

Trends in Outpatient Antibiotic Prescribing in Wisconsin 2018-2024

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. The original report published in February 2023 covered data from 2018–2021. This updated report covers data from 2018–2024 and includes revised measures. Using these measures, the report describes trends in outpatient antibiotic use and identifies additional opportunities 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 1.2 billion claim lines 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 2024 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 department (ED) setting. Antibiotics were included if they were prescribed in the oral formulation and the order was filled at a pharmacy. 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.

It's important to note that changes in methodology make this report not directly comparable to the 2023 report.

Inclusion criteria

Visits were analyzed if they:

- Occurred at a location in Wisconsin.
- Occurred in an outpatient setting, defined as ambulatory clinic, urgent care, or emergency department.

Antibiotics were included if they were:

- Oral.
- Filled 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 or imaging).

Antibiotics were excluded if they were:

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

About these data

Data in this report include insured Wisconsinites receiving outpatient care through clinics, urgent care settings, and EDs, and associated antibiotic prescriptions from 2018 to 2024. 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 Wisconsinites who are uninsured.

Executive Summary

The data included within this report shows that the number of outpatient antibiotic prescriptions was highest in 2018. It decreased during 2019–2021, increased from 2022–2023, and decreased again in 2024. These trends were seen 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 EDs. However, when the appropriateness of these prescriptions are considered, urgent care locations have better antibiotic prescribing practices than offices or clinics.

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. While those patients covered by Medicaid received higher rates of antibiotics, those prescriptions were found to be more appropriately prescribed than in patients covered by Medicare or private insurance. This points to an increase in infections that require antibiotics in this group rather than inadequate access to quality care.

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.

The information summarized in this report can be used to inform strategies to improve antimicrobial stewardship in Wisconsin by identifying potential targets for intervention.

Wisconsin Antibiotic Prescribing Trends

Overall trends

Wisconsin health care providers wrote over 4.1 million antibiotic prescriptions in outpatient settings from 2018 to 2024. The total number of antibiotics captured in the WHIP dataset by year is shown below (Figure 1). This includes prescriptions for both adults and children. Overall, the number of prescriptions decreased overtime to a low in 2020. Prescriptions numbers then increased until 2023 and decreased in 2024.

FIGURE 1

The total number of antibiotic prescriptions initially declined but rose between 2021 and 2023.

Total number of Wisconsin antibiotic prescriptions by year, 2018–2024

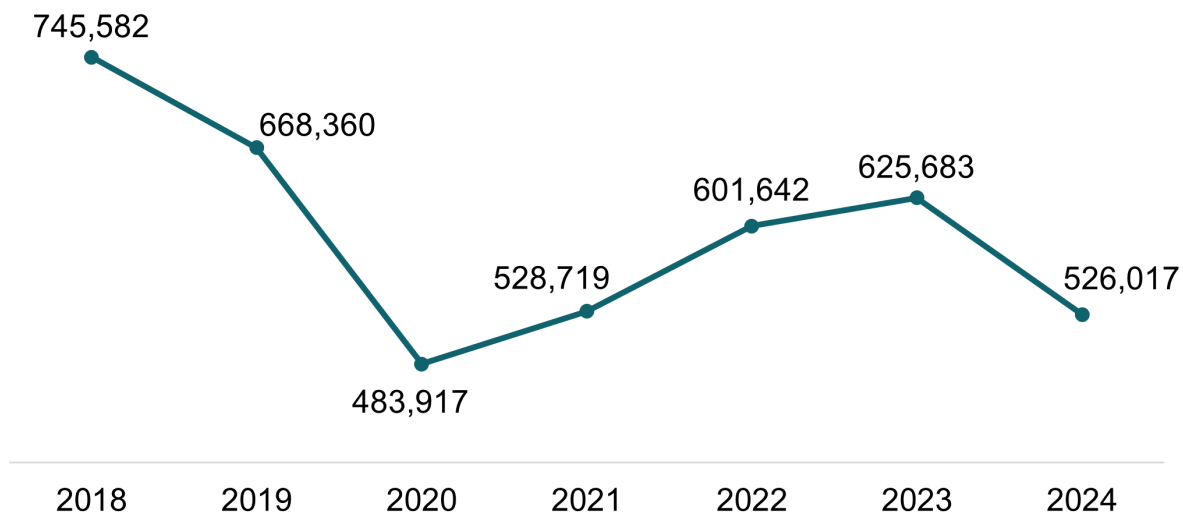
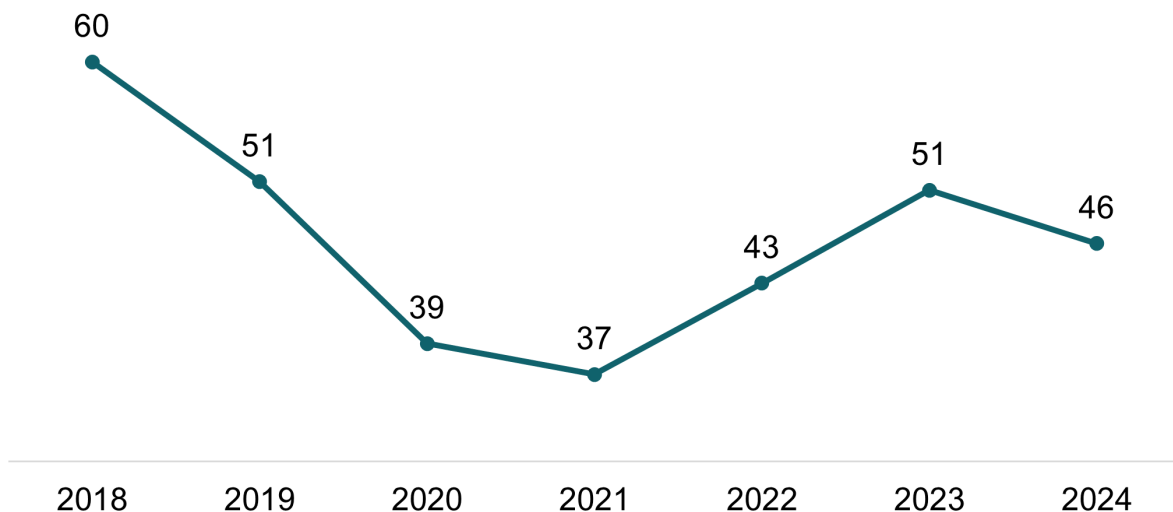


FIGURE 2

Visits in which an antibiotic was prescribed initially fell but rose between 2021 and 2023.

Total number of Wisconsin visits in which an antibiotic was prescribed per 1,000 outpatient visits by year, 2018–2024



Attributes of patients receiving antibiotic prescriptions

WHIO analyzed antibiotic visits in their dataset from 2024 with at least one medical claim. Results are shown as a rate per 1,000 visits.

Key findings:

- 2.0 million WHIO members had at least one medical claim.
- 523,584 (26.6%) of WHIO members had at least one antibiotic prescription claim.
- Of Wisconsin residents in the dataset with at least one antibiotic prescription claim, the average number of antibiotic prescription claims was two.

FIGURE 3

Females received more antibiotic prescriptions than males for every year between 2018 and 2024.

Antibiotic prescriptions per 1,000 visits by patient sex, 2018–2024

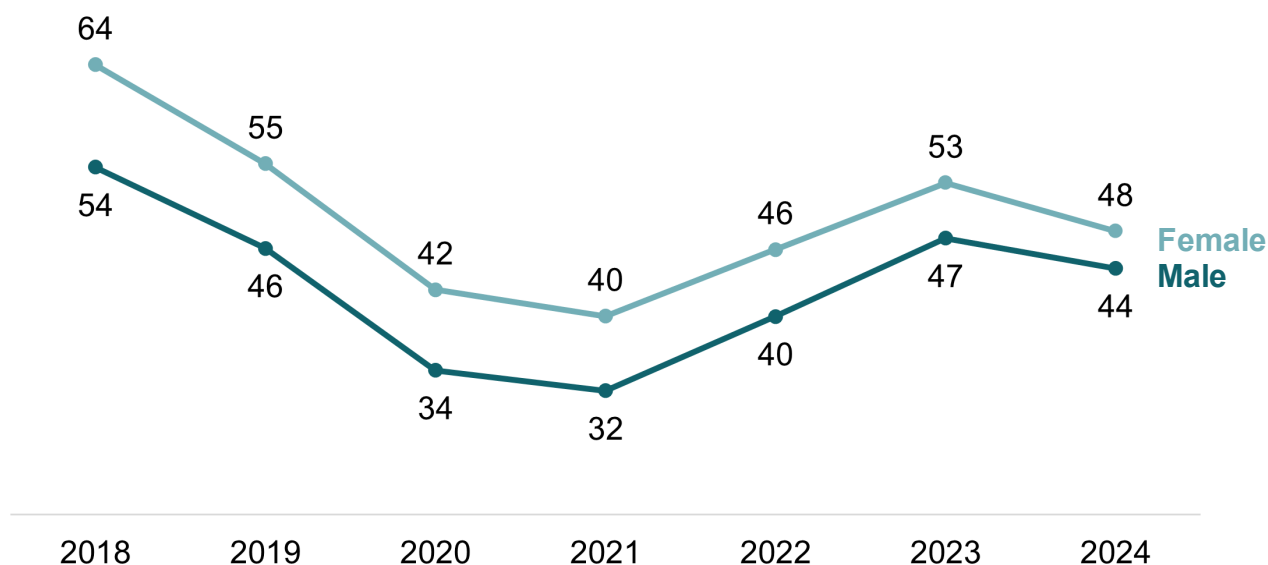
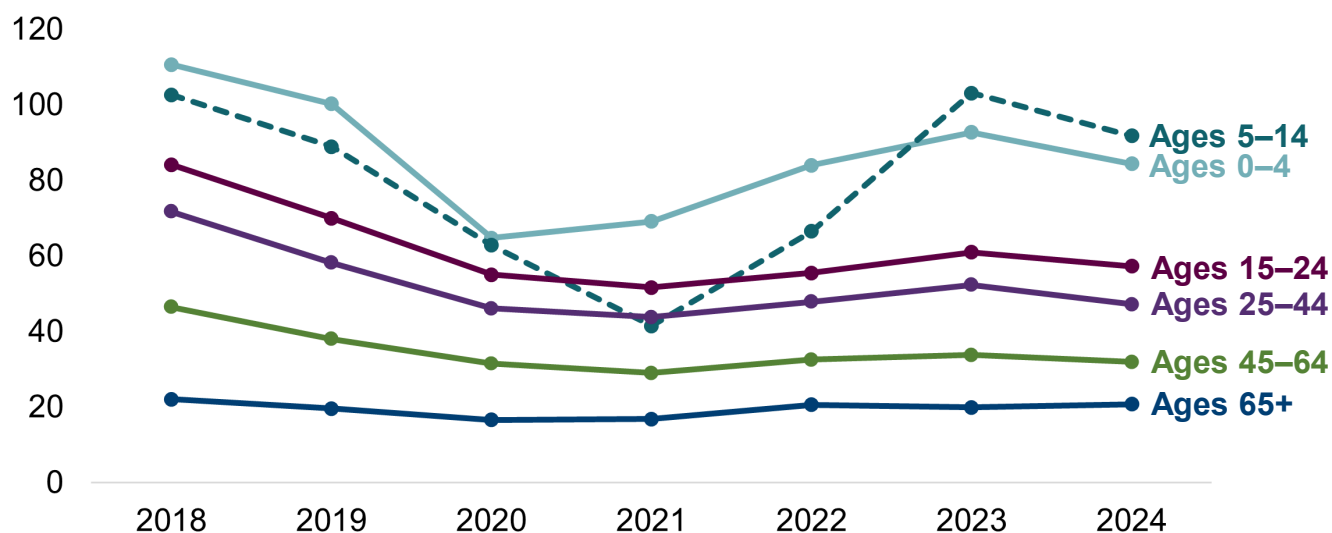


FIGURE 4

Children receive more antibiotics than other age groups.

Antibiotic prescriptions per 1,000 visits by patient age group, 2018–2024



Key finding:

In 2021, 5–14-year-olds saw a sharp decrease in antibiotic prescriptions which is likely associated with COVID-19 restrictions on school attendance that year.

Attributes of outpatient visits with antibiotics prescribed

WHIO analyzed outpatient visits and their associated antibiotic prescriptions.

Key findings:

- Of 794,650 visits to an **EDs** in 2024, **7.3%** were associated with an antibiotic prescription, amounting to 64,562 prescribed antibiotics.
- Of 254,221 visits to an **urgent care** in 2024, **18.7%** were associated with an antibiotic prescription, amounting to 52,985 prescribed antibiotics.

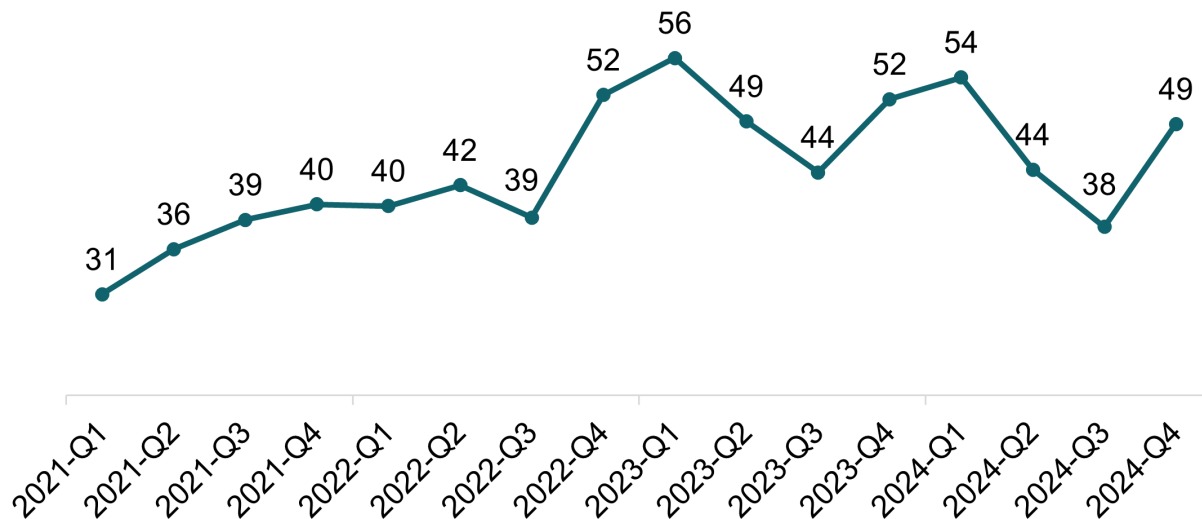
Of 8,954,498 visits to an **office or clinic** in 2024, **4.0%** were associated with an antibiotic prescription, amounting to 410,379 prescribed antibiotics.

While urgent care centers had the highest rate of antibiotic prescribing, this does not imply that these prescriptions were inappropriate. Rather, this is likely due to urgent care being the main care setting for infections that may require antibiotics.

FIGURE 5

Since 2022, antibiotic prescribing has followed a seasonal pattern.

Number of visits with antibiotics prescribed per 1,000 outpatient visits by quarter, 2018–2024



Key finding:

During the peak of COVID-19 restrictions the rate of antibiotic prescriptions remained constant but seasonal patterns resume in Q3 of 2022 with higher prescribing in winter and lower in summer.

Prescribing by Location, Insurance, and Area Deprivation Index

FIGURE 6

Urgent care centers had higher rates of antibiotic prescribing than EDs or offices/clinics.

Number of visits with antibiotics prescribed per 1,000 outpatient visits by place of service, 2018–2024

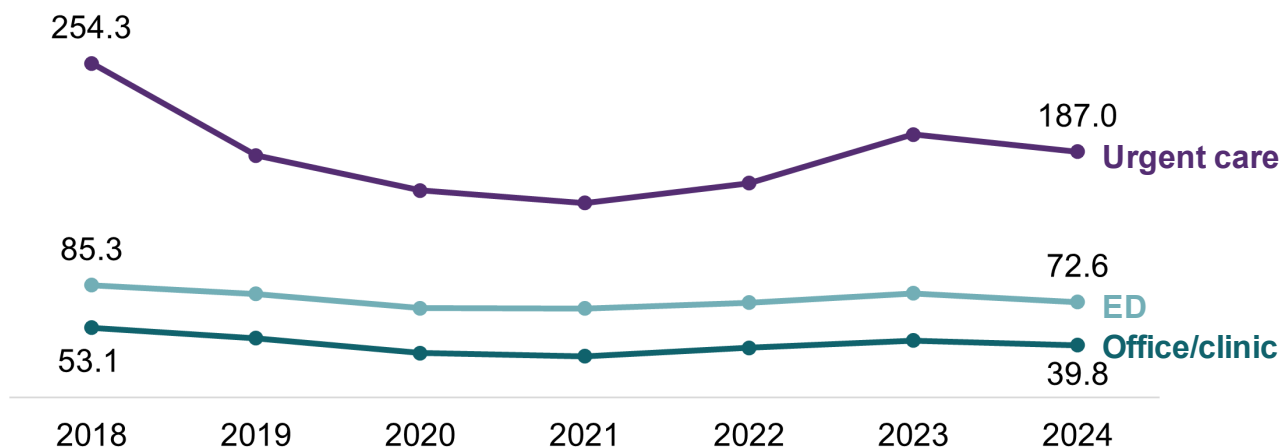


FIGURE 7

The Northern region had the highest rate of antibiotic prescribing while the Southern region had the lowest.

Number of visits with antibiotics prescribed per 1,000 outpatient visits by place of service, 2018–2024

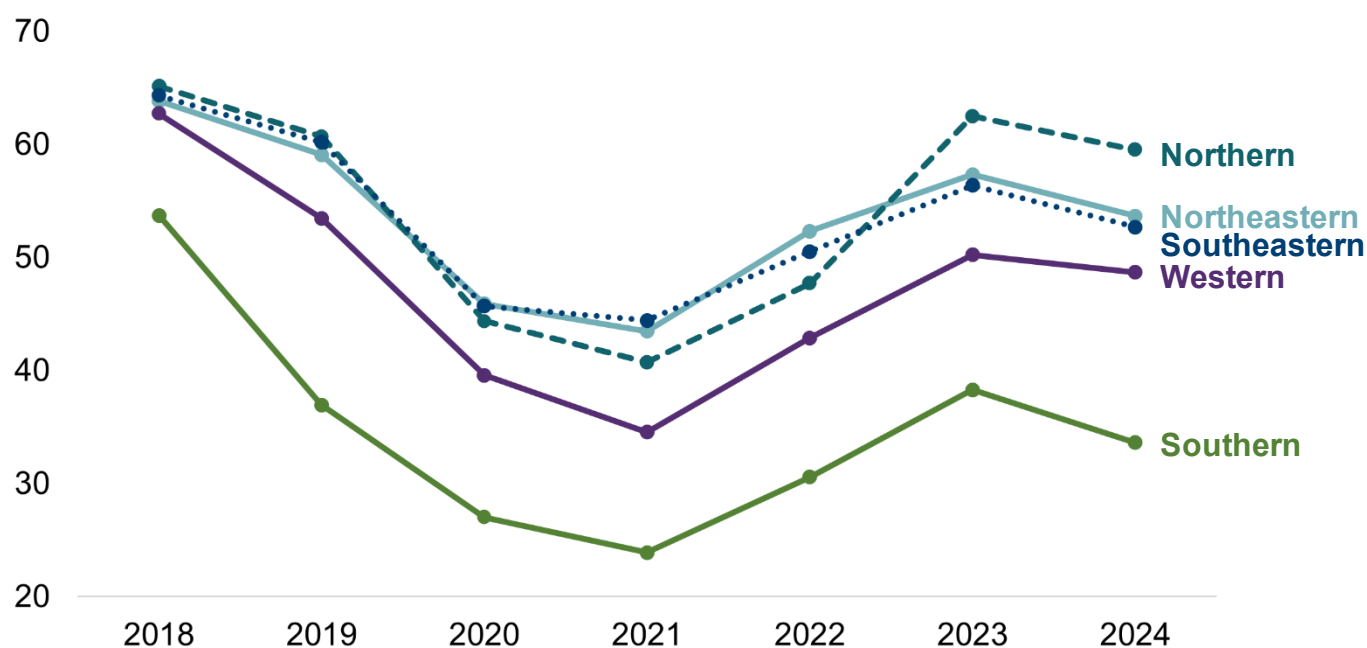
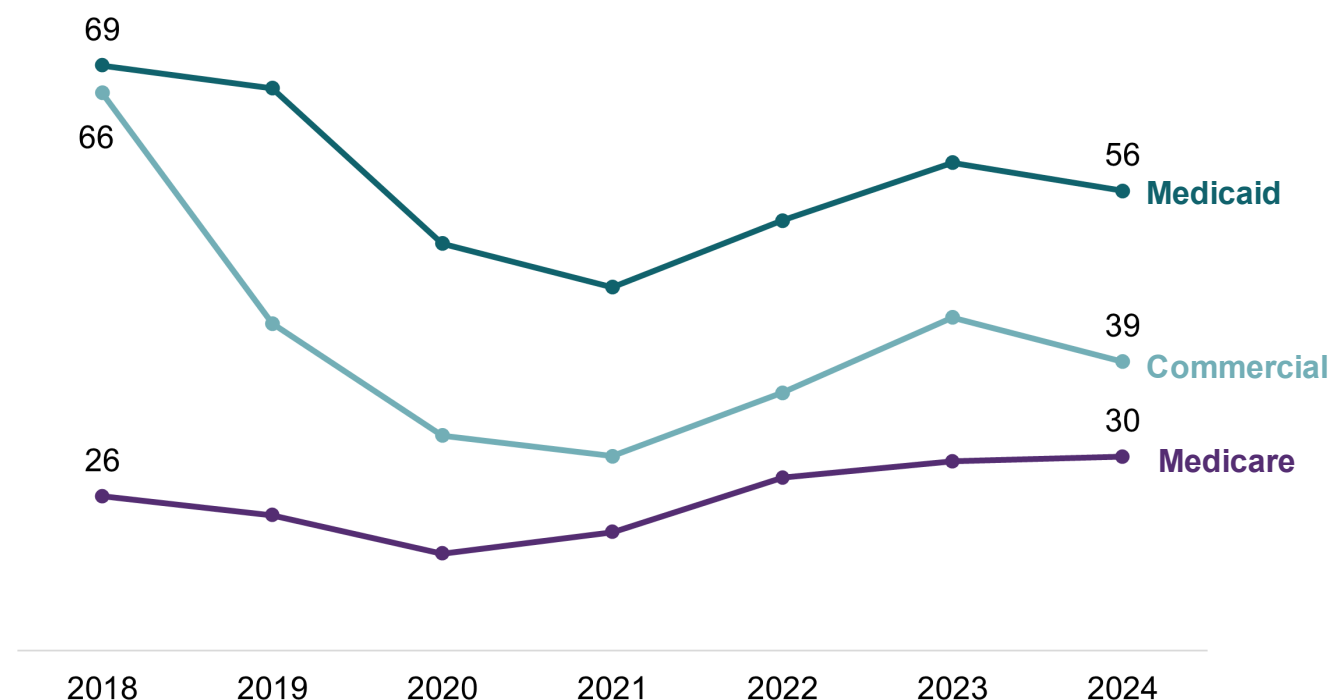


FIGURE 8

Medicaid had a higher rate of antibiotic prescribing than Medicare or private insurance.

Number of visits with antibiotics prescribed per 1,000 outpatient visits by payer type, 2018–2024



What is the area deprivation index?

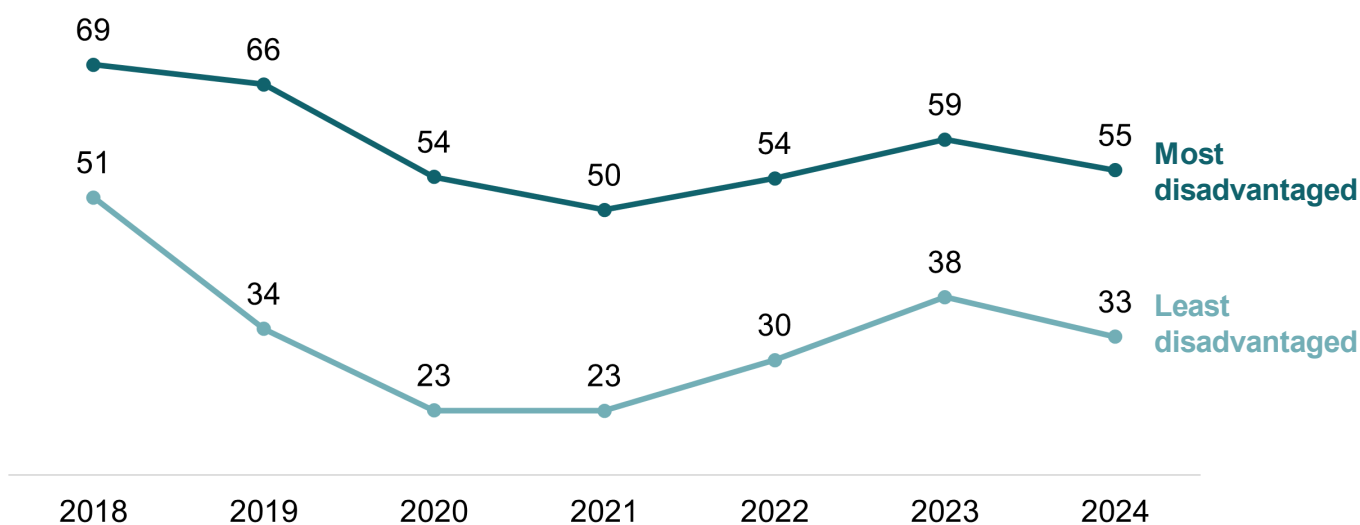
The area deprivation index (ADI) ranks neighborhoods by level of socioeconomic disadvantage, using factors such as income, education, employment, and housing quality. Neighborhoods are grouped in deciles, with one being the lowest level of disadvantage and 10 being the highest level of disadvantage.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

To determine whether social determinants may have contributed to higher antibiotic prescribing in Medicaid patients, we examined whether prescribing rates differed by the area deprivation index of the patients.

FIGURE 9

Patients living in neighborhoods with higher disadvantage received more antibiotic prescriptions for every year studied.

Number of visits with antibiotics prescribed per 1,000 outpatient visits by area deprivation index, 2018–2024



Key finding:

In 2024, there were 55 visits associated with an antibiotic prescription per 1,000 outpatient visits for individuals living in neighborhoods with the greatest disadvantage (ADI 10). In comparison, this number was 33 for Wisconsinites living in neighborhoods with the least disadvantage (ADI 1). This shows higher antibiotic prescribing in neighborhoods with more disadvantage than neighborhoods with less disadvantage.

Prescribing by Infection Type

FIGURE 10

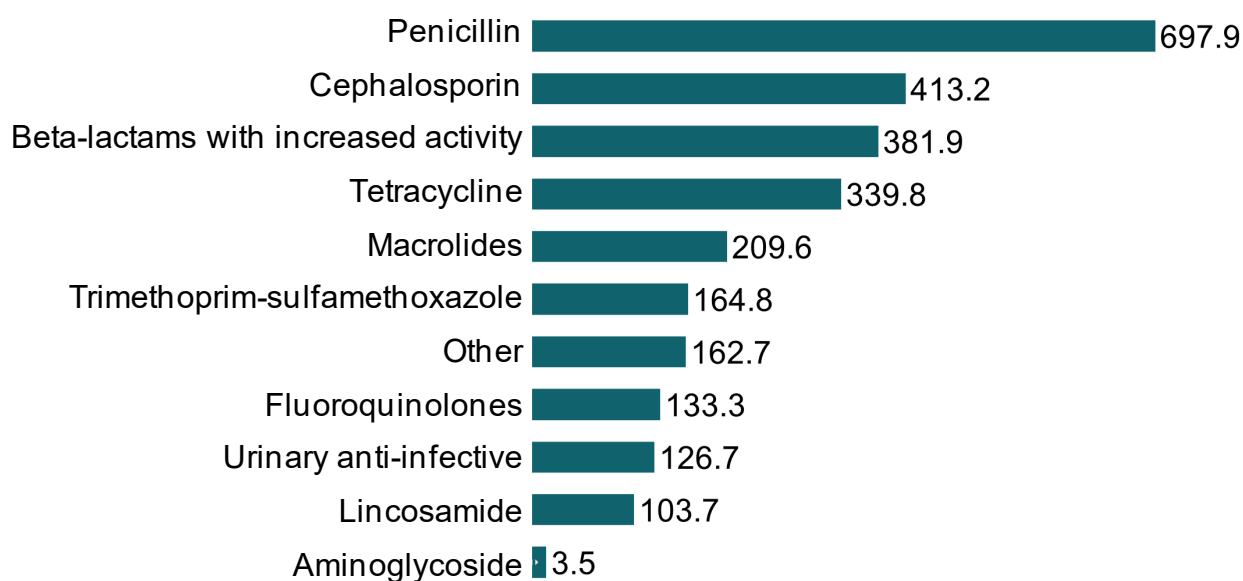
Examples of drugs by drug class.

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

FIGURE 11

Penicillin had the highest rate of prescribing of any antibiotic.

Number of antibiotic prescriptions per 1,000 beneficiaries by drug class, 2018–2024



Antibiotic Prescribing Appropriateness

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
• Urinary tract infection • Streptococcal pharyngitis • Pneumonia • Cellulitis • Pyelonephritis	• Acute pharyngitis • Acute sinusitis • Dysuria • Chronic sinusitis • Otitis media • Cutaneous abscess	• Acute upper respiratory infection • Cough • Acute bronchitis

In 2024, the top diagnoses most commonly associated with antibiotic prescription in Wisconsin were:

- | | |
|-----------------------------|------------------------------|
| 1. Urinary tract infections | 5. Streptococcal pharyngitis |
| 2. Acute sinusitis | 6. Acute bronchitis |
| 3. Cellulitis | 7. Pneumonia |
| 4. Otitis media | 8. Acute pharyngitis |

With the exception of acute bronchitis, all of the top diagnoses are Tier 1 or Tier 2 conditions. For these, antibiotics are always or sometimes recommended. Antibiotics are not recommended for acute bronchitis.

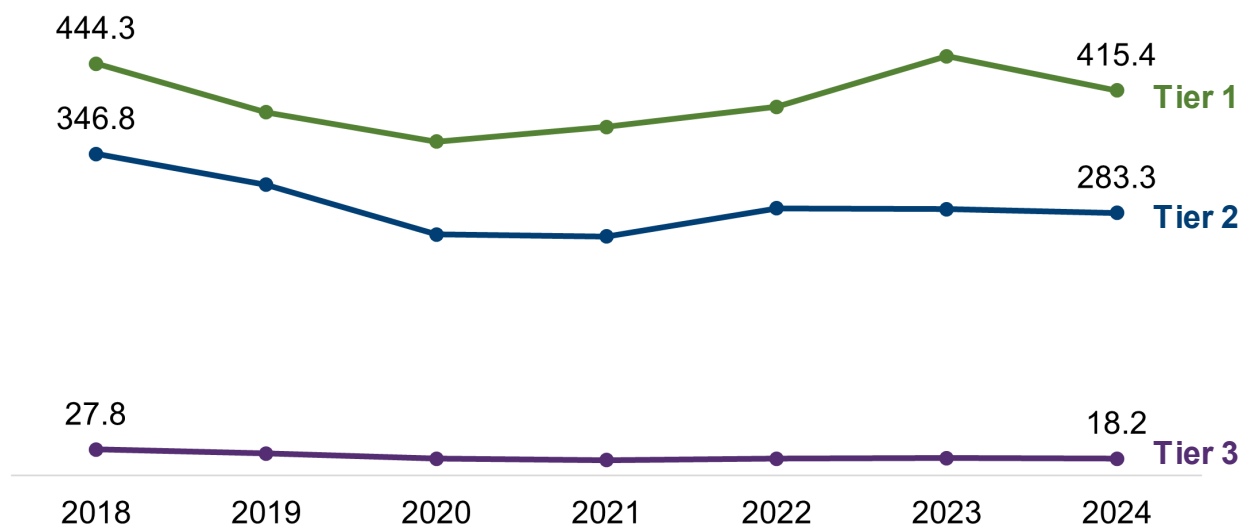
Figure 13 shows the rate of visits that were associated with antibiotic prescriptions by antibiotic indication. Rates may seem lower than what is observed in practice because of the following limitations:

- 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.
- Medical coding is not always perfect.

FIGURE 13

Tier 1 indications were prescribed antibiotics the most and tier 3 the least.

Number of antibiotic prescriptions per 1,000 beneficiaries by antibiotic indication tier, 2018–2024



Key findings:

Cough, acute URI, and acute bronchitis are all Tier 3 diagnoses, indicating that antibiotics should never be prescribed to address these conditions. Prescribing associated with Tier 3 diagnoses decreased substantially between 2018 to 2024. Specifically, antibiotic prescriptions for either cough, acute URI, or acute bronchitis declined from 37,285 in 2018 to 9,989 in 2024.

The most common antibiotics prescribed for these conditions in 2024 were amoxicillin, amoxicillin/potassium clavulanate, azithromycin, doxycycline, and cefdinir.

Inappropriate Prescribing by Region, Location, and Insurance

The graph below (Figure 14) 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 2018–2024. Any visits with a Tier 1 or Tier 2 diagnosis in addition to the cough diagnosis were excluded.

FIGURE 14

The Northern region has had the most inappropriate antibiotic prescriptions between 2018 and 2024.

Number of Tier 3 (inappropriate) antibiotic prescriptions per 1,000 beneficiaries by public health region, 2018–2024

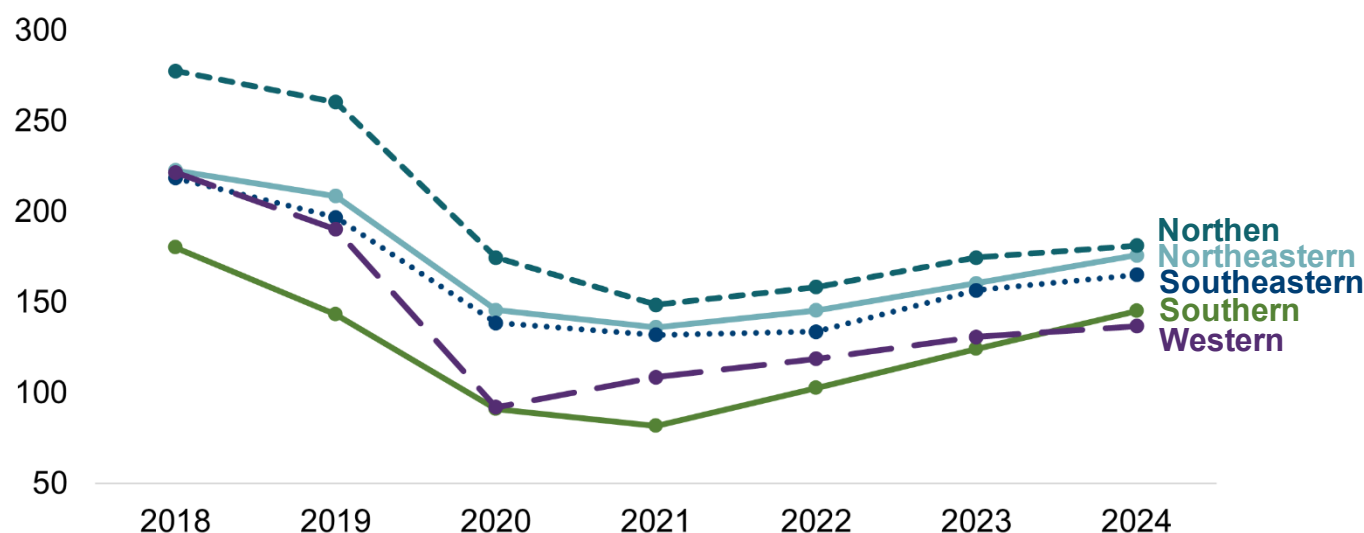
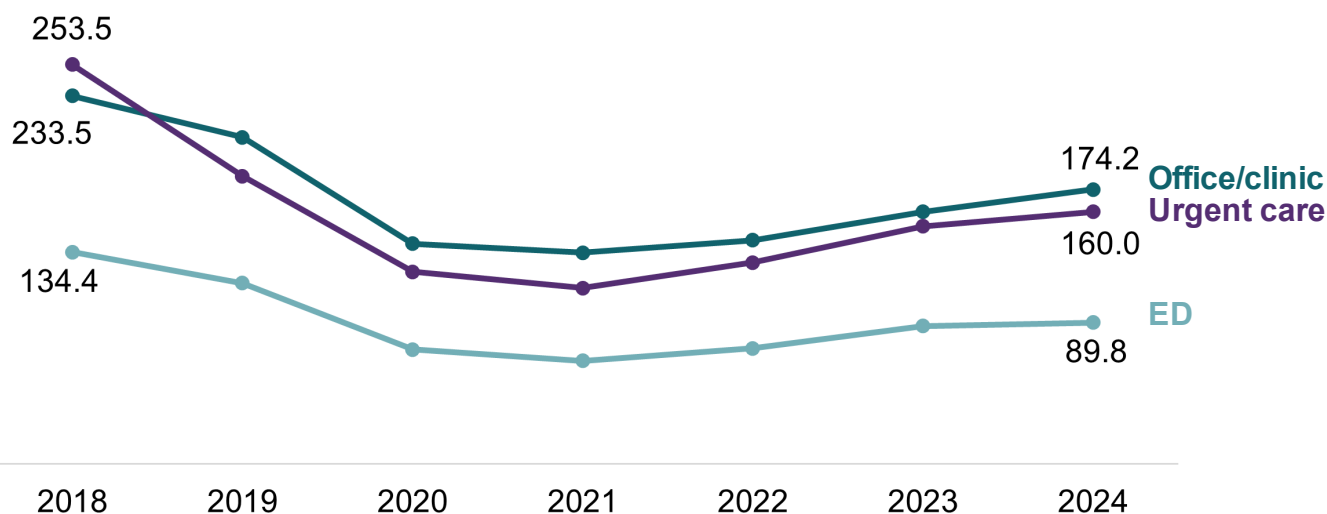


FIGURE 15

Office and clinic locations have the highest rate of inappropriate antibiotic prescribing.

Number of Tier 3 (inappropriate) antibiotic prescriptions per 1,000 beneficiaries by place of service, 2018–2024



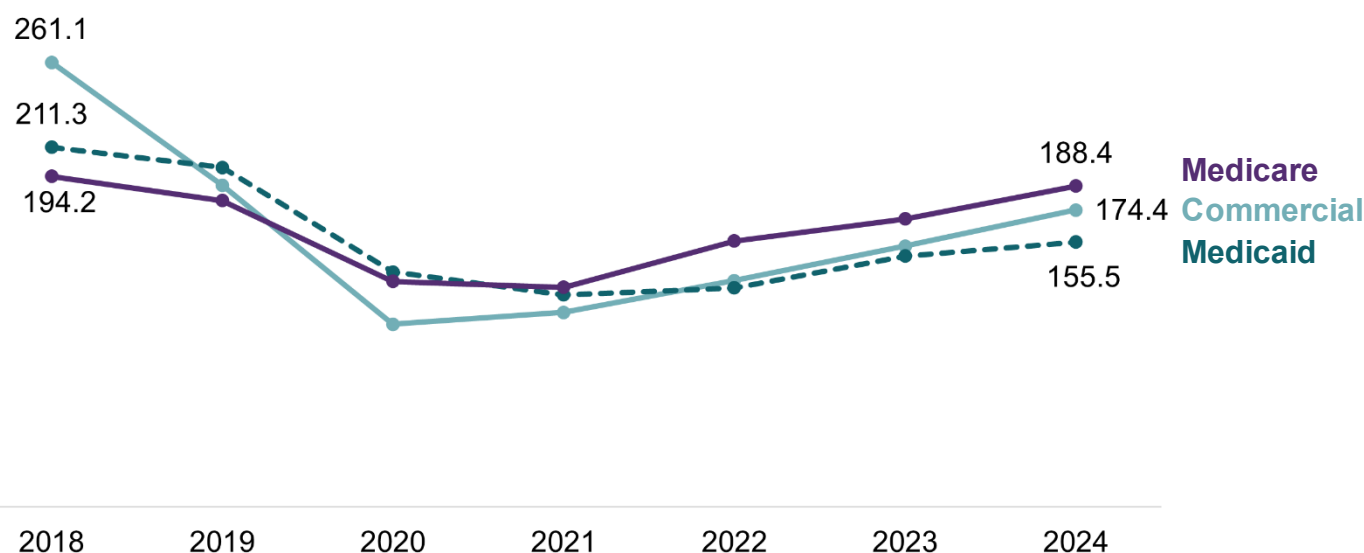
Key finding:

While Figure 6 showed that urgent care locations dispensed more antibiotics than other locations, Figure 15 shows that these prescriptions are more often appropriate than those dispensed in physician offices and clinics.

FIGURE 16

Antibiotic prescriptions for Medicare prescribers were more often inappropriate than other provider types.

Number of Tier 3 (inappropriate) antibiotic prescriptions per 1,000 beneficiaries by payer, 2018–2024



Key finding:

While Figure 8 showed that Medicaid recipients were prescribed higher rates of antibiotics than other payers, Figure 16 shows that Medicaid has the lowest rate of inappropriate prescribing.

Conclusions

- Overall antibiotic prescribing decreased between 2018 and 2021 then increased yearly until 2023 with a modest decline in 2024.
- Antibiotic prescribing was higher in females, children under 14 years old, and people living in disadvantaged neighborhoods.
- Antibiotic prescribing was higher for Medicaid recipients overall. However, inappropriate antibiotic prescribing was highest among Medicare recipients.

- Although antibiotic prescribing has been highest in the Northern region of Wisconsin, the variability between regions has decreased between 2018 and 2024.
- Inappropriate antibiotic prescribing decreased between 2018 and 2024.

Have questions?

Please contact the HAI Prevention Program with questions about the data or information shared in this report by emailing DHSWIHAIPreventionProgram@dhs.wisconsin.gov.

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 413 million medical claims and 276 million pharmacy claims with 1.2 billion total claim line records.
- Made up of 5.8 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

- A. Figure 3 shows that on average females receive more antibiotics per 1000 visits than males. Furthermore, Figure 3 follows the same trend as previous figures with a decline between 2018 and 2021 followed by a rise from 2021 to 2023 and a decrease in 2024.
- B. Figure 4 shows that the age groups 0–4 years and 5–14 years have the highest rate of antibiotic prescriptions per 1000 visits. Between 2018 and 2022, the 0–4 age group had the highest rates followed by 5–14. However, in 2023 and 2024 5–14-year-olds had the highest rates. In 2021, 5–14-year-olds saw a sharp decrease in antibiotic prescriptions. Across all years, ages 65+ had the lowest rate of antibiotic prescriptions followed by ages 45–64.
- C. Figure 7 shows that the Northern, Northeastern, and Southeastern public health regions have the highest rates of antibiotic prescribing in the time period analyzed while the Southern region has the lowest rates while those covered by Medicare have the lowest rates. All regions showed decreases between 2018 and 2021 followed by an increase until 2023 and a decrease in 2024.
- D. Figure 9 shows that patients with the highest area deprivation index (ADI) had a higher rate of antibiotic prescriptions per 1000 outpatient visits than those in the least disadvantaged group. This result agrees with Figure 8 which showed higher antibiotic prescribing in individuals covered by Medicaid.
- E. Figure 14 shows that the Northern, Northeastern and Southeastern public health regions have the most antibiotic prescriptions per 1000 visits for diagnoses for which antibiotics are never indicated. However, in 2024 there is much less variation by region than there was in 2018. The regions with the lowest rates of inappropriate prescribing are the Southern and Western regions.
- F. While Figure 6 showed that urgent care locations dispensed more antibiotics than other locations, Figure 15 shows that these prescriptions are more often appropriate than those dispensed in physician offices and clinics. EDs have the lowest rate of inappropriate antibiotic prescribing.
- G. While Figure 8 showed that Medicaid recipients were prescribed higher rates of antibiotics than other payers, Figure 16 shows that Medicaid has the lowest rate of inappropriate prescribing. Medicare recipients had the highest rates of inappropriate antibiotic prescribing with commercial insurance in the middle.

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