Massachusetts Department of Public Health

**2021 Statewide Antibiogram Report**

**Bureau of Infectious Disease and Laboratory Sciences**

Massachusetts Department of Public Health

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# Introduction

## Overview

 The Massachusetts Department of Public Health 2021 Statewide Antibiogram Report represents cumulative antimicrobial susceptibility data submitted by acute care hospitals across Massachusetts. These data were prepared with consideration to the Clinical and Laboratory Standards Institute (CLSI) guidelines(CLSI, 2022).

## Purpose

 Antimicrobial resistance (AR) is a pressing public health concern. According to the Center for Disease Control and Prevention’s (CDC) 2019 AR Threats Report, over 2.8 million antimicrobial-resistant infections occur annually in the United States, resulting in more than 35,000 deaths a year (CDC, 2019). The COVID-19 pandemic only worsened these trends across measured categories (CDC, 2024). As such, antimicrobial stewardship and infection prevention are vital tools for preventing the development of antimicrobial resistances and slowing their spread. The purpose of the Statewide Antibiogram Reports is to promote stewardship and infection control efforts by presenting healthcare providers, public health professionals, and the public with information on resistance patterns seen across the state of Massachusetts. **The data in this report are not intended for use in clinical decision making.**

 Data for this report were only collected from acute care hospitals. Given this, as well as the impact of the COVID-19 pandemic on infectious disease screening, treatment, and surveillance, it is important to note that these data do not represent the full extent of antimicrobial resistance in Massachusetts.

## Data Description

 Cumulative antimicrobial susceptibility data were submitted by 59 acute care facilities across Massachusetts in 2021, including antimicrobial susceptibility testing for bacterial isolates from cultures for both inpatients and outpatients. Data is separated between tables for Gram-Positive Organisms and Gram-Negative Organisms; there is one row for each organism, and the total number of isolates included for each organism is listed in the N column. For each organism and antimicrobial pair, the percentage of isolates susceptible to the antimicrobial appears above the total number of isolates tested for susceptibility to that antimicrobial.

# Gram-Negative Organisms 2021

Massachusetts Department of Public Health

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| --- |
| **Percent Susceptibilities\*** |
| Gram-NegativeOrganisms | N | Amikacin †  | Amoxicillin + Clavulanate | Ampicillin | Ampicillin + Sulbactam | Aztreonam | Cefazolin | Cefepime | Cefotaxime | Cefotetan | Cefoxitin | Ceftazidime | Ceftriaxone | Cefuroxime | Ciprofloxacin  | Doripenem | Ertapenem | Gentamicin | Imipenem | Levofloxacin | Meropenem | Moxifloxacin | Nitrofurantoin †  | Piperacillin + Tazobactam | Tetracycline | Ticarcillin + Clavulanate | Tigecycline | Tobramycin | Trimethoprim + Sulfamethoxazole |
| *A. baumannii* | 616 | 97 | R | R | 96 | R | R | 83 | \_\_ | R | R | 74 | 32 | R | 81 | \_\_ | R | 92 | 99 | 85 | 87 | \_\_ | \_\_ | 81 | 77 | \_\_ | \_\_ | 95 | 84 |
| 119 | 343 | 443 | 340 | 213 | 563 | 597 | 141 | 488 | 453 | 497 | 236 | 381 | 566 |
| *E. cloacae* | 4593 | 100 | R | R | R | 78 | R | 93 | \_\_ | R | R | 78 | 75 | \_\_ | 93 | \_\_ | 93 | 97 | 94 | 92 | 98 | \_\_ | 37 | 79 | 89 | \_\_ | 95 | 95 | 89 |
| 2890 | 553 | 3649 | 1968 | 3643 | 4167 | 2619 | 4593 | 869 | 4043 | 3698 | 3922 | 4041 | 1559 | 329 | 2787 | 4592 |
| *E. coli* | 88992 | 99 | 85 | 57 | 67 | 93 | 84 | 94 | \_\_ | 99 | 91 | 94 | 91 | 86 | 80 | \_\_ | 100 | 91 | 100 | 79 | 100 | \_\_ | 97 | 96 | 75 | \_\_ | 99 | 91 | 78 |
| 55135 | 30724 | 73868 | 58217 | 10521 | 79028 | 72910 | 707 | 20006 | 38183 | 79464 | 642 | 82508 | 52506 | 88992 | 18549 | 77856 | 68511 | 86433 | 85779 | 21891 | 5551 | 53456 | 88989 |
| *K. aerogenes* | 2104 | 100 | R | R | R | 85 | R | 98 | \_\_ | R | R | 84 | 83 | \_\_ | 96 | \_\_ | 98 | 100 | 80 | 96 | 99 | \_\_ | 20 | 87 | 94 | \_\_ | 95 | 99 | 98 |
| 1186 | 231 | 1606 | 1024 | 1798 | 1957 | 1298 | 2104 | 476 | 1907 | 1478 | 1798 | 1721 | 650 | 154 | 1218 | 2046 |
| *K. oxytoca* | 3592 | 100 | 91 | R | 70 | 94 | 61 | 96 | \_\_ | 100 | 96 | 97 | 94 | 79 | 96 | \_\_ | 100 | 97 | 99 | 97 | 100 | \_\_ | 85 | 94 | 91 | \_\_ | 96 | 96 | 94 |
| 2349 | 1135 | 2156 | 497 | 3133 | 2856 | 67 | 760 | 1635 | 3013 | 63 | 3225 | 1973 | 3592 | 718 | 3164 | 2884 | 3282 | 3182 | 1048 | 224 | 2135 | 3577 |
| *K. pneumoniae* | 20759 | 99 | 90 | R | 82 | 94 | 86 | 92 | \_\_ | 100 | 93 | 92 | 90 | 79 | 88 | \_\_ | 99 | 94 | 99 | 88 | 99 | \_\_ | 35 | 93 | 80 | \_\_ | 99 | 92 | 85 |
| 13304 | 6442 | 11795 | 2439 | 18656 | 17439 | 200 | 5791 | 8559 | 18163 | 322 | 19055 | 11457 | 20759 | 4092 | 18214 | 16648 | 19839 | 20092 | 5247 | 1318 | 13195 | 20758 |
| *P. aeruginosa* | 13748 | 95 | R | R | R | 76 | R | 86 | R | R | R | 88 | R | R | 80 | \_\_ | R | 88 | 89 | 75 | 87 | \_\_ | 05 | 86 | R | \_\_ | R | 96 | R |
| 11568 | 2270 | 12680 | 7986 | 12238 | 13748 | 2586 | 11553 | 11461 | 1847 | 13469 | 10450 |
| *S. maltophilia* | 1348 | 20 | R | R | R | R | 00 | 18 | R | \_\_ | \_\_ | 39 | R | \_\_ | 56 | \_\_ | R | 20 | R | 86 | R | \_\_ | 00 | R | R | \_\_ | \_\_ | 100 | 92 |
| 421 | 335 | 421 | 253 | 421 | 421 | 1348 | 335 | 86 | 1262 |
| *S. marcescens* | 2748 | 99 | R | R | R | 82 | R | 98 | \_\_ | R | R | 94 | 89 | R | 93 | \_\_ | 99 | 99 | 97 | 95 | 99 | \_\_ | R | 87 | 24 | \_\_ | 99 | 91 | 99 |
| 1675 | 410 | 2260 | 1360 | 2210 | 2485 | 1688 | 2748 | 137 | 2238 | 2272 | 1178 | 627 | 93 | 1701 | 2512 |

N is the total number of isolates included for each organism. Only the first microbial isolate of a given species from a single patient per facility for the year is included.

For each organism and antimicrobial pair, the percentage of isolates susceptible to the antimicrobial appears above the total number of isolates tested for susceptibility to that antimicrobial.

(\_\_) in the data box indicates that either data was not reported for a given antimicrobial agent-organism combination or fewer than the standard recommendation of 30 isolates has been reported.

R in the data box indicates that the species or organism group is intrinsically resistant to the antimicrobial agent being tested.

† Amikacin (for *P. aeruginosa*) and Nitrofurantoin were tested against urine isolates only.

\*Data was compiled from Massachusetts Virtual Epidemiologic Network (MAVEN), current as of 06/09/2025, and are subject to change.

# Gram-Positive Organisms 2021

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Bureau of Infectious Disease and Laboratory Sciences

|  |
| --- |
| **Percent Susceptibilities\*** |
| Gram-PositiveOrganisms | N | Ampicillin | Ampicillin + Sulbactam | Azithromycin | Cefazolin | Cefotaxime | Cefotaxime ¥ | Ceftriaxone £ | Ceftriaxone ¥ | Ciprofloxacin† | Clindamycin | Daptomycin | Erythromycin | Gentamicin | Levofloxacin | Linezolid | Moxifloxacin | Nitrofurantoin† | Oxacillin | Penicillin € | Penicillin § | Quinupristin + Dalfopristin | Rifampin | Tetracycline† | Tigecycline | Trimethoprim + Sulfamethoxazole | Vancomycin |
| *ALL S. aureus* | 23749 | 23 | 66 | 54 | 70 | \_\_ | \_\_ | \_\_ | \_\_ | 79 | 73 | 100 | 48 | 99 | 80 | 100 | 91 | 99 | 68 | \_\_ | \_\_ | 100 | 99 | 91 | 100 | 96 | 100 |
| 817 | 3051 | 1262 | 6756 | 5970 | 23163 | 9790 | 17243 | 15614 | 11994 | 16009 | 16009 | 16955 | 23735 | 2431 | 17744 | 20087 | 2431 | 23424 | 23274 |
| *MRSA* | 10313 | \_\_ | 00 | 21 | 00 | \_\_ | \_\_ | \_\_ | \_\_ | 56 | 68 | 98 | 14 | 98 | 54 | 100 | 70 | 99 | 00 | \_\_ | \_\_ | 100 | 99 | 86 | 99 | 95 | 100 |
| 520 | 262 | 1207 | 4435 | 10004 | 3845 | 8289 | 5535 | 5946 | 6403 | 6403 | 7094 | 9169 | 517 | 6999 | 10229 | 1187 | 10309 | 9641 |
| *MSSA* | 21050 | 100 | 100 | 64 | 100 | \_\_ | \_\_ | \_\_ | \_\_ | 90 | 78 | 99 | 64 | 99 | 93 | 100 | 96 | 100 | 100 | \_\_ | \_\_ | 100 | 100 | 93 | 100 | 97 | 100 |
| 121 | 1203 | 950 | 4847 | 9054 | 20594 | 6938 | 17452 | 10712 | 12778 | 9242 | 9242 | 14082 | 20835 | 2419 | 14780 | 20843 | 2502 | 21045 | 19942 |
| *E. faecalis* | 10243 | 100 | \_\_ | \_\_ | R | R | R | R | R | 72 | \_\_ | 99 | 13 | 85 | 53 | 98 | 100 | 97 | \_\_ | 99 | \_\_ | R | 60 | 13 | 72 | R | 89 |
| 10107 | 3560 | 3925 | 2580 | 1547 | 6363 | 9459 | 9459 | 9187 | 1561 | 363 | 4487 | 232 | 9786 |
| *E. faecium* | 1605 | 23 | \_\_ | \_\_ | R | R | R | R | R | 21 | \_\_ | 92 | 05 | 90 | 12 | 97 | \_\_ | 27 | \_\_ | 18 | \_\_ | \_\_ | 08 | 22 | \_\_ | R | 41 |
| 1597 | 265 | 486 | 604 | 336 | 953 | 1550 | 1478 | 177 | 59 | 535 | 1504 |
| *S. pneumoniae* | 568 | 69 | \_\_ | 51 | \_\_ | \_\_ | 92 | 97 | 92 | \_\_ | 73 | \_\_ | 50 | \_\_ | 99 | 100 | 97 | \_\_ | \_\_ | 90 | 65 | \_\_ | 98 | 69 | \_\_ | 82 | 100 |
| 116 | 83 | 52 | 403 | 323 | 320 | 433 | 410 | 64 | 64 | 446 | 238 | 40 | 287 | 375 | 463 |

N is the total number of isolates included for each organism. Only the first microbial isolate of a given species from a single patient per facility for the year is included.

For each organism and antimicrobial pair, the percentage of isolates susceptible to the antimicrobial appears above the total number of isolates tested for susceptibility to that antimicrobial.

Antibiotics used at various concentrations: (¥) Concentration is ≤ 0.5μg/ml, (£) Concentration is ≤ 1μg/ml, (€) Concentration is ≤ 2 μg/ml for *S. pneumoniae* and is ≤ 8 μg/ml for *Enterococcus* spp, (§) Concentration is ≤ 0.06μg/ml.

(\_\_) in the data box indicates that either data was not reported for a given antimicrobial agent-organism combination or fewer than the standard recommendation of 30 isolates has been reported.

R in the data box indicates that the species or organism group is intrinsically resistant to the antimicrobial agent being tested.

†Nitrofurantoin, Ciprofloxacin (for Enterococcus spp), Levofloxacin (for Enterococcus spp) and Tetracycline (for Enterococcus spp) were tested against urine isolates only.

\*Data was compiled from Massachusetts Virtual Epidemiologic Network (MAVEN), current as of 06/09/2025, and are subject to change.

Hospitals That Reported 2021 Antibiogram Data1

|  |  |  |
| --- | --- | --- |
| Athol Memorial Hospital | Lahey Health - Addison Gilbert Hospital | Southcoast Health - Charlton Memorial Hospital |
| Baystate Franklin Medical Center | Lahey Health – Beverly Hospital | Southcoast Health - St. Luke's Hospital |
| Baystate Medical Center | Lahey Health - Lahey Hospital & Medical Center (Burlington) | Southcoast Health - Tobey Hospital |
| Baystate Noble Hospital | Lahey Health – Lahey Medical Center, Peabody | Steward Health Care - Carney Hospital |
| Baystate Wing Hospital | Lahey Health – Winchester Hospital | Steward Health Care - Good Samaritan Medical Center |
| Berkshire Health Systems - Berkshire Medical Center | Lowell General Hospital - Main Campus | Steward Health Care - Holy Family Hospital (Methuen) |
| Berkshire Health Systems - Fairview Hospital | Lowell General Hospital - Saints Campus | Steward Health Care - Holy Family Hospital at Merrimack Valley (Haverhill) |
| Beth Israel Deaconess Hospital - Plymouth | Martha's Vineyard Hospital | Steward Health Care - Morton Hospital |
| Beth Israel Deaconess Medical Center | Massachusetts Eye and Ear Infirmary | Steward Health Care - Nashoba Valley Medical Center |
| Boston Children's Hospital | Massachusetts General Hospital | Steward Health Care - Saint Anne's Hospital  |
| Brigham and Women’s Faulkner Hospital | Mercy Medical Center | Steward Health Care - St. Elizabeth's Medical Center |
| Brigham and Women's Hospital | MetroWest Medical Center - Framingham Union Hospital | Steward Health Care- New England Sinai Hospital |
| Cambridge Health Alliance - Cambridge Hospital | MetroWest Medical Center - Leonard Morse Hospital | Sturdy Memorial Hospital |
| Cambridge Health Alliance - Everett Hospital | Milford Regional Medical Center | The Veteran’s Administration Boston Healthcare System |
| Cambridge Health Alliance - Somerville Hospital | Nantucket Cottage Hospital | UMass Memorial Health Care – Clinton Hospital |
| Cape Cod Healthcare - Cape Cod Hospital | Newton-Wellesley Hospital | UMass Memorial Health Care – HealthAlliance Hospital Leominster |
| Cape Cod Healthcare - Falmouth Hospital | Saint Vincent Hospital | UMass Memorial Health Care – Marlborough Hospital |
| Harrington Memorial Hospital | Shriners Hospital for Children - Boston | UMass Memorial Health Care – UMass Memorial Campus |
| Heywood Hospital | Signature Healthcare - Brockton Hospital | UMass Memorial Health Care – UMass University Campus |
| Holyoke Medical Center | South Shore Hospital |  |

1 Hospitals that reported 2021 antibiogram data in accordance with regulations (105 CMR 300.000) by the reporting deadline.

# Antimicrobial Susceptibility Testing Guidelines

Antimicrobial susceptibility testing is conducted in microbiology laboratories. Microbiologists utilize standardized guidelines, such as those distributed by the Clinical and Laboratory Standards Institute (CLSI. 2025) to determine whether a bacterial isolate is susceptible, intermediate, or resistant to an antimicrobial. These guidelines are updated periodically. The extent to which clinical microbiology laboratories across Massachusetts can implement the most recently updated guidelines within a particular time period varies.

# References

CDC. (2019). *Antibiotic Resistance Threats in the United States.* Atlanta, GA: U.S. Department of Health and Human Services, CDC.

CDC. (2024). *Antimicrobial Resistance Threat in the United States, 2021-2022.* Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

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