

Trends in Outpatient Antibiotic Prescribing in Wisconsin 2018–2021

Wisconsin Department of Health Services
Healthcare-Associated Infections Prevention Program



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About this report

Improving antibiotic prescribing in all health care settings is critical to combatting antibiotic-resistant bacteria. The majority of antibiotics are prescribed in the outpatient setting (Suda et al.), however, most antibiotic use improvement efforts have historically focused on antibiotics prescribed in hospitals. To better understand the current state of outpatient antibiotic use in our state, the Wisconsin Department of Health Services (DHS) Division of Public Health (DPH) Healthcare-Associated Infections (HAI) Prevention Program partnered with the Wisconsin Health Information Organization (WHIO) to develop a series of outpatient antibiotic use measures. This report uses these measures to describe trends in outpatient antibiotic use and identify additional targets for improvement.

About the Wisconsin HAI Prevention Program

The Wisconsin HAI Prevention Program conducts statewide HAI surveillance and provides technical assistance in a variety of areas for health care and public health partners, including infection prevention and control, the National Healthcare Safety Network (NHSN), multidrug-resistant organism containment, and antimicrobial stewardship.

Additional information on the Wisconsin HAI Prevention Program is available on the [DHS website](#). For additional information, email DHSWIHAIPreventionProgram@dhs.wisconsin.gov.

About the WHIO

The WHIO is a not-for-profit organization dedicated to driving higher quality health care at a lower cost. With 450 million records and growing, WHIO is the largest source of health care data and information in Wisconsin, currently covering 74% of the state's population. The WHIO information system includes all care settings, services, and professionals paid for by insurance companies.

Additional information on WHIO data is available in [Appendix A](#) of this report. For more information, visit the [WHIO website](#) or email info@whio.org.

Methodology

All outpatient visits from 2018 to 2021 captured in the WHIO database were analyzed. Outpatient visits were included in this report if they were to a health care provider in Wisconsin in either a clinic, urgent care, or emergency setting. Outpatient antibiotics were included if they were prescribed in the oral formulation and the order was filled. For the purposes of this report, antibiotic visits are defined as any outpatient visit with a health care provider that resulted in an antibiotic being prescribed and filled up to three days after the encounter. Antibiotic visits are normalized as a rate per 1,000 outpatient visits.



Inclusion criteria

Visits were analyzed if they were:

- Made to health care providers in Wisconsin.
- Outpatient visits.

Antibiotics were included if they were:

- Oral.
- Prescribed within three days of encounter.



Exclusion criteria

Visits were excluded from data used in this report if they were:

- Made to health care providers outside of Wisconsin.
- Inpatient visits.
- Not associated with provider services (such as blood draws, imaging, and vaccine administration).

Antibiotics were excluded if they were:

- Intravenous (IV) or injectable antibiotics.
- Topical antibiotics.
- Prescribed outside of the three-day window of the encounter.

About these data

Data in this report include insured Wisconsin residents receiving outpatient care through clinics, urgent care settings, and emergency departments, and associated antibiotic prescriptions from 2018 to 2021. There are key limitations in the measures presented in the report that should be considered. The antibiotic use measures included in this report were developed using claims data, which is retrospective and relies on accurate medical coding. Although the data represent the majority of outpatient oral antibiotic prescribing, it does not include Wisconsin residents who are uninsured.

Executive summary

In general, outpatient antibiotic use in Wisconsin decreased from 2018 to 2021, both in overall volume of oral antibiotic prescribing and the rate of visits associated with an antibiotic prescription. The three most commonly prescribed oral antibiotics by class were:

1. Penicillins.
2. Cephalosporins.
3. Beta-lactams with increased activity.

When stratifying by site of care, urgent care visits were more likely to result in an antibiotic prescription than visits to clinics or emergency departments. Additionally, the rate of visits associated with antibiotic prescriptions was greatest in the northern public health region, for female patients, and for patients living in areas of greater disadvantage.

By grouping common infectious diagnoses into categories based on likelihood of antibiotic prescribing, this report shows a reduction in both the proportion of visits for viral respiratory infection associated with antibiotic prescription and the volume of antibiotics prescribed for these indications. However, when examining the number of antibiotic prescriptions associated with these viral syndromes, there were still 32,596 prescriptions in 2021, indicating that there is room for further improvement.

Based on the findings of this report, DHS recommends the following actions:

1. Target urgent care locations as an area for antibiotic use improvement efforts.
2. Continue efforts to eliminate antibiotic prescribing for acute upper respiratory infections.

Wisconsin antibiotic prescribing trends

Overall trends

Wisconsin health care providers wrote over 3.7 million antibiotic prescriptions in outpatient settings from 2018 to 2021. The total number of antibiotics prescribed in Wisconsin by year is shown below (Figure 1). This includes prescriptions for both adults and children. The number of prescriptions within each drug class is included below by yearly average (Figure 2). Examples of drugs in each drug class are listed in Figure 3. Figure 4 shows outpatient visits resulting in antibiotic prescriptions normalized by all outpatient visits from 2018 to 2021.

FIGURE 1

Total number of Wisconsin antibiotic prescriptions by year, 2018–2021



FIGURE 2

Average number of Wisconsin prescriptions per year by drug class, 2018–2021

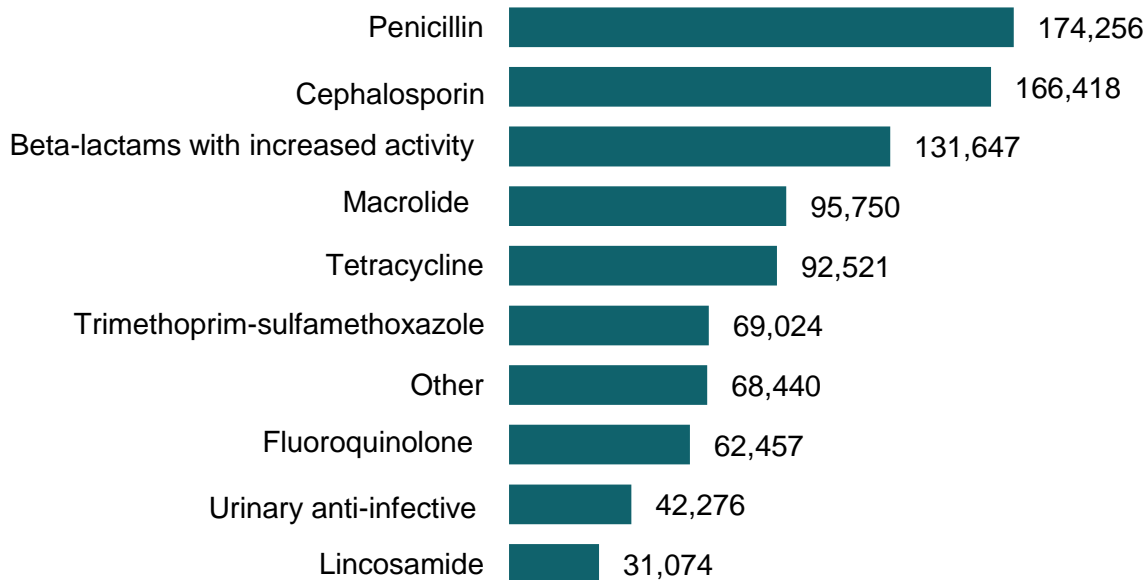


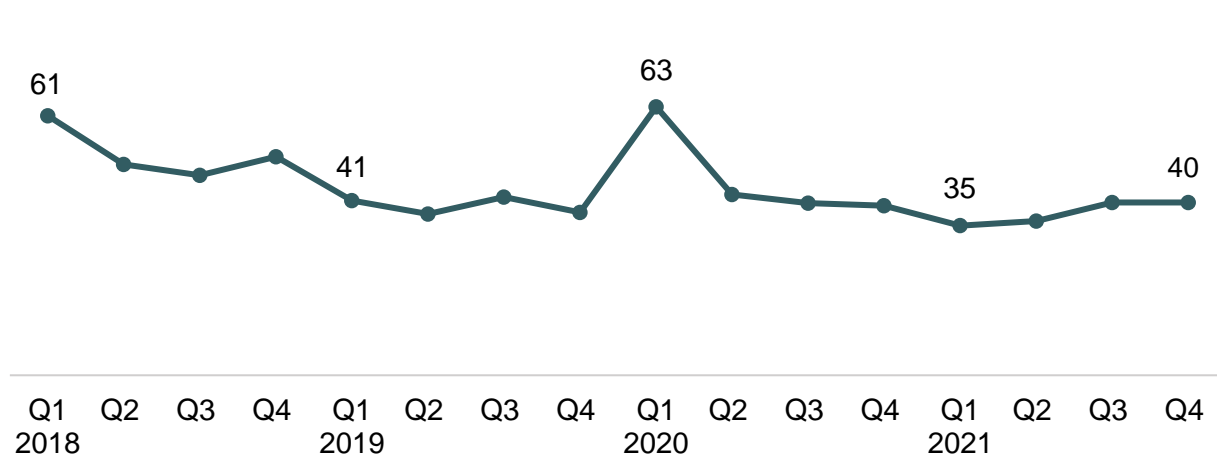
FIGURE 3

Examples of drugs by class

Drug class	Examples
Penicillin	Amoxicillin, penicillin
Cephalosporin	Cefdinir, cephalexin
Beta-lactams with increased activity	Amoxicillin/Potassium clavulanate
Macrolide	Azithromycin, clarithromycin
Tetracycline	Doxycycline
Trimethoprim-sulfamethoxazole	Trimethoprim, sulfamethoxazole-trimethoprim
Other	Metronidazole, minocycline, vancomycin
Fluoroquinolone	Ciprofloxacin, levofloxacin
Urinary anti-infective	Nitrofurantoin, methenamine
Lincosamide	Clindamycin

FIGURE 4

Number of Wisconsin outpatient visits with antibiotics prescribed per 1,000 visits by quarter, 2018–2021



Attributes of outpatient visits with antibiotics prescribed

WHIO analyzed outpatient visits and their associated antibiotic prescriptions.

Key findings:

- Of 1,640,239 visits to an emergency department in 2021, **9.8% were associated with an antibiotic prescription**, amounting to 160,335 prescribed antibiotics.
- Of 255,223 visits to an urgent care in 2021, **18.7% were associated with an antibiotic prescription**, amounting to 47,710 prescribed antibiotics.
- Of 21,559,163 visits to an office or clinic in 2021, **3.2% were associated with an antibiotic prescription**, amounting to 688,872 prescribed antibiotics.



FIGURE 5

Wisconsin antibiotic visits per 1,000 visits by payer, 2018–2021

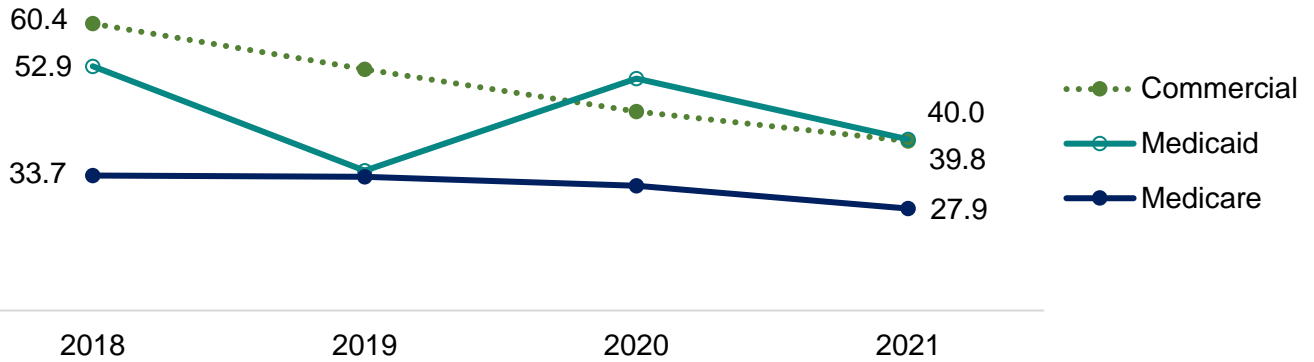


FIGURE 6

Wisconsin antibiotic visits per 1,000 visits by location, 2018–2021

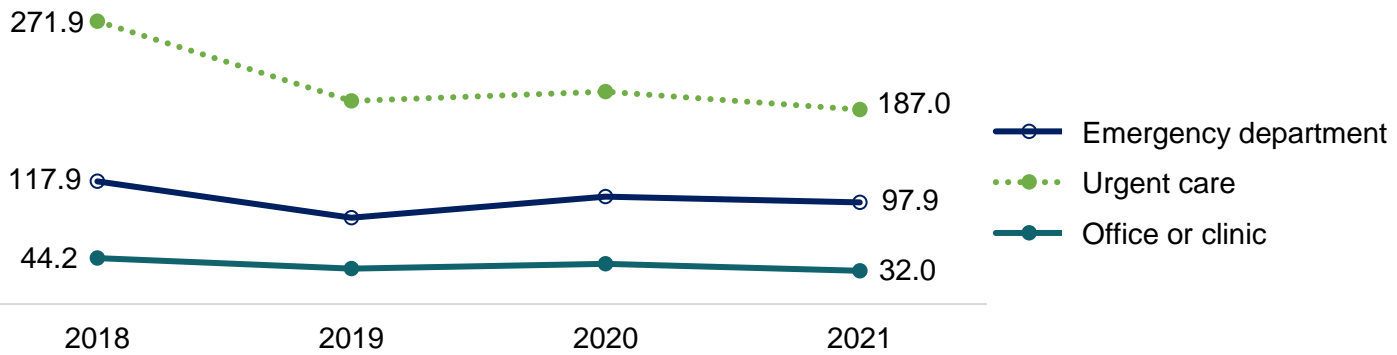
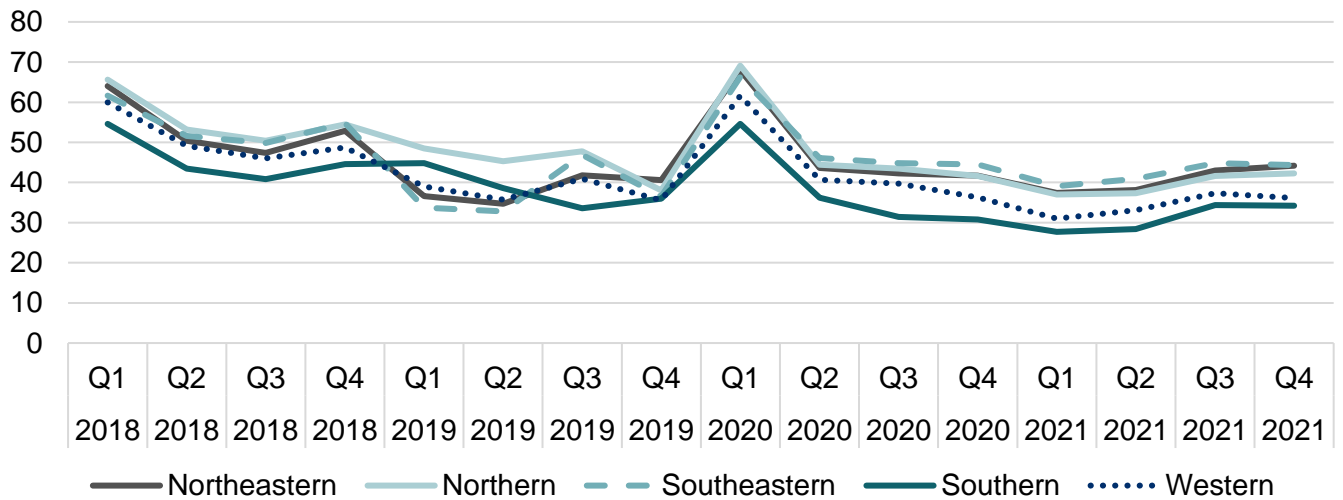


FIGURE 7

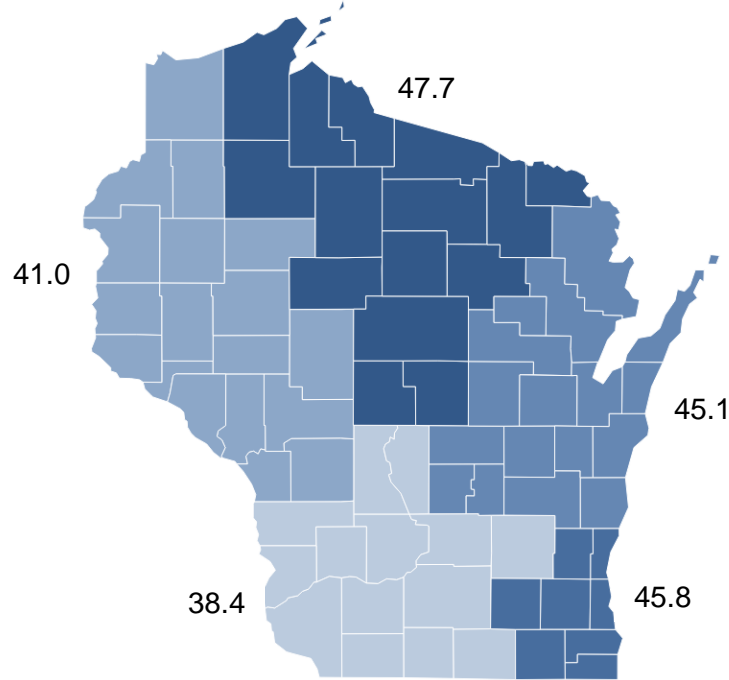
Antibiotic visits per 1,000 visits by Wisconsin public health region by quarter, 2018–2021



*A map of Wisconsin public health region is available in [Appendix B](#) of this report.

FIGURE 8

Antibiotic visits per 1,000 visits by Wisconsin public health region, 2018–2021



Attributes of patients receiving antibiotic prescriptions

WHIO analyzed antibiotic visits from 2021 for all insured lives with at least one medical claim. Results are shown as a rate per 1,000 visits.

Key findings:

- 2.7 million WHIO members had at least one medical claim.
- 473,286 (21.4%) of WHIO members had at least one antibiotic prescription claim.
- Of Wisconsinites with at least one antibiotic prescription claim, the average number of antibiotic prescription claims was 1.9.

FIGURE 9

Wisconsin antibiotic visits per 1,000 visits by patient gender, 2018–2021

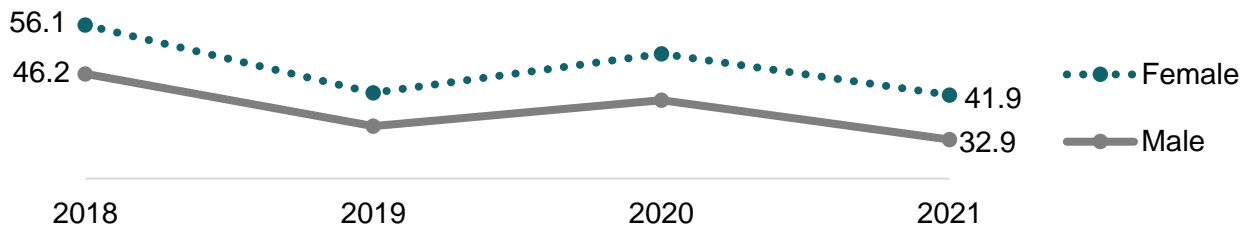


FIGURE 10

Wisconsin antibiotic visits per 1,000 visits by patient age, 2018–2021

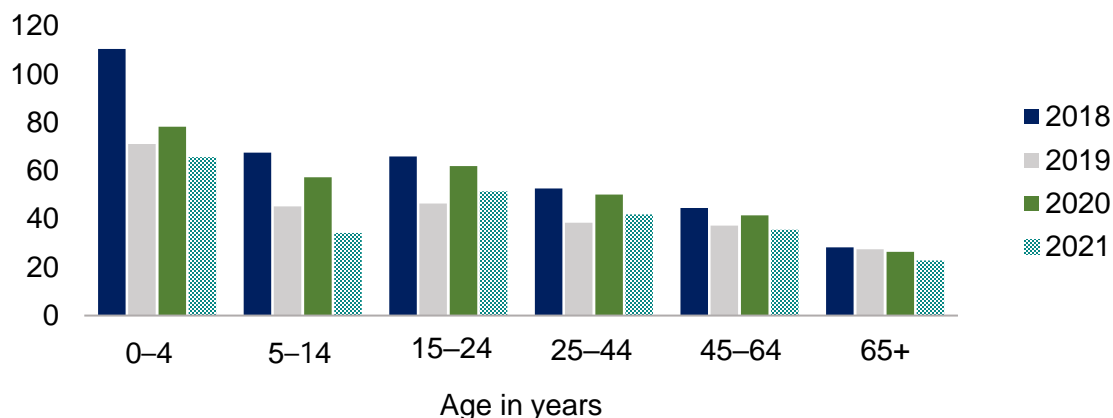
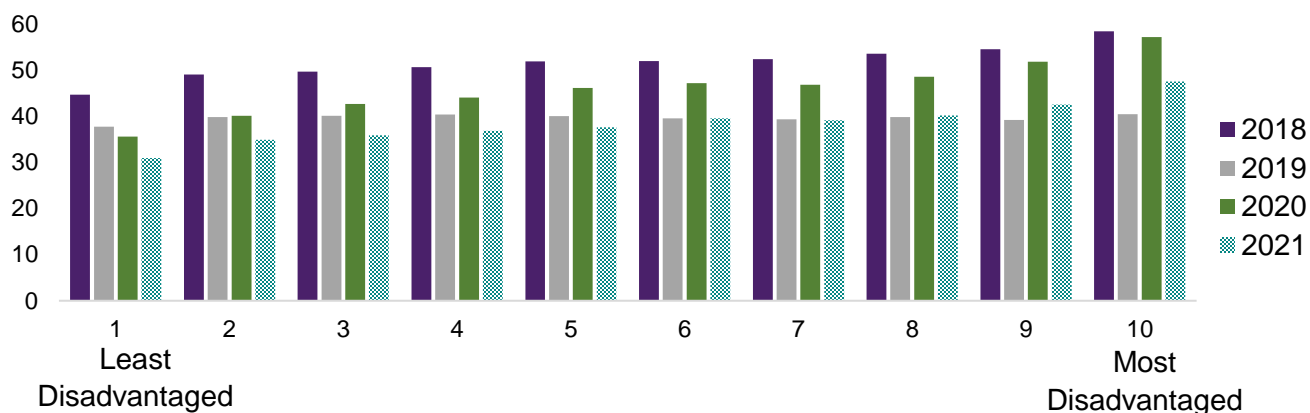


FIGURE 11

Wisconsin antibiotic visits per 1,000 visits by area deprivation index, 2018–2021



What is the area deprivation index?

The area deprivation index (ADI) ranks neighborhoods by level of socioeconomic disadvantage, using factors such as income, education, employment, and housing quality. Neighborhoods are grouped in deciles, with one being the lowest level of disadvantage and 10 being the highest level of disadvantage. ADI was assigned using the patient’s address. More information can be found [online](#).

In 2021, there were 124,798 visits associated with an antibiotic prescription for individuals living in neighborhoods with the greatest disadvantage (ADI 10). In comparison, this number was 65,447 for Wisconsinites living in the least disadvantaged neighborhoods (ADI 1).

Prescribing by infection and indication

Antibiotic prescribing by appropriateness tier

Using methods established by a 2020 study (Stenehjem et al.), common ICD-10 codes were grouped into three tiers, based on whether antibiotics are almost always (Tier 1), sometimes (Tier 2), or never (Tier 3) indicated for that condition.

FIGURE 12

Examples of conditions by antibiotic indication tier

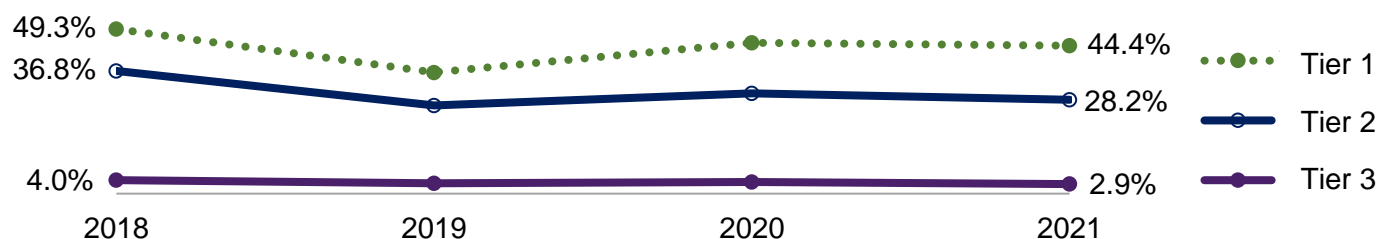
Tier 1 Antibiotics are almost always indicated.	Tier 2 Antibiotics are sometimes indicated.	Tier 3 Antibiotics are never indicated.
<ul style="list-style-type: none"> • Urinary tract infection • Streptococcal pharyngitis • Pneumonia • Cellulitis • Pyelonephritis 	<ul style="list-style-type: none"> • Acute pharyngitis • Acute sinusitis • Dysuria • Chronic sinusitis • Otitis media • Cutaneous abscess 	<ul style="list-style-type: none"> • Acute upper respiratory infection • Cough • Acute bronchitis

Wisconsin outpatient antibiotic visits from 2018 to 2021 were categorized into the above tiers. Figure 13 shows the percent of visits that were associated with antibiotic prescriptions, by antibiotic indication. Rates may seem lower than what is observed in practice because of the following limitations:

- Follow-up visits for the same infection may not be associated with an antibiotic prescription.
- The patient did not fill the antibiotic prescription.
- The antibiotic was prescribed before the visit, or more than three days after the visit.
- The medical coding was inaccurate.

FIGURE 13

Percent of visits associated with antibiotic prescribing by antibiotic indication tier in Wisconsin, 2018–2021



Top 10 diagnoses most commonly associated with antibiotic prescription

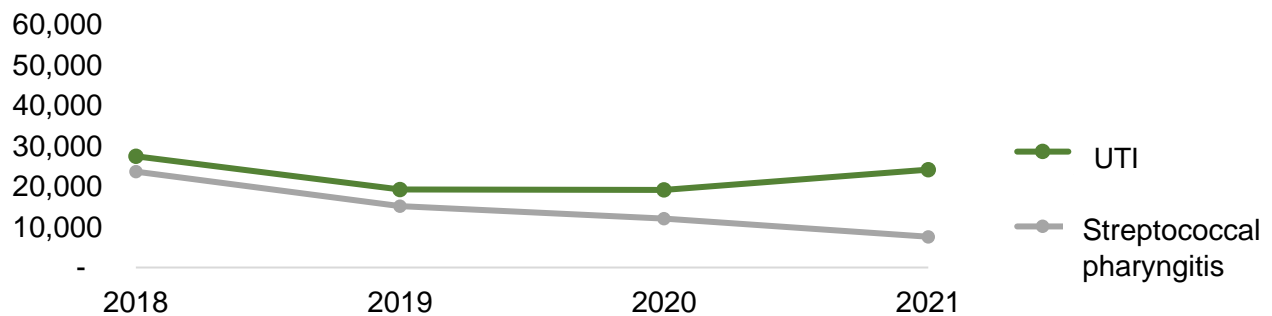
In Wisconsin, the top 10 diagnoses most commonly associated with antibiotic prescription include:

1. Urinary tract infection (UTI)
2. Streptococcal pharyngitis
3. Otitis media
4. Acute pharyngitis
5. Acute sinusitis
6. Dysuria
7. Acute maxillary sinusitis
8. Cough
9. Acute upper respiratory infection (URI)
10. Acute bronchitis

Although prescribing associated with Tier 3 diagnoses decreased from 2018 to 2021, there were still 32,596 prescriptions associated with either cough, acute URI, or acute bronchitis in 2021. Figures 14–16 feature the 10 diagnoses most commonly associated with antibiotic prescription by tier. Note that a new health plan was added to WHIO data in 2019.

FIGURE 14

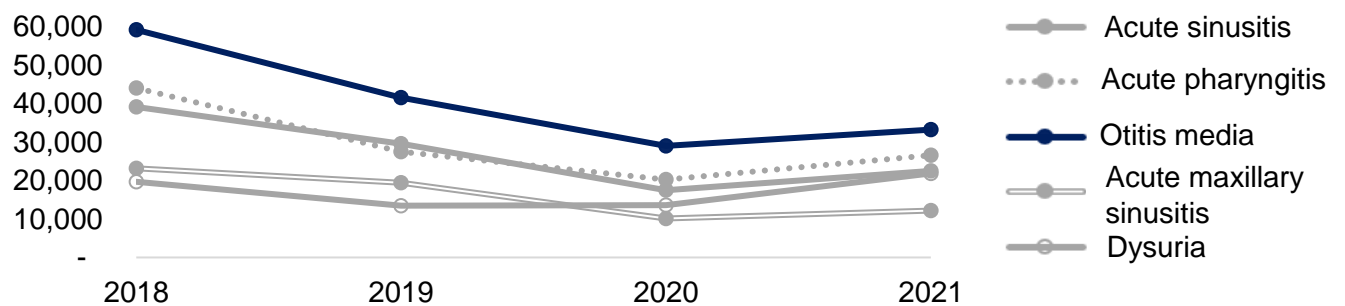
Wisconsin antibiotic prescriptions associated with Tier 1 diagnoses (antibiotics almost always indicated), 2018–2021



*Excludes any visits with any other competing Tier 1 diagnoses.

FIGURE 15

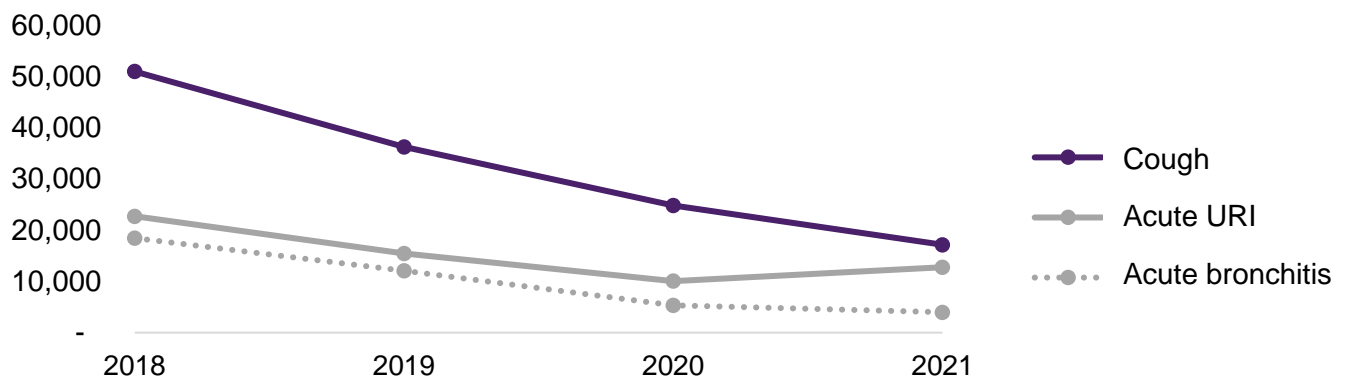
Wisconsin antibiotic prescriptions associated with Tier 2 diagnoses (antibiotics sometimes indicated), 2018–2021



*Excludes any visits with Tier 1 diagnoses.

FIGURE 16

Wisconsin antibiotic prescriptions associated with Tier 3 diagnoses (antibiotics not indicated), 2018–2021



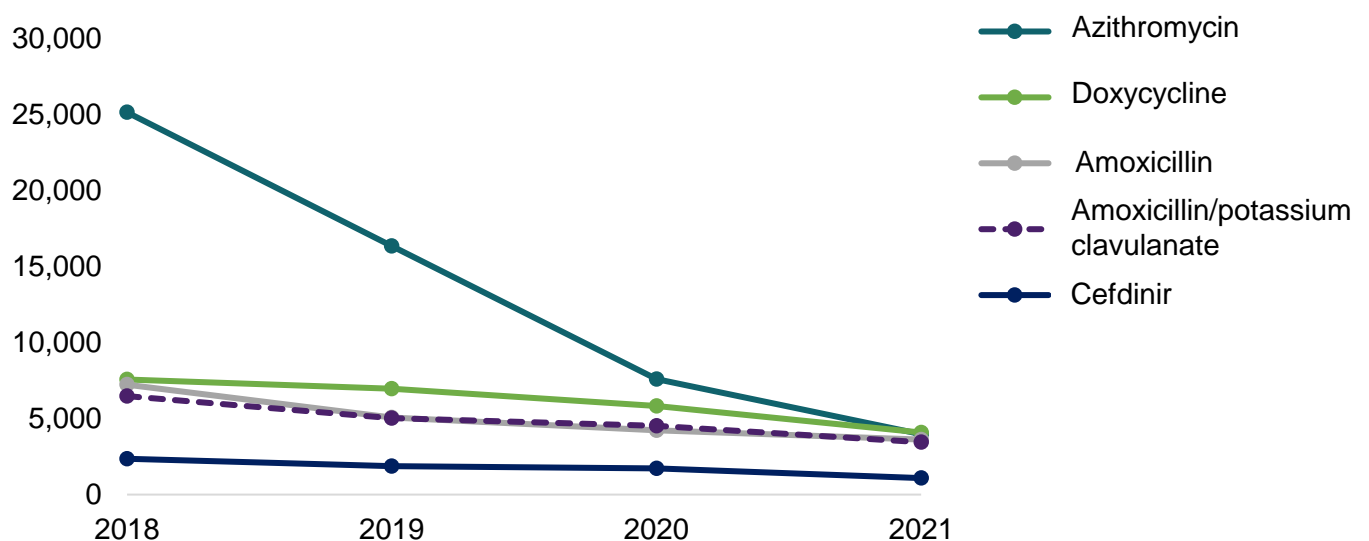
*Excludes any visits with Tier 1 or Tier 2 diagnoses.

Antibiotics associated with cough, acute URI, or bronchitis

Cough, acute URI, and acute bronchitis are all Tier 3 diagnoses, indicating that antibiotics should never be prescribed to address these conditions. The number of prescriptions for the five most commonly prescribed antibiotics associated with cough, acute URI, or acute bronchitis are shown below (Figure 17). Any visits with a Tier 1 or Tier 2 diagnosis were excluded. Note that a new health plan was added to WHIO data in 2019.

FIGURE 17

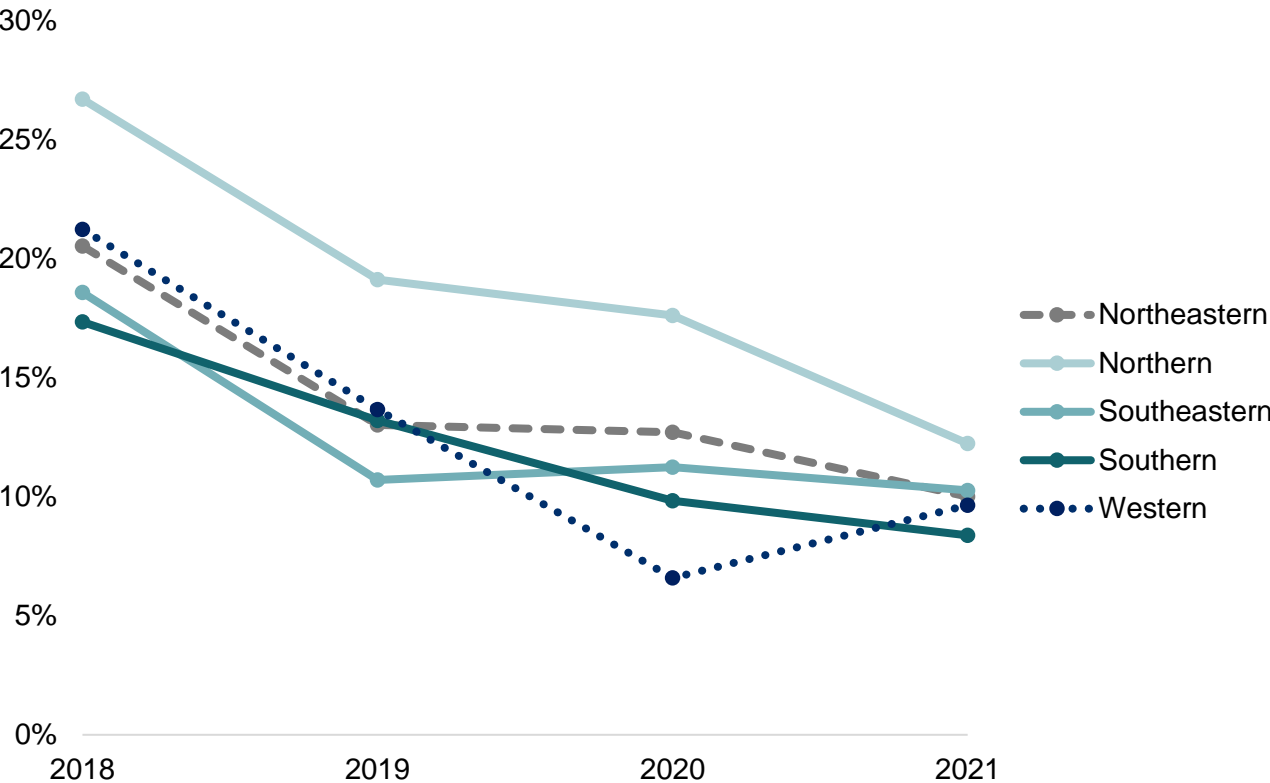
Wisconsin prescriptions associated with cough, acute URI, or acute bronchitis by antibiotic type, 2018–2021



Prescribing by location, insurance, and region

The graph below (Figure 18) shows the percent of visits for cough, acute URI, or acute bronchitis that were associated with an antibiotic prescription, by Wisconsin public health region from 2018–2021. Any visits with a Tier 1 or Tier 2 diagnosis in addition to the cough diagnosis were excluded.

FIGURE 18
Percent of visits with Wisconsin prescriptions associated with cough, acute URI, or bronchitis by antibiotic type, 2018–2021



Additional findings:

- There was **no significant difference in antibiotic prescribing associated with cough, acute URI, or bronchitis by location type** (such as emergency department, urgent care, office, or clinic).
- There was **no significant difference in antibiotic prescribing associated with cough, acute URI, or bronchitis by insurance type** (such as commercial, Medicaid, Medicare).

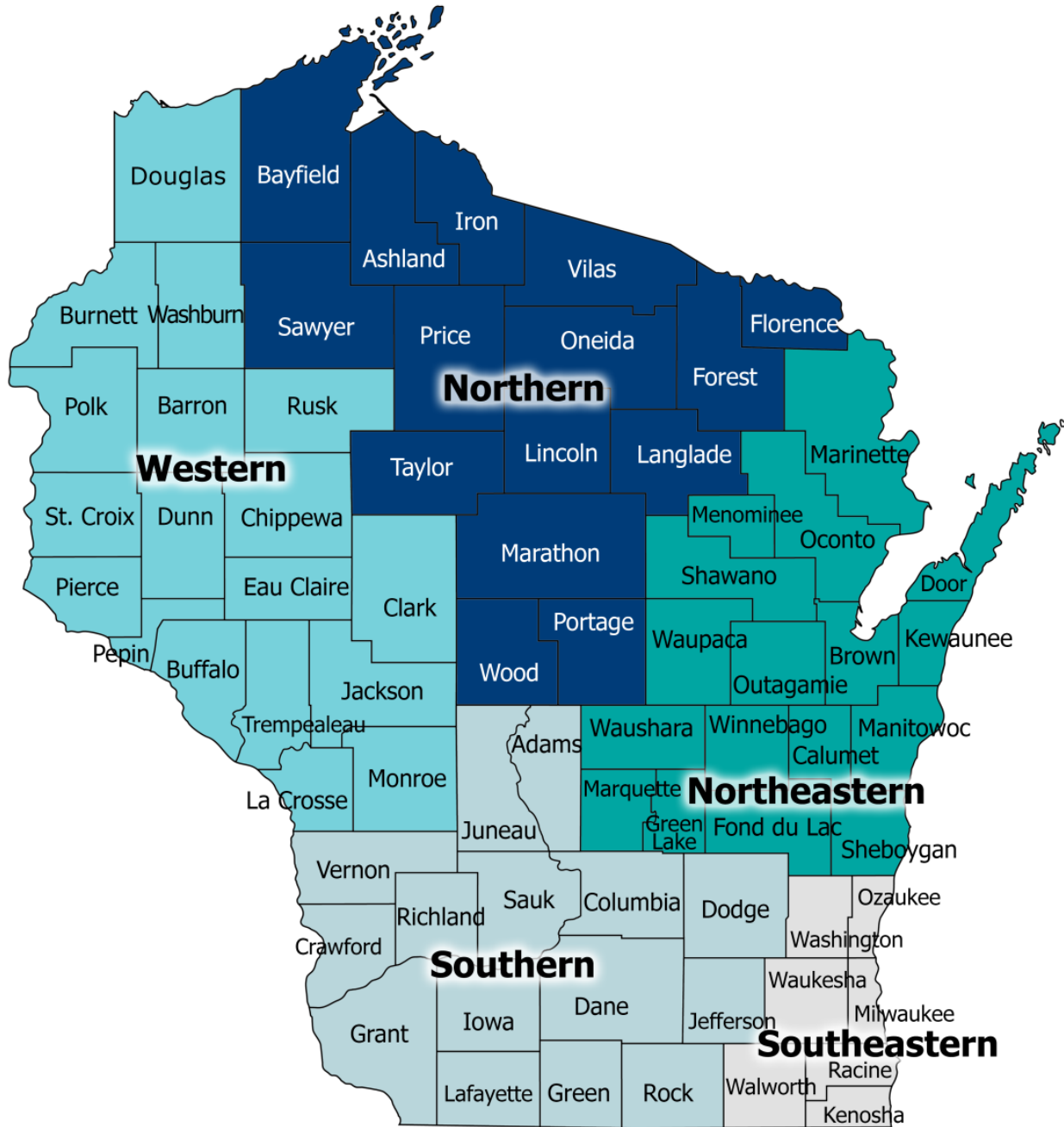
Appendix A

This report was prepared using data from the WHIO information system. The WHIO database comprises medical and pharmacy claims. These records are submitted to the WHIO database on a monthly basis in the month after processing to shorten the time lag between service date and WHIO data availability date. As a result, the ending months of service dates in WHIO's database will be marked by the normal claims processing lag experienced by WHIO's data submitters.

Features of the WHIO database

- Includes data from 17 Wisconsin-based organization participants: health plans, an employer purchasing coalition, a pharmacy benefits manager, and the Wisconsin Medicaid Program
- Includes medical claims service dates, pharmacy fill dates, and eligibility coverage dates starting January 1, 2017
- Integrates of the prior three months of submitted records quarterly into a patient-centered database that combines services across all provider types, settings, and coverage types into a persistent and unique WHIO member ID
- Contains over 160 million medical claims and 90 million pharmacy claims with 510 million total claim line records
- Made up of 4.8 million unique patients (about 75% of the Wisconsin population)
- Includes all service settings and types paid for by insurance such as:
 - Inpatient
 - Outpatient
 - Home health
 - Post-acute care, long-term care, hospice
 - Professional
 - Ancillary (for example, lab and radiology)
 - Pharmacy

Appendix B



www.dhs.wisconsin.gov/aboutdhs/regions.htm

Appendix C

The following are working group members that contributed to this report.

DHS

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- Lindsay Taylor, MD, MS

WHIO

- Jim Auron
- Brian Hutchinson, MBA
- Abby Klemp, MPH
- Dana Richardson, MA

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- Gerald Frye
- Matthew Weimer

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