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NH DIVISION OF Public Health Services
Improving health, preventing disease, reducing costs *for all*
Department of Health and Human Services

Antibiotic Prescribing for Common Infections

Key Points and Recommendations:

- NH DPHS has prioritized coordination of antibiotic stewardship work in New Hampshire. We invite healthcare providers and facilities to partner with us to improve treatment of common infections in order to improve patient outcomes and minimize the chance of bacterial pathogens becoming resistant to some of our best antibiotics.
- This second annual New Hampshire State Antibiogram is a tool to both monitor bacterial antibiotic resistance patterns, and help inform clinician antibiotic prescribing. The 2017 New Hampshire State Antibiogram with key clinical messages about treating common infectious syndromes is attached; it can also be accessed at the following link: https://www.dhhs.nh.gov/dphs/cdcs/hai/publications.htm.
- SAVE THE DATE: On March 20, 2019 we will host our 2nd annual NH Antibiotic Stewardship Symposium. Dr. Arjun Srinivasan from the Centers for Disease Control and Prevention will be our keynote speaker to set the stage for further presentations and discussion about how we can improve the health of patients through better antibiotic use and infection management.
- For questions or information about how to be involved in statewide antibiotic stewardship work, please call (603)-271-4496 and ask to speak with the Healthcare-Associated Infections (HAI) Program, or email the HAI program at HAIProgram@dhhs.nh.gov.

Antimicrobial Resistance and Public Health Response

At least 30% of all outpatient antibiotic prescriptions are unnecessary and more than half of hospitalized patients receive antibiotics during their admission, many with broad-spectrum coverage. We know that the more antibiotics are used, the more bacteria will become resistant to those antibiotics, and we will lose the ability to use some of our most effective and best tolerated antibiotics. Joining with federal and local partners, the New Hampshire Division of Public Health Services (DPHS) is looking to collaborate with local clinicians and healthcare facilities to improve the use of antibiotics and more effectively treat patients' infections. We have convened a multidisciplinary group of individuals from around the state to:

1. Build interest and commitment to prevent and respond to antibiotic resistant infections
2. Improve antibiotic resistance surveillance
3. Evaluate antibiotic use and prescribing
4. Promote and coordinate antibiotic stewardship activities

Our 2nd annual NH State Antibiogram provides an updated picture of resistance in New Hampshire and includes key messages about antibiotic prescribing for common infectious clinical syndromes, including urinary tract infections (UTIs), pneumonia, and skin and soft tissue infections (SSTIs). Please review the attached document or visit the following link to review key clinical information about antibiotic prescribing: https://www.dhhs.nh.gov/dphs/cdcs/hai/publications.htm.

For any questions regarding the contents of this message, please contact NH DHHS, DPHS, Bureau of Infectious Disease Control at 603-271-4496 (after hours 1-800-852-3345 ext.5300).

To change your contact information in the NH Health Alert Network, contact Adnela Alic at 603-271-7499 or email adnela.alic@dhhs.nh.gov.

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From:	Benjamin P. Chan, MD, MPH – State Epidemiologist
Originating Agency:	NH Department of Health and Human Services, Division of Public Health Services

Attachments: 2017 Statewide Antibiogram and Executive Summary

NH DIVISION OF
Public Health Services
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Department of Health and Human Services

STATE OF NEW HAMPSHIRE

2017 STATE ANTIBIOGRAM & IMPLICATIONS FOR ANTIBIOTIC PRESCRIBING

Released:
October 2018

New Hampshire Department of Health and Human Services
Division of Public Health Services

The New Hampshire Department of Health and Human Services, Division of Public Health Services (DPHS), Healthcare Associated Infections (HAI) Program has released the 2017 statewide antibiograms for non-urine and urine clinical isolates. Included is one presentation of the data showing the percent susceptibility, and a second presentation which shows the total number of isolates in the numerator and denominator that corresponds to each percent susceptible value. Methodology and data limitations can be found in the Appendix at the end of the document.

Purpose

- The information contained in these antibiograms can help clinicians choose appropriate empiric antibiotics to treat common infectious syndromes and avoid overuse of broad spectrum antibiotics. Antibiotics should be chosen based on the clinical syndrome and the most likely pathogen(s) associated with the clinical syndrome.
- Annual antibiogram analysis allows the New Hampshire DPHS to evaluate temporal trends and geographic patterns of antibiotic resistance to guide antibiotic stewardship efforts at the local, regional, and state level. Antibiotic stewardship refers to the implementation of coordinated efforts to promote the appropriate use of antibiotics in order to improve patient outcomes, reduce antibiotic resistance, and prevent the spread of multidrug-resistant organisms.

Clinical Implications

This year's Executive Summary expands on the 2016 State Antibiogram and Executive Summary guidance (released in 2017) and focuses on improving treatment of urinary tract infections (UTIs), pneumonia, and skin and soft tissue infections. Each patient should be treated based on a clinician's assessment of the type of infection and acuity, and ***a patient's antibiotic regimen should always be tailored to susceptibility testing results once they are available.***

Important Notes for Interpreting the Antibiogram:

- "High" resistance to an antibiotic is when more than 20% of isolates are resistant
- The following antibiotics indicate susceptibility to others in the same/related class
    - Oxacillin predicts nafcillin susceptibility
    - Tetracycline predicts doxycycline susceptibility
    - Erythromycin predicts azithromycin susceptibility
    - Ampicillin predicts amoxicillin susceptibility
    - Cefazolin predicts cephalexin susceptibility
    - Ampicillin/sulbactam predicts amoxicillin/clavulanate susceptibility

Table 1: Short Course Antibiotic Therapy for Specific Infectious Syndromes in Adults

Syndrome	**Short Course of Therapy (Days)**
Uncomplicated urinary tract infections	3-5 days (depending on antibiotic)
Complicated urinary tract infections, including acute pyelonephritis	May be as short as 7 days
Community-acquired pneumonia (CAP)	May be as short as 5 days
Hospital-acquired pneumonia (HAP)	7 days
Skin and soft tissue infections (SSTI), including Cellulitis	May be as short as 5 days
Note: Antibiotic duration should be based on clinical response. The suggested short course duration of antibiotics is not intended to supplant physician judgement about individual patients or special clinical situations. References: • Spellberg B. The new antibiotic mantra – "shorter is better". JAMA Intern Med 2016;176(9):1254-5 • IDSA treatment guidelines for HAP/VAP • IDSA treatment guidelines for CAP in adults • IDSA treatment guidelines for UTIs • IDSA treatment guidelines for skin and soft tissue infections (SSTIs)	

Urinary Tract Infections (UTIs):

- In most patients, asymptomatic bacteriuria should not be treated with antibiotics. Treatment may be indicated during pregnancy, before certain urologic procedures, and in first three months after renal transplant.
- The most common Gram-negative bacteria to be isolated from urine were *Escherichia coli* (70% of isolates) followed by *Klebsiella* spp. (14%) and *Proteus mirabilis* (5%). *Pseudomonas aeruginosa* was recovered in fewer than 5% of urine specimen cultures; therefore, empiric UTI coverage with a fluoroquinolone to cover *Pseudomonas* is not usually needed.
- Nitrofurantoin remains the most likely active agent against *Escherichia coli* (98% susceptible), followed by cephalexin (predicted by cefazolin, 92% susceptible). Trimethoprim-sulfamethoxazole and ciprofloxacin are less likely to be active, and we recommend avoiding ciprofloxacin as first-line therapy because of the potential for toxicity and *C. difficile* infection.
- We recognize that many providers are prescribing antibiotic therapy for UTIs by phone. We recommend that providers obtain a urine culture before antibiotics are started in cases where the provider elects initial broad spectrum antibiotic therapy (e.g., third-generation cephalosporin or fluoroquinolone), or when a patient has failed the above recommended narrow spectrum therapy.

- For patients with antibiotic allergies or risk for resistant bacteria, fosfomycin can be considered for *E.coli* and enterococcal UTIs. While most hospital laboratories do not routinely test susceptibilities for this antibiotic, testing can be requested. According to national data, >90% of *E. coli* were sensitive to fosfomycin and, at two New Hampshire hospitals in 2017, 100% of the 81 *E.coli* isolates tested were susceptible to fosfomycin.
- The most common Gram-positive bacteria to be isolated from urine are *Enterococcus spp.* (81%). The majority of *Enterococcus spp.* isolates in the urine were susceptible to ampicillin/amoxicillin (93% susceptible). Susceptible uncomplicated enterococcal UTIs can be treated with high-dose amoxicillin.
- *Staphylococcus aureus* is an infrequent isolate from urine. In the absence of ureteral hardware (e.g., stents), finding *Staphylococcus aureus* in an aseptically obtained urine specimen (either MSSA or MRSA) should lead a provider to consider an intravascular source (e.g., bacteremia).
- For most patients hospitalized for a complicated UTI or acute pyelonephritis, empiric initial treatment with ceftriaxone while awaiting culture results is appropriate, if there is no history of a UTI with a ceftriaxone-resistant bacteria. Ceftriaxone maintains very good activity against the most common Gram-negative bacteria in the urine.

<u>Community Acquired Pneumonia (CAP) and Hospital Acquired Pneumonia (HAP)</u>:

- National data shows that 44% of outpatient antibiotic prescriptions are written for acute respiratory conditions, at least half of which are caused by viruses and will not respond to antibiotics (JAMA 2016;315:1864-73).
- The most commonly prescribed antibiotic in the outpatient setting is azithromycin (Clinical Infectious Disease 2015;60:1308-16), but 41% of *Streptococcus pneumoniae* (Pneumococcus) isolates in NH are resistant to azithromycin (predicted by erythromycin susceptibility). As a result, azithromycin should not be prescribed for suspected Pneumococcal pneumonia (e.g., when the clinical presentation is acute with a focal infiltrate on chest x-ray).
- Preferred antibiotics to treat an acute outpatient bacterial pneumonia suspected due to *Streptococcus pneumoniae* include amoxicillin, amoxicillin-clavulanate, and cefpodoxime. Historically cefuroxime had been a good choice, but this year we have found 21% of *Streptococcus pneumoniae* strains are resistant to cefuroxime (increased from 16% resistance in 2016).
- The respiratory fluoroquinolones (e.g., levofloxacin and moxifloxacin) remain highly active against *Streptococcus pneumoniae;* however, quinolones should be avoided for the treatment of outpatient CAP because of class toxicities, their ability to cause *C. difficile* infection even months after antibiotics have completed, and the availability of suitable alternatives.

- For patients with CAP requiring hospitalization, we recommend treatment with ceftriaxone and either doxycycline or azithromycin (for atypical bacterial pathogens).
- As of 2016, national guidelines have moved away from the diagnosis of "healthcare-associated pneumonia" (HCAP). Studies have shown that patients meeting the former HCAP criteria did NOT have a higher risk of multi-drug resistant organisms (MDROs) than patients meeting the CAP criteria (Clin Infect Dis 2014;58:330-9). Multiple studies failed to demonstrate benefits on length of stay, time to clinical stability, or mortality in patients treated with empiric broad-spectrum antibiotics for HCAP (Lung 2013;191:229-37). Standard therapy for CAP is often appropriate for non-critically ill patients meeting the former HCAP criteria.
- Hospital-acquired pneumonia (HAP) is the onset of pneumonia more than 48 hours after hospitalization. HAP still warrants treatment with broad-spectrum empiric therapy pending respiratory culture results; however, vancomycin is not needed in all cases of HAP. Indications for empiric vancomycin include septic shock, worsening respiratory failure (+/- necrotizing pneumonia or empyema), IV antibiotics within the past 90 days, prior MRSA colonization or infection, and MRSA known to be cultured in >5% of all respiratory cultures sent (Clin Infect Dis 2016;63:e61-e111).
- Patients who are hospitalized for CAP with concern for MDROs or patients being treated for HAP should have sputum obtained for culture, ideally before antibiotic administration, to help guide and narrow antibiotic therapy.

<u>Skin and soft tissue infections (SSTIs), including cellulitis</u>:

- Most SSTIs are due to either streptococcal infection or *Staphylococcus aureus*. Non-purulent SSTIs (e.g. cellulitis) are usually not caused by methicillin-resistant *Staphylococcus aureus* (MRSA), so coverage of this organism is not necessary. 68% all non-urine *Staphylococcus aureus* isolates in New Hampshire were methicillin-sensitive *Staphylococcus aureus* (MSSA). There are many options that treat both streptococci and MSSA, including ceftriaxone, cefazolin, cephalexin, and dicloxacillin.
- Two studies have now demonstrated no benefit in adding an empiric MRSA antibiotic to the more standard therapy targeted at streptococci and MSSA in cases of non-purulent SSTIs (Clin Infect Dis 2013;56:1754-62 and JAMA 2017;317:2088-96).
- In the case of skin abscess (i.e. purulent SSTI), the abscess should be incised and drained with drainage sent for bacterial Gram-stain and culture. Empiric outpatient therapy with either trimethoprim-sulfamethoxazole or doxycycline (97% and 94% susceptibility against MRSA, respectively) are the preferred antibiotic regimens for MRSA SSTIs. Adjunctive antibiotic therapy does improve cure rates when paired with incision and drainage (N Engl J Med 2016;374:823-32 and N Engl J Med 2017;376:2545-5).

- Clindamycin should not be prescribed empirically for MRSA, because approximately one-third (32%) of isolates are resistant.

Specific Antibiotic Recommendations:

- Meropenem remains active against almost all *Enterobacteriaceae*. In 2017 there were only 50 CRE cases in NH residents reported to the NH DPHS. We recommend that antimicrobial stewardship programs continue to restrict the use of carbapenem antibiotics, because healthcare settings with more liberal use of carbapenems have seen a more rapid rise in carbapenem-resistance.
- The U.S. Food and Drug Administration (FDA) Drug Safety Communication recommends restricting fluoroquinolone antibiotic use for certain uncomplicated infections (U.S. Food and Drug Administration 2018). In July of 2008, the FDA issued a safety alert for the potential development of tendinitis and tendon rupture in patients while taking a fluoroquinolone (U.S. Food and Drug Administration 2008). The warning has since been expanded to include potential mental health side effects and severe hypoglycemia (U.S. Food and Drug Administration 2018).

- Over 90% of patients with a penicillin allergy listed in their medical record are not actually allergic to penicillin, and over 80% of penicillin allergic patients "outgrow" their allergy after 10 years. Additionally, in patients with a confirmed penicillin allergy, less than 2% have a reaction to cephalosporins. Therefore, patients with any history of a penicillin allergy should be evaluated by taking a thorough history of their allergy, and providers should consider: 1) de-labeling the penicillin allergy, 2) providing a supervised penicillin challenge (if patient reports a mild reaction), or 3) penicillin skin testing (for moderate or serve reactions). In a setting without access to penicillin skin testing, patients with mild penicillin allergy, such as morbilliform drug rash or hives alone, can safely receive 3rd and 4th generation cephalosporins.

- In hospitalized patients with a presumed Gram-negative infection, use of two different classes of antibiotics as empiric treatment may be indicated in cases with septic shock, respiratory failure, intravenous antibiotics in the prior 90 days, and/or structural lung disease (e.g. bronchiectasis, cystic fibrosis). Otherwise, monotherapy is typically appropriate when selecting an antibiotic for which resistance on the local antibiogram is <10%.

Public Health Implications

1. NH DPHS will continue to monitor and analyze antibiotic resistance data on a yearly basis and track patterns and trends over time. Future reports may highlight changes in susceptibility patterns and overall state and regional trends.
2. The statewide antibiogram can be used as a baseline to compare local data and can be used by healthcare facilities without access to a local antibiograms (i.e. outpatient care, long-term care facilities, assisted living, ambulatory surgery, etc.) to assist with appropriate antibiotic prescribing.
3. The data and information presented is intended to encourage statewide coordinated antibiotic stewardship efforts to prevent antibiotic resistance and slow the spread of multidrug-resistant organisms. The data reveals levels of resistance consistent with national trends, which have been steadily increasing. https://www.cdc.gov/hai/surveillance/ar-patient-safety-atlas.html. For more information on how to develop a stewardship program in your facility, explore the CDC Core Elements of Stewardship resources.
4. Antibiotic resistance is an issue that crosses multiple different but connected disciplines, including: human, veterinary, and environmental health. The New Hampshire Antibiotic Resistance Advisory Workgroup (ARAW)[1] is working to integrate efforts across multiple disciplines to address antibiotic resistance through a One Health perspective to reduce the development and spread of antimicrobial resistance for people, animals, and our environment. For more information on One Health visit the CDC's One Health Page.

The NH DPHS HAI Program is a resource for guidance in developing and strengthening your facilities stewardship program, please contact us at haiprogram@dhhs.nh.gov or (603) 271-4496.

[1] ARAW is a group of subject matter experts and stakeholders across the State of New Hampshire who meet regularly to discuss and work to combat issues of antimicrobial resistance in NH. This is a forum for stakeholder input facilitated by NH DPHS.

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New Hampshire Statewide Antibiogram 2017

All Sources Other Than Urine

Percent Susceptible

Bureau of Infectious Disease Control
Infectious Disease Surveillance Section

Gram Negative Organisms	**Total Number of Isolates**	Ampicillin (Amoxicillin)	Ampicillin/Sulbactam	Piperacillin/Tazobactam	Cefazolin (Cephalexin)	Cefuroxime	Cefoxitin	Ceftriaxone	Ceftazidime	Cefepime	Aztreonam	Ertapenem	Meropenem	Imipenem	Doripenem	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Tigecycline	Tetracycline (Doxycycline)	Trimethoprim/Sulfamethoxazole
Escherichia coli	2669	60	65	97	88	91	94	95	95	96	94	100	100	100	100	84	84	100	93	94	100	78	80
Enterobacter aerogenes (Klebsiella aerogenes)	129			88				84	85	100	92	99	100	91	100	99	99	99	99	99	99	91	100
Enterobacter cloacae	634			93				82	88	96	87	98	100	98	100	97	99	100	98	99	97	90	95
Klebsiella pneumoniae	858		89	97	94	92	94	97	97	97	97	100	100	100	100	97	97	99	98	97	98	88	93
Klebsiella oxytoca	446		79	97	58	92	98	98	98	97	98	100	100	100	100	100	100	100	99	99	100	93	96
Proteus mirabilis	601	82	91	100	90	97	97	98	99	99	96	100	100		100	83	86	100	93	93			85
Serratia marcescens	424			86				90	84	100	87	100	100	96	100	97	99	99	99	91	98	9	98
Citrobacter freundii	159			96				83	87	99	91	99	99	95	---	97	96	99	95	97	99	86	94
Morganella morganii	186		6	98			88	88	87	98	87	99	100		95	84	89	99	88	94	10	21	84
Pseudomonas aeruginosa	1562			97					94	92	83		95	92	98	87	86	98	89	97			
Acinetobacter baumannii	165		86	---				53	94	91			96	---	---	94	96	98	93	95	---	88	88
Stenotrophomonas maltophilia	355								48								80						97
Haemophilus influenzae	293	72	---			---		100					---			---	---					---	76

Gram Positive Organisms	**Total Number of Isolates**	Penicillin	Ampicillin (Amoxicillin)	Oxacillin	Ampicillin/Sulbactam	Cefazolin (Cephalexin)	Cefuroxime	Ceftriaxone	Levofloxacin	Moxifloxacin	Tetracycline (Doxycycline)	Trimethoprim/Sulfamethoxazole	Clindamycin	Erythromycin (Azithromycin)	Vancomycin	Linezolid	Daptomycin	Rifampin
Methicillin-**Sensitive** *Staphylococcus aureus* (MSSA)	7759	13		100	100	100	---	100	93	96	95	98	80		100	100	100	99
Methicillin-**Resistant** *Staphylococcus aureus* (MRSA)	3598								57	70	94	97	68		100	100	100	99
Enterococcus faecalis	1100	99	99		---										98	99	100	
Enterococcus faecium	156	23	29		---										39	97	94	
Enterococcus spp. (all hospital data)	1642	91	92		---										92	99	99	
Coagulase negative *Staphylococcus*	1727	8		52	52	53		52	69	77	85	69	67		100	100	100	99
Streptococcus pneumoniae (non-meningitis)	445	85	---	---	---		79	98	98	100	81	80	83	59	100	100		

Indicates data have been censored because of intrinsic resistance and/or inappropriate clinical use.

--- Indicates data have been censored because of insufficient sample. CLSI guidelines suggest total isolate counts of less than 30 are exclude

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New Hampshire Statewide Antibiogram 2017

All Sources Other Than Urine

Total Number of Susceptible Isolates/Total Tested

Bureau of Infectious Disease Control
Infectious Disease Surveillance Section

Gram Negative Organisms	**Total Number of Isolates**	Ampicillin (Amoxicillin)	Ampicillin/Sulbactam	Piperacillin/Tazobactam	Cefazolin (Cephalexin)	Cefuroxime	Cefoxitin	Ceftriaxone	Ceftazidime	Cefepime	Aztreonam	Ertapenem	Meropenem	Imipenem	Doripenem	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Tigecycline	Tetracycline (Doxycycline)	Trimethoprim/Sulfamethoxazole
Escherichia coli	2669	1516/ 2518	1513/ 2337	2594/ 2663	2153/ 2453	1639/ 1811	1486/ 1576	2522/ 2660	2016/ 2113	2551/ 2661	1818/ 1929	2531/ 2534	2074/ 2074	1420/ 1422	634/ 634	2223/ 2645	1598/ 1897	1802/ 1808	2396/ 2570	2272/ 2421	1419/ 1423	1124/ 1446	2110/ 2639
Enterobacter aerogenes (Klebsiella aerogenes)	129			115/ 131				112/ 134	104/ 123	135/ 135	93/ 101	134/ 135	105/ 105	63/ 69	49/ 49	133/ 134	97/ 98	109/ 110	134/ 135	131/ 132	87/ 88	82/ 90	129/ 129
Enterobacter cloacae	634			572/ 614				516/ 628	459/ 519	609/ 633	423/ 487	598/ 613	512/ 514	282/ 289	208/ 209	617/ 633	442/ 447	503/ 505	623/ 634	576/ 583	364/ 375	368/ 408	602/ 631
Klebsiella pneumoniae	858		691/ 779	818/ 839	734/ 784	586/ 634	513/ 546	830/ 857	681/ 702	811/ 832	625/ 645	827/ 828	679/ 679	443/ 443	205/ 205	830/ 857	563/ 579	607/ 612	841/ 858	753/ 775	470/ 478	405/ 461	793/ 852
Klebsiella oxytoca	446		321/ 405	418/ 431	231/ 400	324/ 352	309/ 316	435/ 445	373/ 380	431/ 446	356/ 365	439/ 439	371/ 371	201/ 201	139/ 139	445/ 446	307/ 308	349/ 349	443/ 446	410/ 414	266/ 266	258/ 276	427/ 446
Proteus mirabilis	601	463/ 568	476/ 525	599/ 601	490/ 546	415/ 428	345/ 355	589/ 601	456/ 462	593/ 601	417/ 434	568/ 568	472/ 472		150/ 150	495/ 594	352/ 409	402/ 404	552/ 596	477/ 511			504/ 593
Serratia marcescens	424			324/ 376				378/ 422	280/ 333	403/ 405	285/ 328	404/ 406	354/ 355	158/ 164	108/ 108	413/ 424	282/ 284	334/ 336	420/ 424	353/ 388	245/ 250	21/ 228	404/ 413
Citrobacter freundii	159			152/ 158				131/ 157	119/ 137	158/ 159	126/ 139	156/ 158	137/ 138	71/ 75	---	154/ 159	109/ 113	135/ 136	151/ 159	147/ 152	110/ 111	91/ 106	150/ 160
Morganella morganii	186		11/ 171	183/ 186			112/ 127	163/ 185	141/ 162	183/ 186	135/ 156	184/ 185	155/ 155		62/ 65	155/ 185	116/ 130	158/ 159	162/ 185	169/ 179	12/ 121	26/ 121	153/ 183
Pseudomonas aeruginosa	1562			1507/ 1556					1376/ 1466	1295/ 1411	940/ 1126		1203/ 1263	722/ 789	426/ 435	1352/ 1555	954/ 1113	1107/ 1133	1392/ 1556	1367/ 1407			
Acinetobacter baumannii	165		130/ 152	---				86/ 163	140/ 149	135/ 148			128/ 133	---	---	154/ 164	101/ 105	111/ 113	153/ 165	146/ 153	---	82/ 93	145/ 165
Stenotrophomonas maltophilia	355								145/ 304								225/ 280						344/ 355
Haemophilus influenzae	293	157/ 219	---			---		133/ 133					---			---	---					---	105/ 138

Gram Positive Organisms	**Total Number of Isolates**	Penicillin	Ampicillin (Amoxicillin)	Oxacillin	Ampicillin/Sulbactam	Cefazolin (Cephalexin)	Cefuroxime	Ceftriaxone	Levofloxacin	Moxifloxacin	Tetracycline (Doxycycline)	Trimethoprim/Sulfamethoxazole	Clindamycin	Erythromycin (Azithromycin)	Vancomycin	Linezolid	Daptomycin	Rifampin
Methicillin-**Sensitive** *Staphylococcus aureus* (MSSA)	7759	821/ 6370		7753/ 7758	6156/ 6213	5870/ 5928	---	4833/ 4855	7063/ 7580	6034/ 6316	7173/ 7586	7471/ 7591	5871/ 7325		7582/ 7582	6435/ 6444	6337/ 6350	7304/ 7354
Methicillin-**Resistant** *Staphylococcus aureus* (MRSA)	3598								2000/ 3514	1999/ 2855	3307/ 3520	3406/ 3524	2327/ 3402		3614/ 3614	3077/ 3078	3171/ 3176	3408/ 3439
Enterococcus faecalis	1100	850/ 857	1091/ 1100		---										1073/ 1095	887/ 894	916/ 918	
Enterococcus faecium	156	30/ 133	45/ 156		---										61/ 156	128/ 132	112/ 119	
Enterococcus spp. (all hospital data)	1642	1245/ 1375	1504/ 1641		---										1512/ 1636	1396/ 1412	1354/ 1364	
Coagulase negative *Staphylococcus*	1727	103/ 1283		855/ 1639	609/ 1170	580/ 1104		483/ 925	1177/ 1704	989/ 1283	1445/ 1704	1124/ 1637	1088/ 1630		1716/ 1720	1414/ 1417	1373/ 1377	
Streptococcus pneumoniae (non-meningitis)	445	345/ 407	---	---	---		118/ 150	345/ 352	300/ 305	88/ 88	205/ 253	189/ 235	141/ 170	164/ 276	270/ 270	87/ 87		

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New Hampshire Statewide Antibiogram 2017

Urine Only Sources

Percent Susceptible

Bureau of Infectious Disease Control
Infectious Disease Surveillance Section

Gram Negative Organisms	**Total Number of Isolates**	Ampicillin (Amoxicillin)	Piperacillin/Tazobactam	Cefazolin (Cephalexin)	Cefuroxime	Cefoxitin	Ceftriaxone	Ceftazidime	Cefepime	Aztreonam	Ertapenem	Meropenem	Imipenem	Doripenem	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Tigecycline	Tetracycline (Doxycycline)	Trimethoprim/Sulfamethoxazole	Nitrofurantoin
Escherichia coli	29741	65	98	92	94	96	96	96	97	96	100	100	100	100	87	87	99	94	94	100	81	83	98
Enterobacter aerogenes (Klebsiella aerogenes)	521		92				87	89	100	92	99	100	94	100	97	98	100	100	100	99	91	97	19
Enterobacter cloacae	797		86				77	82	98	83	97	99	97	100	97	98	100	99	99	98	89	91	33
Klebsiella pneumoniae	5152		98	95	93	95	97	98	98	97	100	100	100	99	97	98	100	99	98	99	87	92	48
Klebsiella oxytoca	825		96	50	89	96	96	97	98	96	100	100	100	100	98	99	100	98	98	100	94	95	86
Proteus mirabilis	2282	78	99	91	99	99	98	99	98	97	100	100		99	76	79	100	89	92			79	
Serratia marcescens	327		92				90	86	98	91	99	100	96	100	91	95	100	97	90	99	6	98	
Citrobacter freundii	782		93				83	86	99	88	100	100	98	100	94	96	100	96	96	100	86	88	96
Morganella morganii	265		99			84	94	90	99	91	100	100		99	83	88	100	91	95	4	16	86	
Pseudomonas aeruginosa	1909		97					94	92	83		95	92	98	81	80	97	87	96				
Acinetobacter baumannii	89		---				42	90	85			96	---	---	91	96	91	88	93	---	86	82	

Gram Positive Organisms	**Total Number of Isolates**	Penicillin	Ampicillin (Amoxicillin)	Oxacillin	Cefazolin (Cephalexin)	Ceftriaxone	Levofloxacin	Moxifloxacin	Tetracycline (Doxycycline)	Trimethoprim/Sulfamethoxazole	Clindamycin	Vancomycin	Linezolid	Daptomycin	Rifampin	Nitrofurantoin
Methicillin-**Sensitive** *Staphylococcus aureus* (MSSA)	711	18		100	100	100	93	82	98	98	76	100	100	100	99	
Methicillin-**Resistant** *Staphylococcus aureus* (MRSA)	393						21	21	94	94	41	100	100	99	98	
Enterococcus faecalis	2806	99	99									98	99	100		99
Enterococcus faecium	299	17	20									44	97	90		39
Enterococcus spp. *(all hospital data)*	4625	92	93									94	99	99		94

Indicates data have been censored because of intrinsic resistance and/or inappropriate clinical use.

--- Indicates data have been censored because of insufficient sample. CLSI guidelines suggest total isolate counts of less than 30 are excluded.

NH DIVISION OF Public Health Services
Improving health, preventing disease, reducing costs for all
Department of Health and Human Services

New Hampshire Statewide Antibiogram 2017

Urine Only Sources

Total Number of Susceptible Isolates/Total Tested

Bureau of Infectious Disease Control
Infectious Disease Surveillance Section

Gram Negative Organisms	**Total Number of Isolates**	Ampicillin (Amoxicillin)	Piperacillin/Tazobactam	Cefazolin (Cephalexin)	Cefuroxime	Cefoxitin	Ceftriaxone	Ceftazidime	Cefepime	Aztreonam	Ertapenem	Meropenem	Imipenem	Doripenem	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Tigecycline	Tetracycline (Doxycycline)	Trimethoprim/Sulfamethoxazole	Nitrofurantoin
Escherichia coli	29741	18185/ 28177	29241/ 29700	27164/ 29682	20889/ 22261	18437/ 19157	28521/ 29719	23684/ 24658	28858/ 29722	23783/ 24710	28414/ 28518	23888/ 23939	15079/ 15122	9038/ 9038	25951/ 29661	19061/ 21787	21165/ 21276	27817/ 29704	25705/ 27221	18372/ 18398	15075/ 18517	23707/ 28558	28594/ 29164
Enterobacter aerogenes (Klebsiella aerogenes)	521		466/ 506				450/ 520	377/ 425	518/ 520	410/ 448	512/ 515	415/ 415	254/ 271	174/ 174	504/ 521	397/ 407	398/ 398	519/ 521	487/ 488	323/ 327	330/ 361	506/ 520	99/ 514
Enterobacter cloacae	797		671/ 783				611/ 792	535/ 650	782/ 797	588/ 711	760/ 784	666/ 671	392/ 406	224/ 224	774/ 797	567/ 581	634/ 634	789/ 797	734/ 743	481/ 490	450/ 503	722/ 794	258/ 776
Klebsiella pneumoniae	5152		4934/ 5048	4912/ 5145	3614/ 3906	3161/ 3333	5011/ 5148	4195/ 4299	5033/ 5148	4155/ 4269	4937/ 4956	4152/ 4166	2619/ 2625	1506/ 1516	4983/ 5145	3629/ 3719	3770/ 3788	5071/ 5148	4653/ 4758	3156/ 3190	2746/ 3163	4748/ 5135	2406/ 5044
Klebsiella oxytoca	825		763/ 793	367/ 734	541/ 607	503/ 523	790/ 823	654/ 671	806/ 824	658/ 683	820/ 821	623/ 623	439/ 439	281/ 281	807/ 824	622/ 629	621/ 621	812/ 825	734/ 749	511/ 512	504/ 539	782/ 824	699/ 814
Proteus mirabilis	2282	1696/ 2182	2262/ 2275	2062/ 2272	1673/ 1694	1425/ 1444	2231/ 2281	1922/ 1946	2241/ 2281	1707/ 1751	2155/ 2155	1776/ 1776		669/ 675	1729/ 2262	1341/ 1691	1622/ 1630	2037/ 2277	1940/ 2110			1789/ 2266	
Serratia marcescens	327		261/ 284				292/ 324	234/ 273	322/ 327	218/ 240	302/ 306	274/ 275	123/ 128	96/ 96	297/ 327	222/ 233	255/ 256	318/ 327	279/ 309	196/ 197	11/ 198	319/ 327	
Citrobacter freundii	782		710/ 763				652/ 782	549/ 642	764/ 769	577/ 657	724/ 726	659/ 659	360/ 369	236/ 236	735/ 782	531/ 555	577/ 577	749/ 781	689/ 715	487/ 489	410/ 475	669/ 756	743/ 778
Morganella morganii	265		261/ 264			139/ 166	250/ 265	192/ 213	262/ 265	191/ 209	265/ 265	208/ 209		83/ 84	219/ 264	164/ 186	229/ 229	242/ 265	240/ 252	5/ 141	27/ 168	228/ 264	
Pseudomonas aeruginosa	1909		1844/ 1904					1747/ 1861	1638/ 1771	1088/ 1304		1527/ 1614	920/ 998	460/ 471	1544/ 1895	1080/ 1347	1219/ 1254	1649/ 1895	1762/ 1833				
Acinetobacter baumannii	89		---				36/ 85	60/ 67	57/ 67			64/ 67	---	---	78/ 86	155/ 161	49/ 54	77/ 88	75/ 81	---	49/ 57	72/ 88	

Gram Positive Organisms	**Total Number of Isolates**	Penicillin	Ampicillin (Amoxicillin)	Oxacillin	Cefazolin (Cephalexin)	Ceftriaxone	Levofloxacin	Moxifloxacin	Tetracycline (Doxycycline)	Trimethoprim/Sulfamethoxazole	Clindamycin	Vancomycin	Linezolid	Daptomycin	Rifampin	Nitrofurantoin
Methicillin-**Sensitive** *Staphylococcus aureus* (MSSA)	711	106/ 590		680/ 680	495/ 495	361/ 361	551/ 690	75/ 92	655/ 692	680/ 691	104/ 137	92/ 130	692/ 692	648/ 650	527/ 528	
Methicillin-**Resistant** *Staphylococcus aureus* (MRSA)	393						77/ 373	14/ 68	348/ 383	350/ 372	35/ 85	8/ 83	384/ 384	373/ 374	315/ 317	
Enterococcus faecalis	2806	1965/ 1979	2781/ 2803									39/ 378	2728/ 2785	2611/ 2639		1007/ 1869
Enterococcus faecium	299	41/ 247	57/ 287									1/ 30	131/ 296	277/ 285		39/ 222
Enterococcus spp. (all hospital data)	4625	3422/ 3732	4265/ 4599									61/ 604	4324/ 4589	4378/ 4441		1692/ 3352

Indicates data have been censored because of intrinsic resistance and/or inappropriate clinical use.

--- Indicates data have been censored because of insufficient sample. CLSI guidelines suggest total isolate counts of less than 30 are excluded.

Methodology

Reporting Requirements:

Reporting requirements are governed by RSA 141:C6 with authority given to DHHS to develop administrative rules to provide specific reporting instructions and methodology. Administrative rules He-P 301 were adopted in fall 2016 "He-P 300 Diseases, PART He-P 301.02 Communicable Diseases," were updated in 2016 with stakeholder input and approved by the Joint Legislative Committee on Administrative Rules. The updated rules require hospital laboratories to report antibiogram data annually to the State of New Hampshire.

Collection Process and Validation:

NH DPHS developed a standardized antibiogram fillable form for reporting susceptibility data, and requested data from hospital microbiology laboratories in January 2018. This form was developed to encompass most relevant antibiotic and organism combinations, created in collaboration between the NH DPHS and stakeholder subject matter experts. All 26 NH hospitals reported antibiogram data as required under He-P301; along with the Veteran's Affairs Hospital whom voluntarily reported data.

The HAI Program reconciled data to confirm reported data and evaluate accuracy and reliability of the data. The HAI Program first conducted an internal assessment to identify outliers or implausible data by comparing the percent susceptibilities between all hospitals for every organism and antibiotic combination and then corrected or confirmed data with each respective microbiology laboratory. The program subsequently convened an infectious disease medical and pharmacy advisory group to review the clinical implications of the data and ensure data was clinically accurate and relevant. The advisory group determined which antibiotic-organism combinations to censor due to clinical inappropriateness. Lastly, the antibiogram data was reviewed by the NH Antimicrobial Resistance Advisory Workgroup (ARAW)[2] to provide feedback and suggestions for use.

Antibiogram Development:

The Clinical and Laboratory Standards Institute (CLSI) guidelines were followed in the aggregation of data from all reported hospital antibiograms. Antibiotic and organism combinations that are either intrinsically resistance or not clinically appropriate were censored from the antibiogram. Per CLSI guidelines, any antibiotic and organism combination with a total number of isolate counts of less than 30 isolates were excluded.

An ARAW subcommittee, made up of infectious disease clinical specialists, drafted and reviewed the antibiogram executive summary to assist with clinical interpretation. The summary focused on treatment of common infections syndromes and was based on review of NH antibiogram data and current national treatment guidelines (https://www.idsociety.org/PracticeGuidelines/).

[2] ARAW is a group of subject matter experts and stakeholders across the State of New Hampshire who meet regularly to discuss and work to combat issues of antimicrobial resistance in NH. This is a forum for stakeholder input facilitated by NH DPHS.

Data Limitations

- Antibiotic susceptibility data from regional reference labs is not included in this data set and therefore the antibiogram is limited in its representativeness to hospital laboratory isolates.
- The urine only antibiogram includes all urine isolates, not necessarily only those pertaining to urinary tract infections. These isolates may represent other types of infections where bacteria were cultured from other clinical isolates in addition to the urine (e.g. bacteremia with seeding of the urine).
- The lack of reported susceptibility results for an antibiotic against a specific organism doesn't necessarily mean that the antibiotic isn't active. In some cases activity is reliably predicted by the activity of another agent (e.g. cefazolin activity against *Staphylococcus aureus* is predicted by oxacillin susceptibility); while in some other cases it is not possible to test susceptibility due to lack of testing reagents. Conversely, reported activity on *in vitro* susceptibility results does not necessarily mean an agent is clinically effective (or as effective as alternatives). For example, ciprofloxacin may show *in vitro* activity against *Staphylococcus aureus*, but ciprofloxacin should never be used to treat infections caused by this organism. This is because of the potential for rapid development of resistance while being treated with ciprofloxacin.
- The values presented in the antibiogram are rounded and do not show exact values.

Note: All the data in this report are based upon information provided to the New Hampshire Department of Health and Human Services under specific legislative authority. The numbers reported may represent an underestimate of the true absolute number in the state. Any release of personal identifying information is conditioned upon such information remaining confidential. The unauthorized disclosure of any confidential medical or scientific data is a misdemeanor under New Hampshire law. The department is not responsible for any duplication or misrepresentation of surveillance data released in this report. Data are complete as of 10/01/18. Report prepared by the Healthcare-Associated Infections Program, Infectious Disease Surveillance Section, haiprogram@dhhs.nh.gov, (603)-271-4496.

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