about the AR Patient Safety Portal Antimicrobial Resistance HAI dataset, visit: <https://arpsp.cdc.gov/about?tab=antibiotic-resistance>

Phenotype Analytical Definitions

Key

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

Enterococcus faecalis

Vancomycin-resistant (VRE)	Any isolate that tested (R) to vancomycin	
Daptomycin-resistant	Any isolate that tested (NS), (I), or (R) to daptomycin	<i>Starting with 2021 data, the option for a resistant (R) result for daptomycin was added into NHSN and incorporated into this phenotype definition.</i> <i>Starting with 2022 data, the option for an intermediate (I) result for daptomycin was added into NHSN and incorporated into this phenotype definition.</i>



Enterococcus faecium

Vancomycin-resistant (VRE)	Any isolate that tested (R) to vancomycin	
Daptomycin-resistant	Any isolate that tested (NS) or (R) to daptomycin	<i>Starting with 2021 data, the option for a resistant (R) result for daptomycin was added into NHSN and incorporated into this phenotype definition.</i>

Coagulase-negative Staphylococci

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

Staphylococcus aureus

Methicillin-resistant (MRSA)	Any <i>Staphylococcus aureus</i> isolate that tested (R) to at least 1 of these: methicillin, oxacillin, ceftiofur	
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	<i>For data prior to 2021, moxifloxacin was not included in the phenotype definition.</i>
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	<i>For data prior to 2021:</i> • <i>Ceftolozane/tazobactam and ceftazidime/avibactam were not included in the phenotype definition</i> • <i>Piperacillin was included in the phenotype definition</i>

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	<i>For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.</i>
----------------------------	--	--



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	<i>For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.</i>
Cephalosporin-resistant	Any isolate that tested (I) or (R) to at least 1 of these: ceftriaxone, ceftazidime, cefepime, cefotaxime, ceftolozane/tazobactam, or ceftazidime/avibactam	<i>For data prior to 2021, ceftolozane/tazobactam and ceftazidime/avibactam were not included in the phenotype definition.</i>
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	<i>For data prior to 2021, the following antibiotics were not included in the phenotype definition:</i> • 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	<i>For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.</i>
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	<i>For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.</i>

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

Carbapenem-resistant (CRE) (<i>K. aerogenes</i> 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	<i>For data prior to 2021, meropenem/vaborbactam and imipenem/relebactam were not included in the phenotype definition.</i>
--	--	---



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	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	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	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

For data prior to 2021:

- *Ceftolozane/tazobactam and ceftazidime/avibactam were not included in the phenotype definition*
- *Piperacillin was included in the phenotype definition*

