State of Wisconsin *Streptococcus pneumoniae* Sensitivity Data: 2008-2020

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Highlights

- The proportion of invasive *Streptococcus pneumoniae* isolates with penicillin resistance remained roughly steady in Wisconsin for the last 12 years.

- Antibiotic resistance among invasive *S. pneumoniae* isolates to third generation cephalosporins was infrequent in Wisconsin during this period.

Highlights

- Erythromycin resistance in *S. pneumoniae* isolates was common, both in Wisconsin and nationally.
- Tetracycline resistance remained relatively low in Wisconsin.
- There is regional variability in susceptibility to common antibiotics for *S. pneumoniae* among Wisconsin public health regions.

Data Sources

Enhanced passive surveillance coordinated by the Division of Public Health Invasive Bacterial Disease Surveillance Program with testing at WSLH

- 2008-2018 average number of isolates submitted annually: 357 (range: 269-435).

Data Sources

Marquette University **Surveillance of Wisconsin Organisms for Trends in Antimicrobial Resistance and Epidemiology (SWOTARE) Program** collaboration with 21 clinical microbiology laboratories for surveillance isolates

- 591 total isolates
- 237 invasive (98% blood, 2% CSF)
- 354 non-invasive (66% lower respiratory, 29% URI, 5% tissue)

Surveillance via WSLH

- WSLH tested voluntary invasive bacterial isolate submissions from hospitals and laboratories. Each also included a report specifying the organism, specimen source, and patient demographics.

- Invasive isolates include blood, cerebrospinal fluid (CSF), pleural fluid, or another normally sterile body site.

Surveillance via WSLH (cont.)

Surveillance excluded duplicate isolates (for example, from a hospital laboratory and a reference laboratory) and isolates from non-Wisconsin residents.

SWOTARE Surveillance 2016–2020

- Each laboratory provided 70 consecutive (duplicates excluded) isolates of clinically significant species annually with limited demographic information.

- Isolates were tested by standardized broth microdilution. Data were analyzed via minimum inhibitory concentration (MIC) frequency distribution and by categorical interpretive criteria updated annually by the Clinical and Laboratory Standards Institute (CLSI).

Demographic Characteristics of Patients with Invasive Pneumococcal Disease

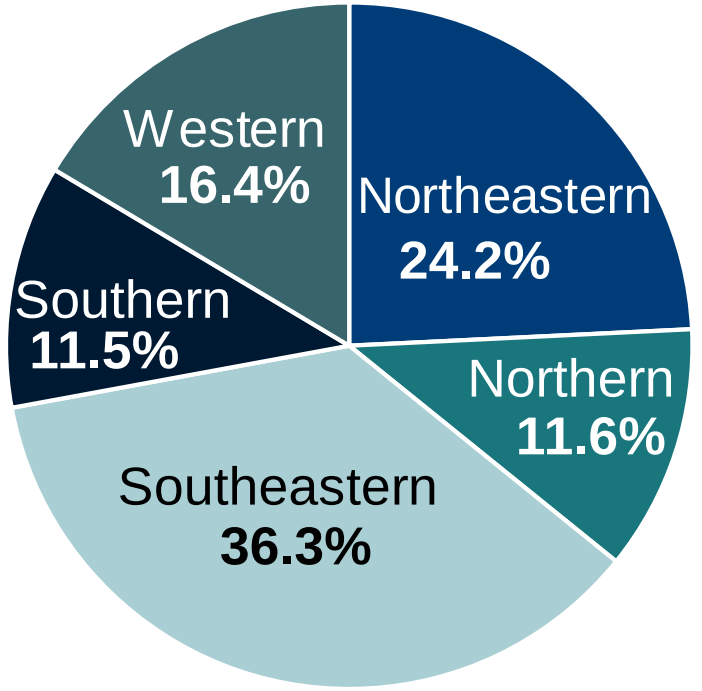
Sex	Number	Percent
Female	593	54.6%
Male	493	45.4%

Age	Number	Percent
< 5 years	51	4.6%
5 – 19 years	25	2.3%
20 – 39 years	96	8.7%
40 – 59 years	267	24.1%
60 – 79 years	456	41.2%
80+ years	211	19.1%

Source: Isolates submitted to and tested by the Wisconsin State Laboratory of Hygiene. Cumulative data from 2016 – 2020.

Demographics of Patients with Invasive Pneumococcal Disease by Public Health Region, 2016-2020

Region of Residence	Number	Percent	Rate per 100,000
Northeastern	205	24.2%	16.5
Northern	98	11.6%	20.1
Southeastern	307	36.3%	15.1
Southern	97	11.5%	8.0
Western	139	16.4%	17.7



Source: Isolates submitted to and tested by the Wisconsin State Laboratory of Hygiene. Cumulative data from 2016 – 2020.

Penicillin Breakpoints

- "Breakpoints" are the thresholds that differentiate susceptible, intermediate, and resistant results in antibiotic susceptibility testing.

- Prior to 2008, there was only one set of breakpoints for use with isolates of *Streptococcus pneumoniae* when testing for resistance to penicillin:
  - ≤0.06: Susceptible
  - 0.12 – 1: Intermediate
  - ≥2 *µ*g/mL: Resistant

Source: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5750a2.htm

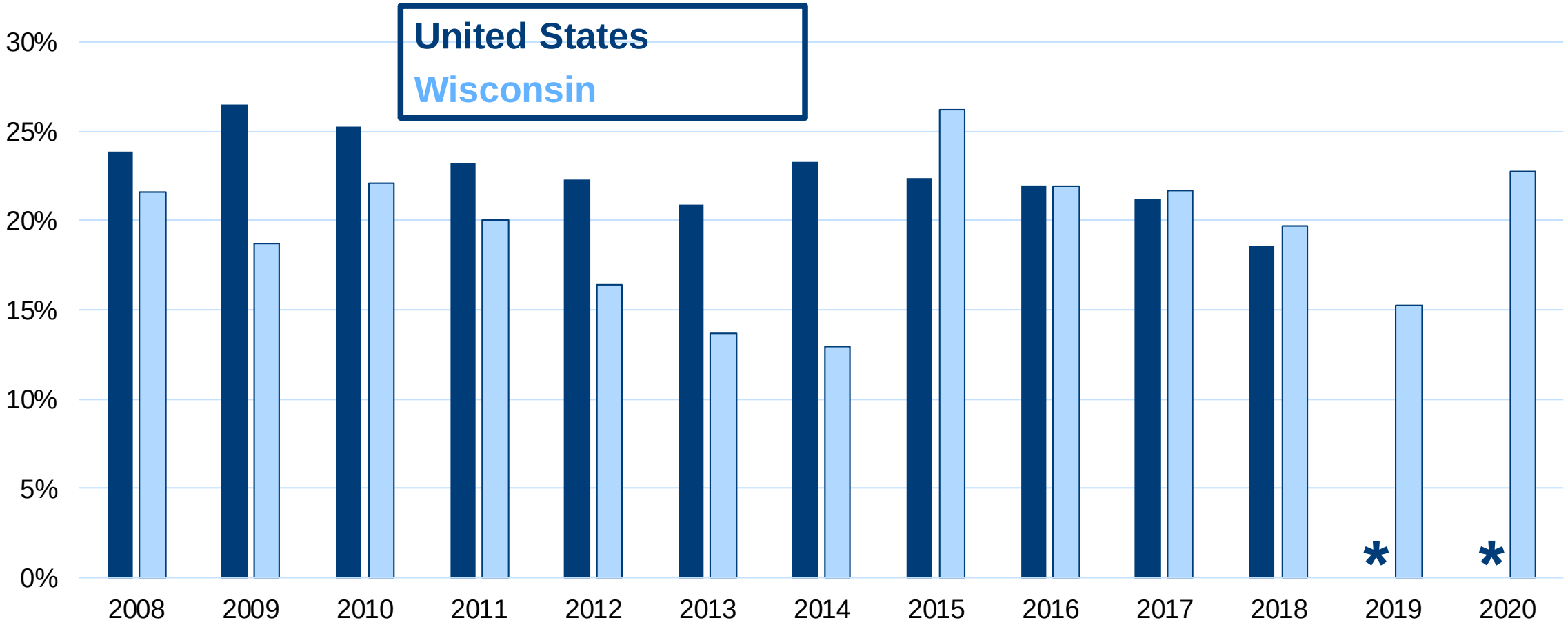
Penicillin Breakpoints

CLSI revised the guidance in January 2008 to differentiate between clinical syndrome and penicillin administration route.

- Breakpoints remain unchanged for patients without meningitis (non-invasive) who could be treated with **oral penicillin**.
- Patients **without meningitis** treated with intravenous penicillin use higher CLSI breakpoints of ≤2, 4, and ≥8 *μ*g/mL.
- Isolates from patients **with meningitis** are only categorized as susceptible or resistant, using breakpoints of ≤0.06 or ≥0.12 *μ*g/mL, respectively.

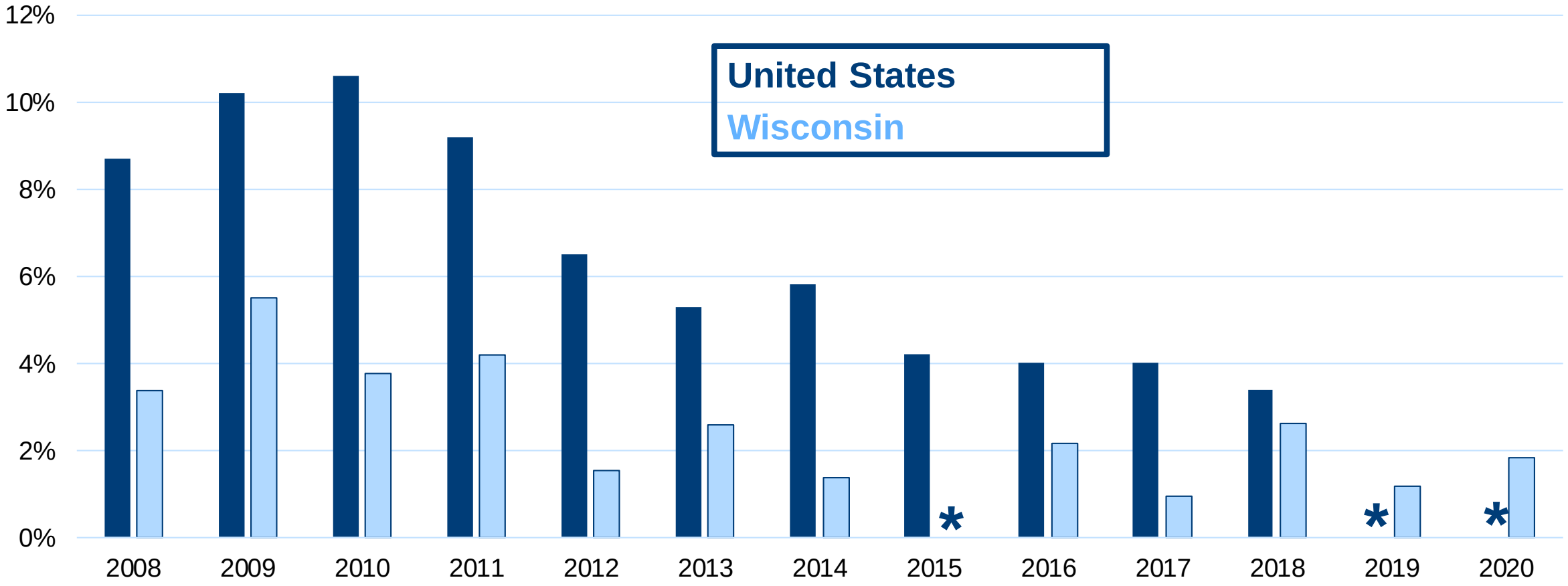
Source: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5750a2.htm

Penicillin Resistance with Invasive *Streptococcus pneumoniae* Isolates, Oral Breakpoints, 2008–2020



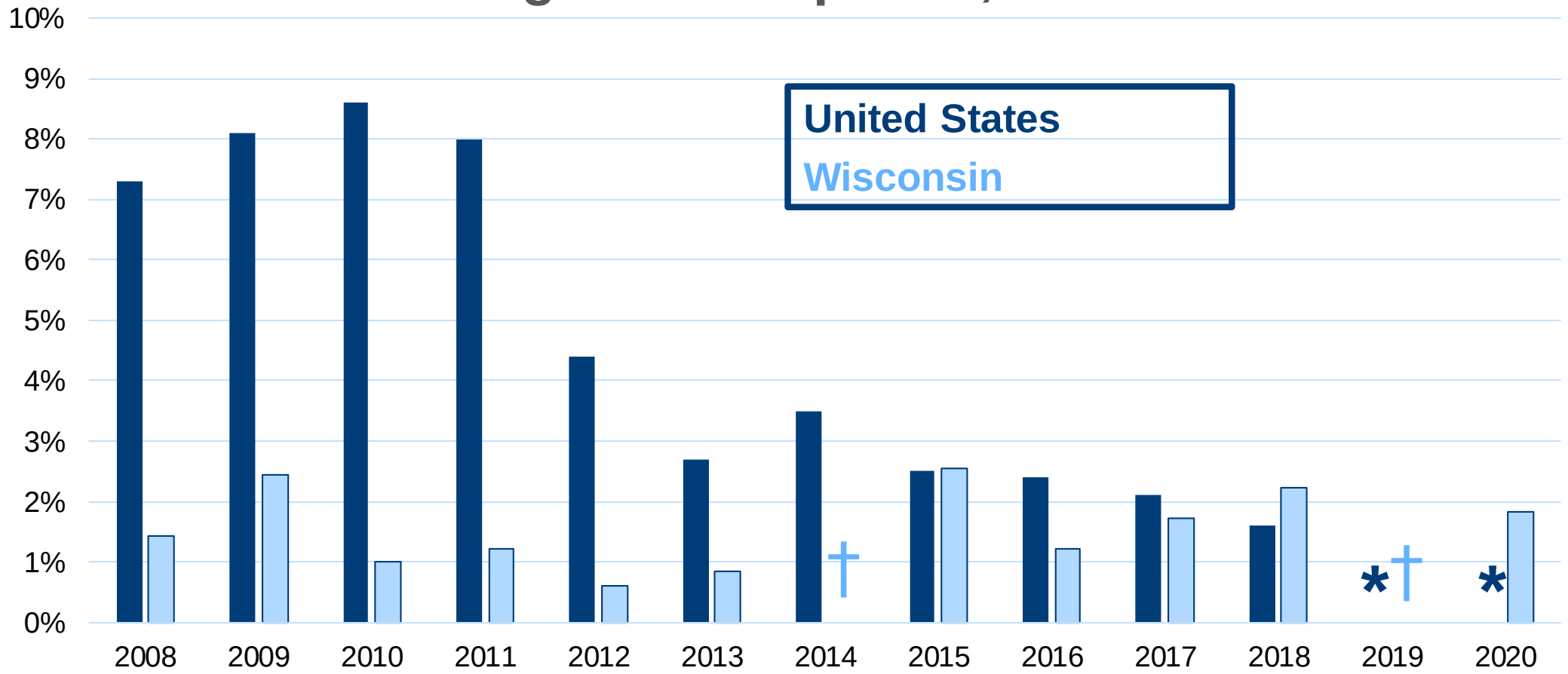
Wisconsin data for 2008–2020 from WSLH testing. Wisconsin data in 2016, 2017, and 2020 supplemented with data from SWOTARE.
U.S. data from CDC's Active Bacterial Core Surveillance Program, https://wwwn.cdc.gov/BactFacts/index.html?dl=SPN_AntibioticResistance.
*No CDC data for 2019 & 2020.

Penicillin Resistance with Invasive *Streptococcus pneumoniae* Isolates, Parenteral (Non-Meningitis) Breakpoints, 2008–2020



Wisconsin data for 2008-2014 and 2018-2019 from WSLH testing. 2016 and 2017 data provided by SWOTARE. 2020 data combined from both sources. U.S. data from CDC's Active Bacterial Core Surveillance Program, https://wwwn.cdc.gov/BactFacts/index.html?dl=SPN_AntibioticResistance.
* No WI data for 2015. No CDC data for 2019 & 2020.

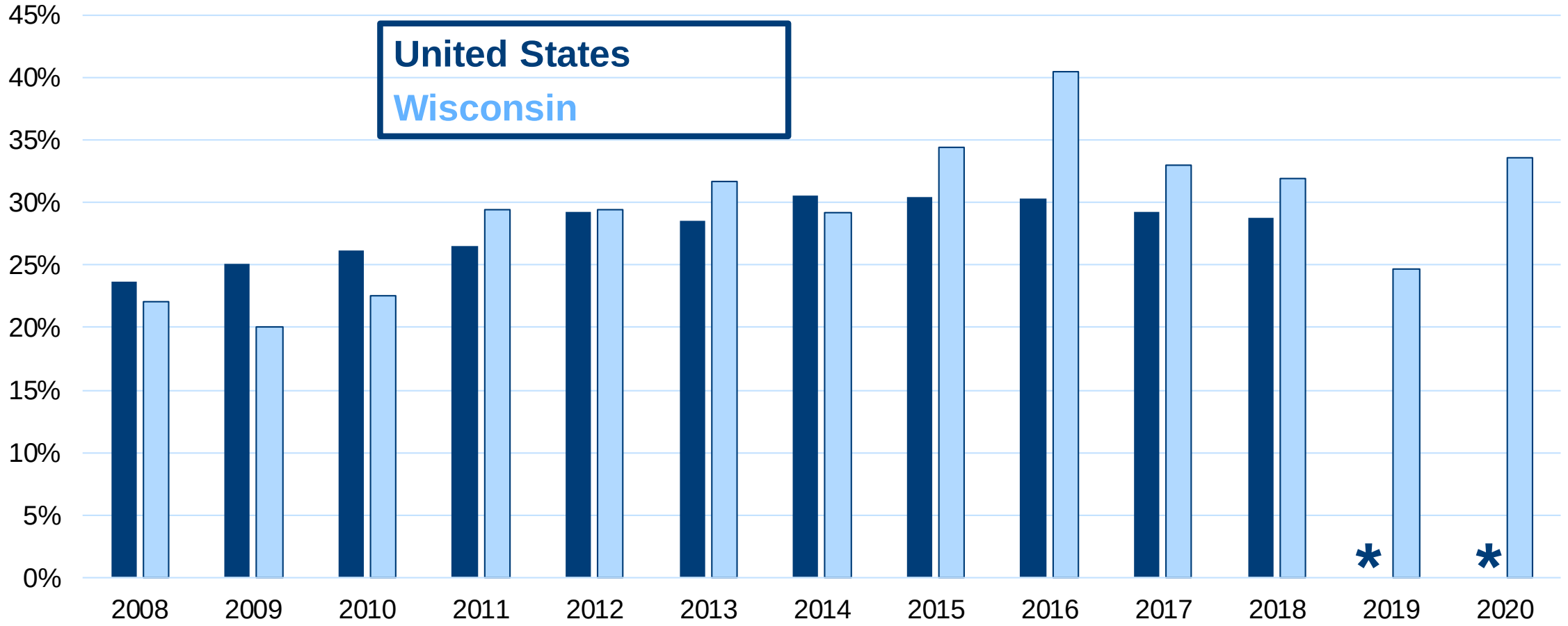
Third Generation Cephalosporin Resistance with Invasive *Streptococcus pneumoniae* Isolates, Meningitis Breakpoints, 2008–2020



Wisconsin data 2008-2020 from WSLH testing. Wisconsin data in 2016, 2017, and 2020 supplemented with data from SWOTARE. Isolates tested against ceftriaxone. U. data from CDC's Active Bacterial Core Surveillance Program, https://wwwn.cdc.gov/BactFacts/index.html?dl=SPN_AntibioticResistance, isolates tested against cefotaxime.

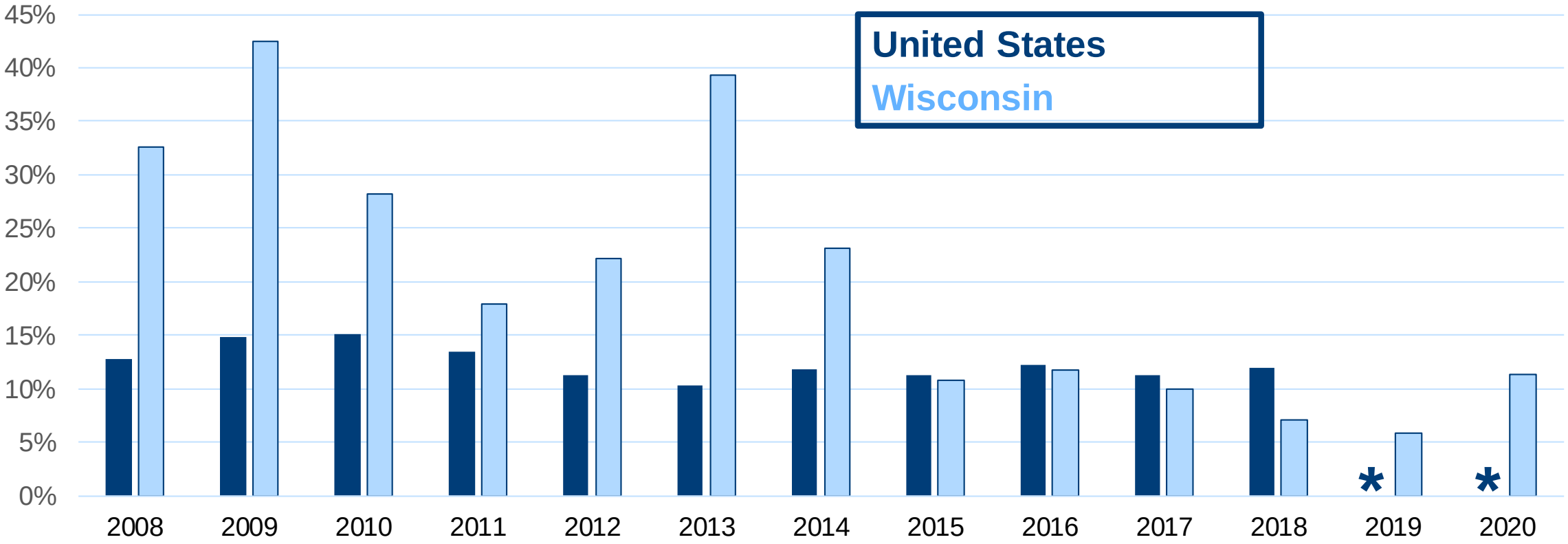
* No CDC data for 2019 and 2020. † All Wisconsin isolates in 2014 and 2019 were susceptible to ceftriaxone.

Erythromycin Resistance with Invasive *Streptococcus pneumoniae* Isolates, 2008–2020



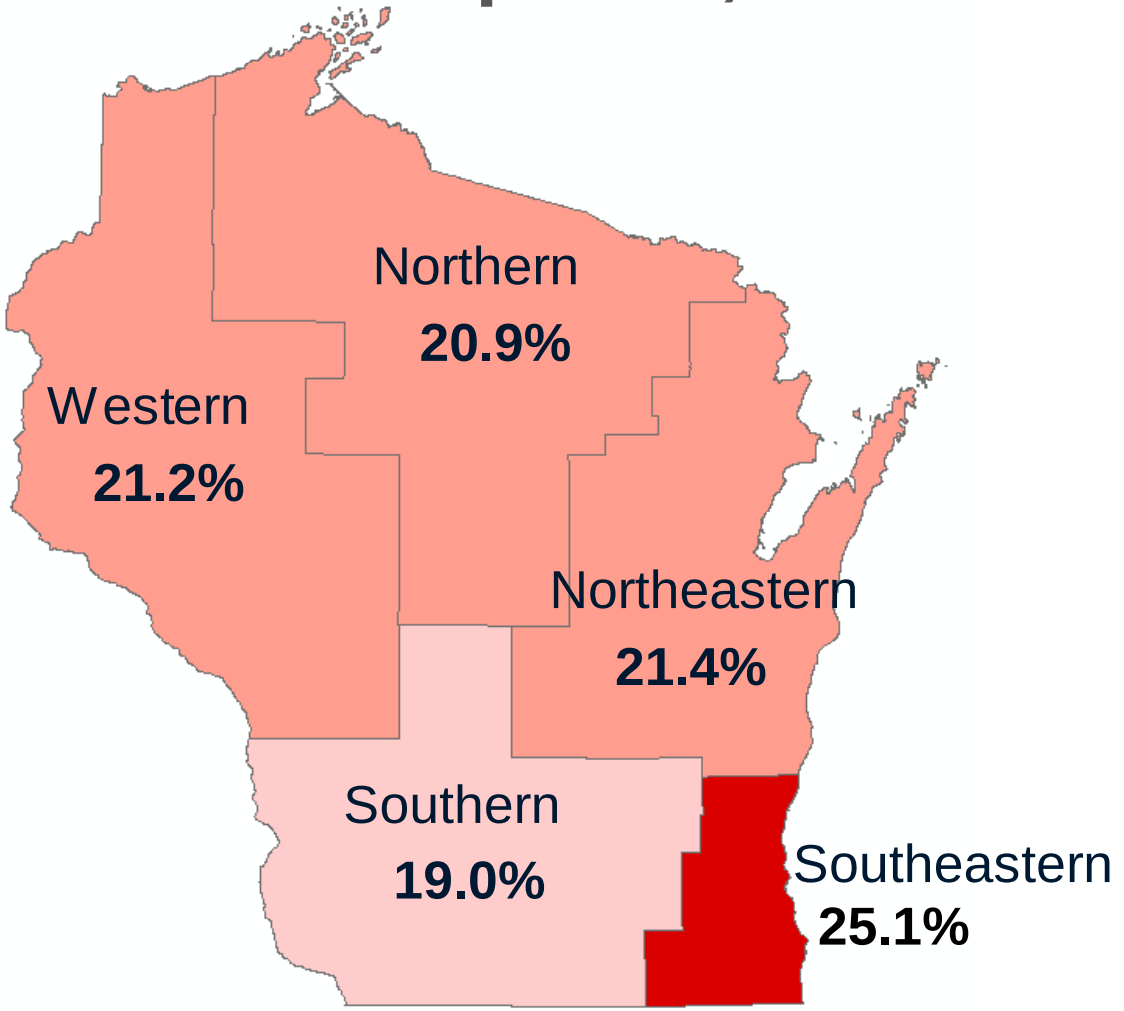
Erythromycin breakpoints ≥21, 16-20, ≤15 mm (disk diffusion) / ≤0.25, 0.5, ≥1 μg/mL (MIC).
Wisconsin data 2008-2020 from WSLH testing. Wisconsin data in 2016, 2017, and 2020 supplemented with data from SWOTARE.
U.S. data from CDC's Active Bacterial Core Surveillance Program, https://wwwn.cdc.gov/BactFacts/index.html?dl=SPN_AntibioticResistance.
* No CDC data for 2019 and 2020.

Tetracycline Resistance with Invasive *Streptococcus pneumoniae* Isolates, 2008–2020



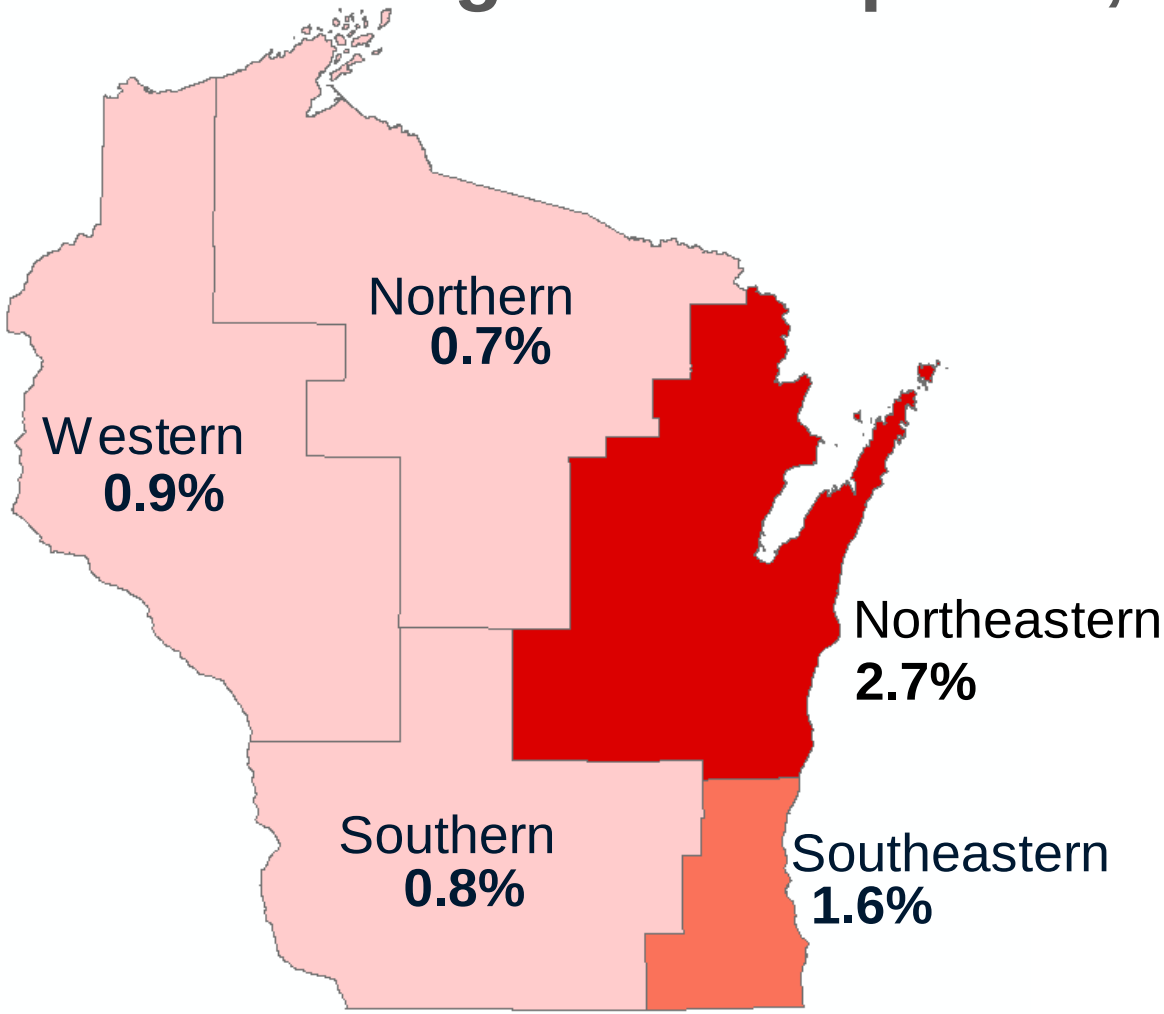
Tetracycline breakpoints ≥28, 25-27, ≤24 mm (disk diffusion) / ≤1, 2, ≥4 μg/mL (MIC) used before 2018.
Doxycycline breakpoints ≥28, 25-27, ≤24 mm (disk diffusion) / ≤0.25, 0.5, ≥1 μg/mL (MIC) used in 2018-20.
Wisconsin data 2008-2020 from WSLH testing, 2018-2020 using doxycycline. Data in 2016, 2017, and 2020 supplemented from SWOTARE.
U.S. data from CDC's Active Bacterial Core Surveillance Program, https://wwwn.cdc.gov/BactFacts/index.html?dl=SPN_AntibioticResistance,
* No CDC data for 2019 and 2020.

Regional Penicillin Resistance in *Streptococcus pneumoniae*, Invasive and Non-Invasive Isolates, Oral Breakpoints, 2016–2020



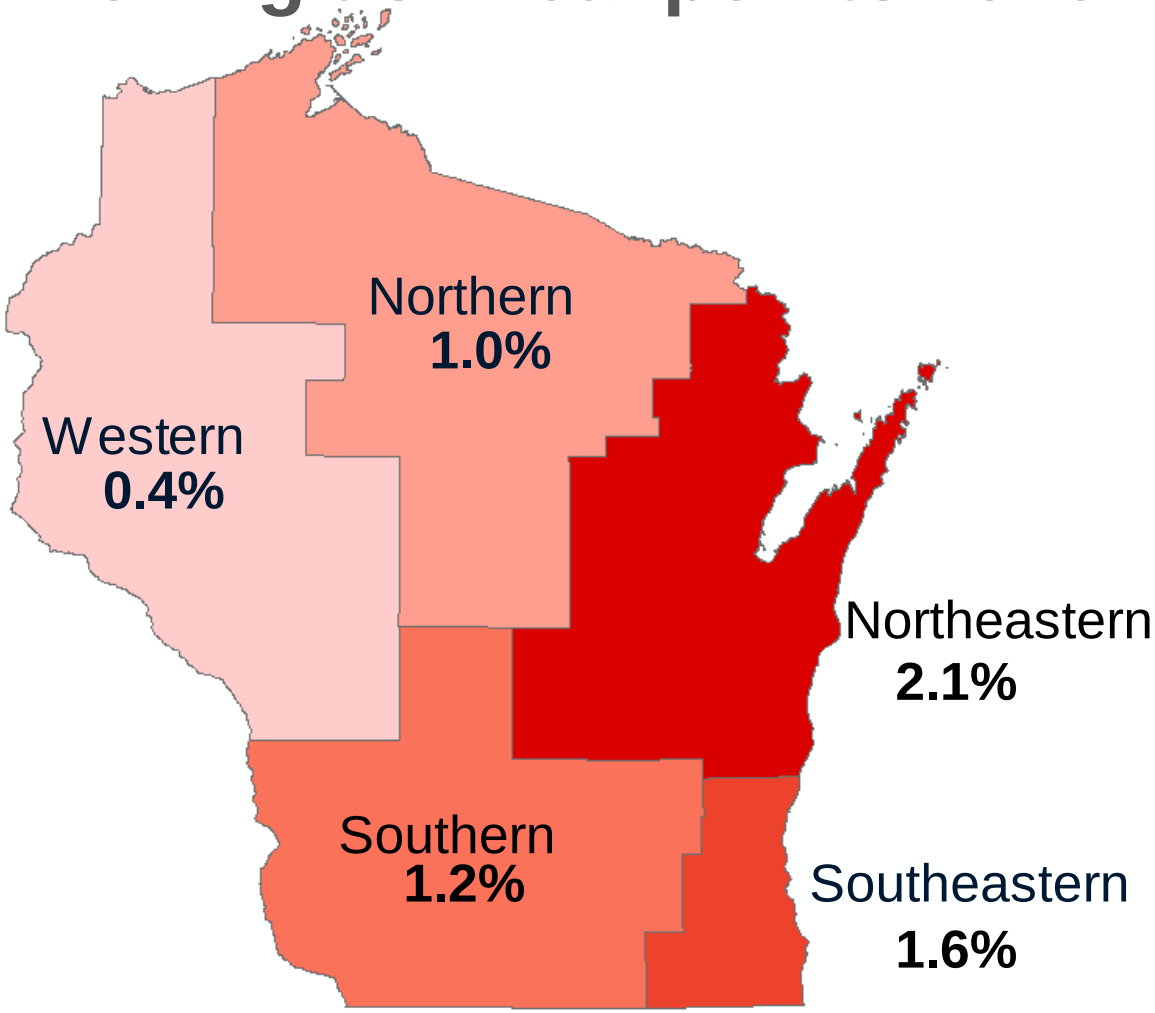
Data includes 5-year cumulative WSLH testing (2016-2020) in addition to SWOTARE data from 2016, 2017, and 2020.

Regional Penicillin Resistance in *Streptococcus pneumoniae*, Invasive and Non-Invasive Isolates, Parenteral Non-Meningitis Breakpoints, 2016–2020



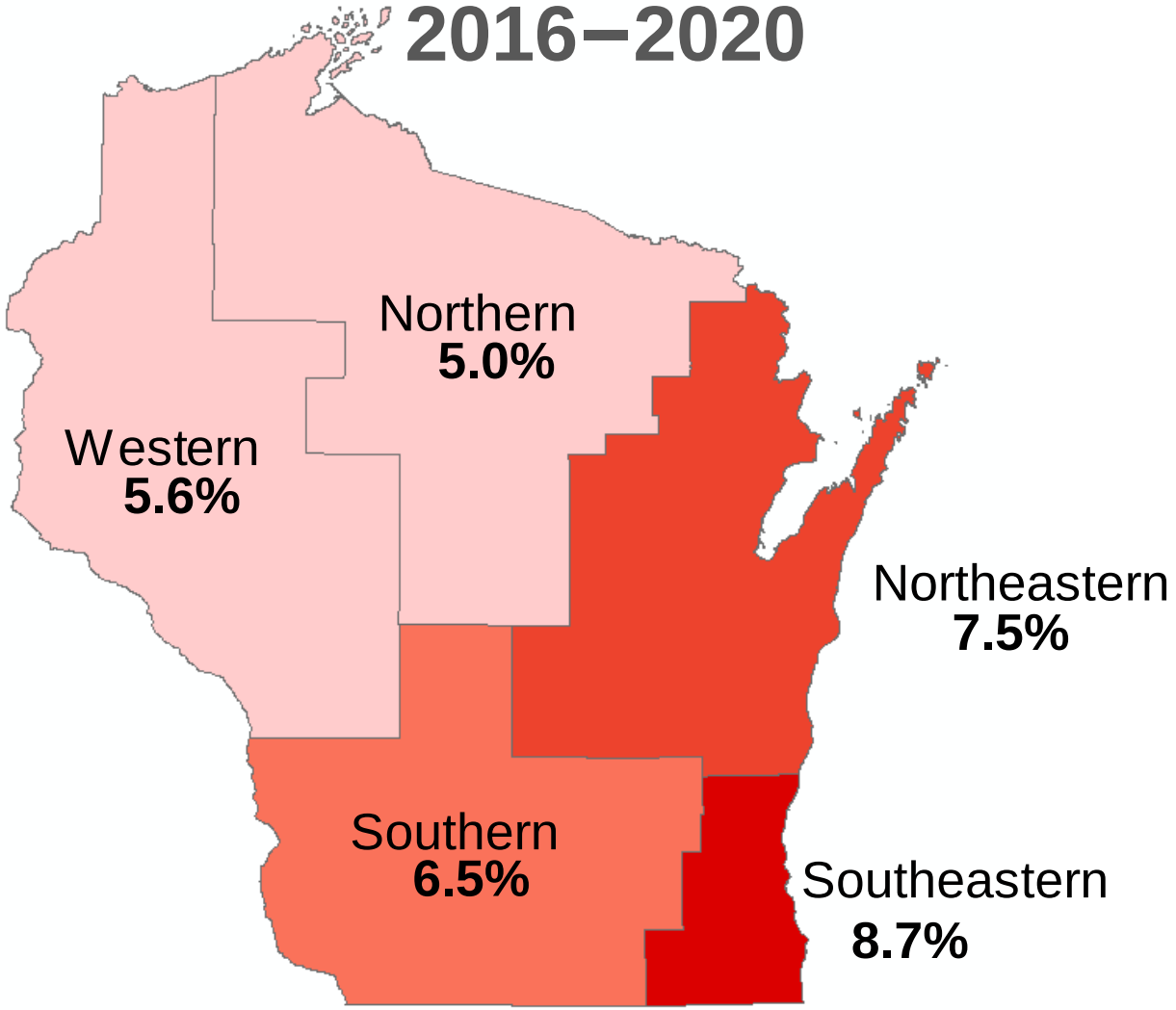
Data includes 5-year cumulative WSLH testing (2016-2020) in addition to SWOTARE data from 2016, 2017, and 2020.

Regional Ceftriaxone Resistance in *Streptococcus pneumoniae*, Invasive and Non-Invasive Isolates, Non-Meningitis Breakpoints 2016–2020



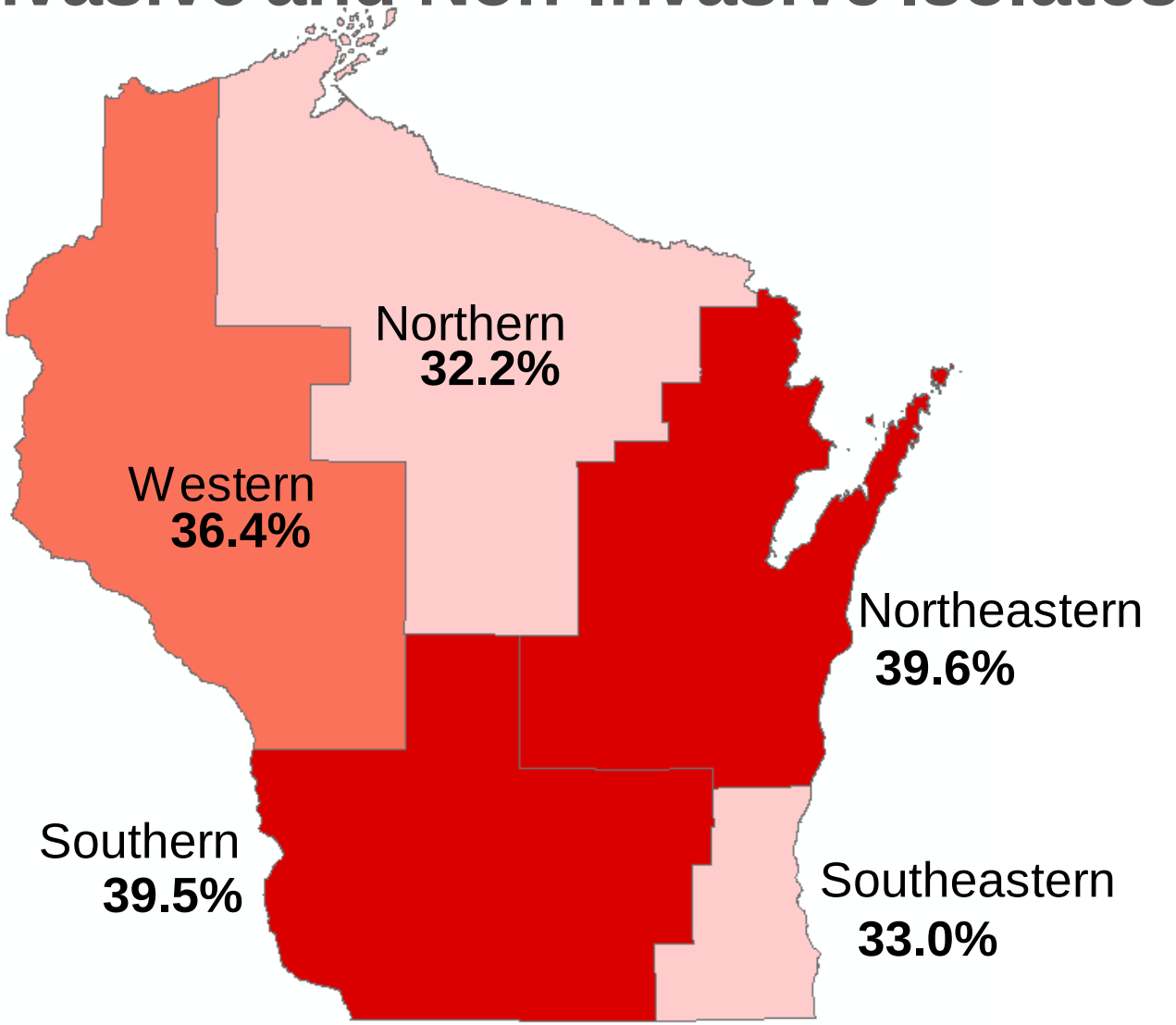
Data includes 5-year cumulative WSLH testing (2016-2020) in addition to SWOTARE data from 2016, 2017, and 2020.

Regional Ceftriaxone Resistance in *Streptococcus pneumoniae*, Invasive and Non-Invasive Isolates, Meningitis Breakpoints, 2016–2020



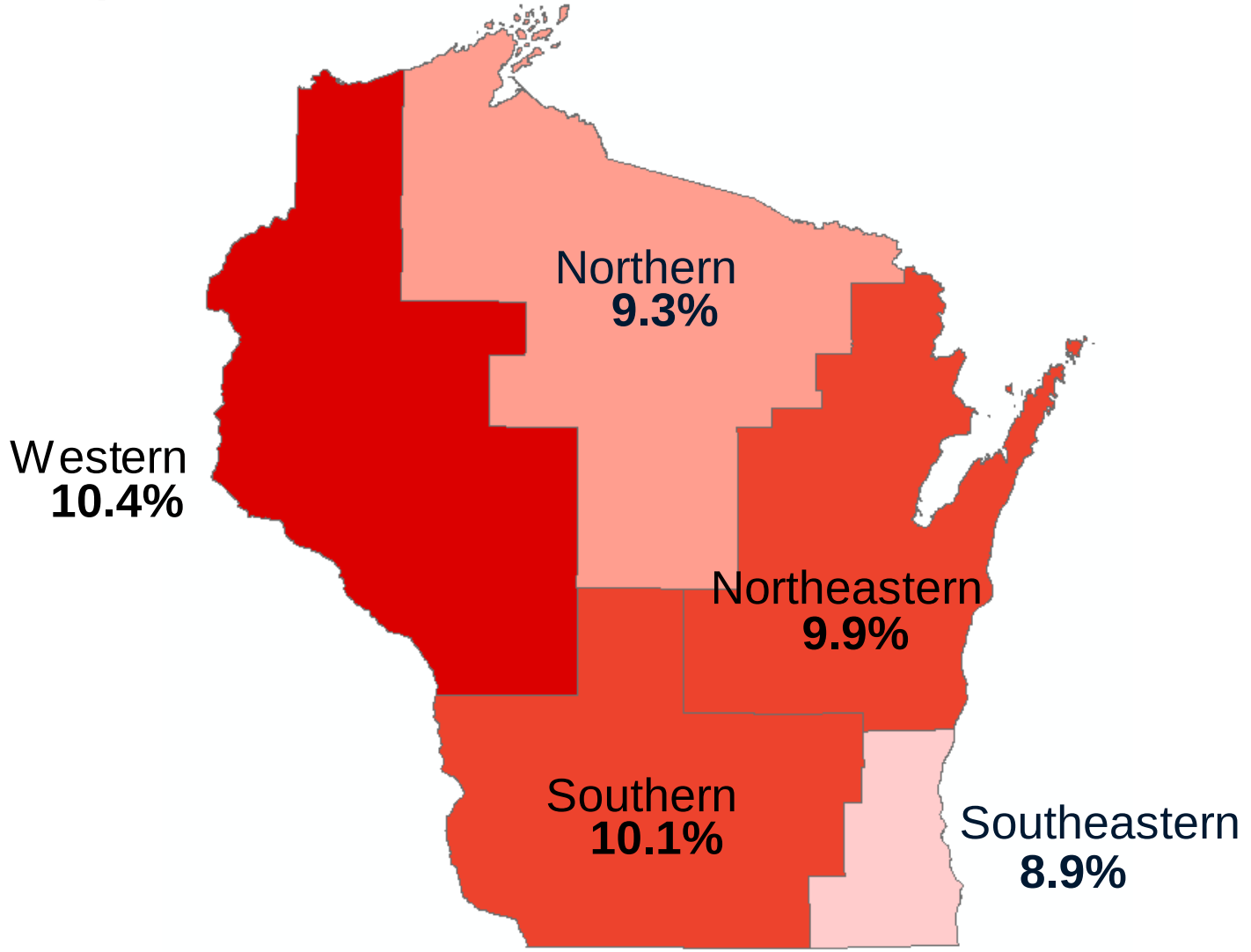
Data includes 5-year cumulative WSLH testing (2016-2020) in addition to SWOTARE data from 2016, 2017, and 2020.

Regional Erythromycin Resistance in *Streptococcus pneumoniae*, Invasive and Non-Invasive Isolates, 2016–2020



Data includes 5-year cumulative WSLH testing (2016-2020) in addition to SWOTARE data from 2016, 2017, and 2020.

Regional Tetracycline Resistance in *Streptococcus pneumoniae*, Invasive and Non-Invasive Isolates, 2016–2020



Data includes 5-year cumulative WSLH testing (2016-2020) in addition to SWOTARE data from 2016, 2017, and 2020.