

Trends in Dental 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. Most antibiotic use (AU) data come from the hospital setting, but the majority of antibiotics are prescribed in non-hospital settings¹. Over the past few years, increased AU tracking and reporting across all facets of health care has provided a better understanding of antibiotic prescribing.

Prior studies reported that dentists prescribe approximately 10% of outpatient antibiotics, making dentists the fourth most frequent prescribers of antibiotics after family practitioners, pediatricians, and internists¹. Little is known about dental antibiotic prescribing in Wisconsin. To better understand the current state of dental AU, the Wisconsin Department of Health Services (DHS) Division of Public Health (DPH) Healthcare-Associated Infections (HAI) Prevention Program partnered with BSG Analytics, Delta Dental of Wisconsin, and the Wisconsin Health Information Organization (WHIO) to develop a series of dental AU measures. This report uses these measures to describe trends in dental AU and identify 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](#). Please email questions to DHSWIHAIPreventionProgram@dhs.wisconsin.gov.

About our partners

- BSG Analytics, an Alliant Company, integrates employer, payer, and provider perspectives while utilizing data to develop analytical solutions beneficial to all stakeholders. BSG Analytics has partnered with payers, providers, device manufacturers, business alliances, trade associations, and government agencies, giving it a panoramic view of the health care landscape.
- Delta Dental of Wisconsin is the state's leading dental insurer, providing dental benefits to more than two million members.
- WHIO is a not-for-profit organization dedicated to driving higher quality health care at a lower cost. For more information, visit the [WHIO website](#) or email info@whio.org.

Methodology

All Delta Dental of Wisconsin insurance claims data from 2018–2021 were analyzed. Dental insurance claims data was merged with pharmacy claims data obtained from the WHIO using a shared de-identified person identifier. Filled outpatient oral antibiotic prescriptions ordered by a dentist were linked with dental services if provided within three days before or after the dental visit. If a prescription was linked to two different dental visits, the visit closest temporally was associated. If tied, the prescription was linked to the prior dental service.

As dental antibiotic prophylaxis prescribing is not always temporally linked with dental visits (prescription filled before and kept by patient until visit), nor is dental antibiotic prophylaxis prescribed uniformly by dentists, we focused this report on visits for services most likely to be associated with dental infections, such as root canals or endodontic surgical treatment.

Antibiotics were also linked to dental service category. If multiple dental services were associated with a single antibiotic prescription, it was only associated with the service most likely associated with treatment of a dental infection ([see Appendix A](#)).

For the purposes of this report, antibiotic visits are defined as any dental visit that resulted in an antibiotic being prescribed and filled up to three days before or after the encounter. Antibiotic visits are normalized as a rate per 1,000 dental visits.

Inclusion criteria include:

- Visits by dentists in Wisconsin.
- Antibiotics if:
 - Prescribed by a dentist.
 - Oral.
 - Prescribed within three days before or after a dental visit.

Exclusion criteria include:

- Visits made to dentists outside Wisconsin.
- Not associated with interventional dental services.
- Antibiotics if:
 - Topical, injectable, or intravenous.
 - Prescribed outside the three-day window of the dental visit.

About these data

The data in this report include insured Wisconsinites receiving dental care and are associated with antibiotic prescriptions from calendar years 2018–2021. There are key limitations in the measures presented in this report that should be considered. The measures use claims data, which is retrospective and relies on accurate coding. The dental data include only privately insured individuals enrolled with Delta Dental of Wisconsin and misses Wisconsinites that are insured by other private and public insurance and the uninsured.

Executive summary

The number of antibiotic prescriptions per patient increased from 2018 to 2021 (31.9 per 1,000 patients to 34.8 per 1,000 patients). When controlling for the number of dental visits, 2020 had the greatest rate of antibiotic prescribing per dental visit. This was likely in part due to the COVID-19 pandemic, a time when dental offices were closed for routine dental care and patients seeking care were more likely to have advanced dental issues.

Most commonly prescribed antibiotics

Consistent with national dental antibiotic prescribing data, the five most commonly prescribed oral antibiotics by dentists in order were:

1. Amoxicillin
2. Clindamycin
3. Penicillin VK
4. Azithromycin
5. Amoxicillin-clavulanate

Clindamycin was the second most prescribed antibiotic by dentists across the four years. Clindamycin use in dentistry has been shown to be associated with community-associated *Clostridioides difficile* infections² and both fatal and non-fatal adverse reactions³. Clindamycin was previously listed as a second line for dental prophylaxis in patients with true penicillin allergies, however, the updated 2021 [guidelines](#) from the American Heart Association no longer recommend it due to its known side effects. The American Dental Association's evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling designates azithromycin as an option for patients with a history of penicillin allergy⁴.

Penicillin allergy is a common reason for avoidance of first line antibiotics. Nearly 21% of all antibiotic orders were for a second line agent, including clindamycin, macrolides, cephalosporins, and tetracyclines. This percentage is twice the estimated 10% of patients who report a penicillin allergy⁵. Furthermore, an estimated 90% of patients who report a penicillin allergy are not truly allergic⁵. Antibiotic stewardship efforts in dental clinics should focus on improved evaluation of reported penicillin allergies. There are existing free resources to support penicillin allergy assessments in dental clinics such as those included in the DHS [Oral Health Antibiotic Stewardship Toolkit](#) and those provided by the [Organization for Safety, Asepsis and Prevention \(OSAP\)](#).

Next steps

1. The Wisconsin HAI Prevention Program and partners plan to update this report annually. This first iteration does not include duration of antibiotic therapy. Future iterations will include duration for two key reasons:
 - To provide a more descriptive, robust measure of antibiotic volume (days of therapy).
 - To differentiate between antibiotic orders likely used as dental prophylaxis versus treatment.

2. Additionally, the Wisconsin HAI Prevention Program and partners are developing prescriber-level reports with built-in antibiotic prescribing benchmarks to provide dental prescription data directly back to dentists.
3. Based on our findings of high non-penicillin use, the Wisconsin HAI Prevention Program plans to support efforts to de-label penicillin allergies through dental care.

Wisconsin dental antibiotic prescribing trends

Overall trends

From 2018–2021, there was a total of 34 antibiotic prescriptions per 1,000 patients per year. Reviewing all dental and pharmacy claims data, less than 1% of all dental services were associated with an oral antibiotic prescription. Of the excluded dental services, 0.16% of visits were associated with an oral antibiotic prescription whereas 1.70% of included dental visits were associated with an oral antibiotic prescription.

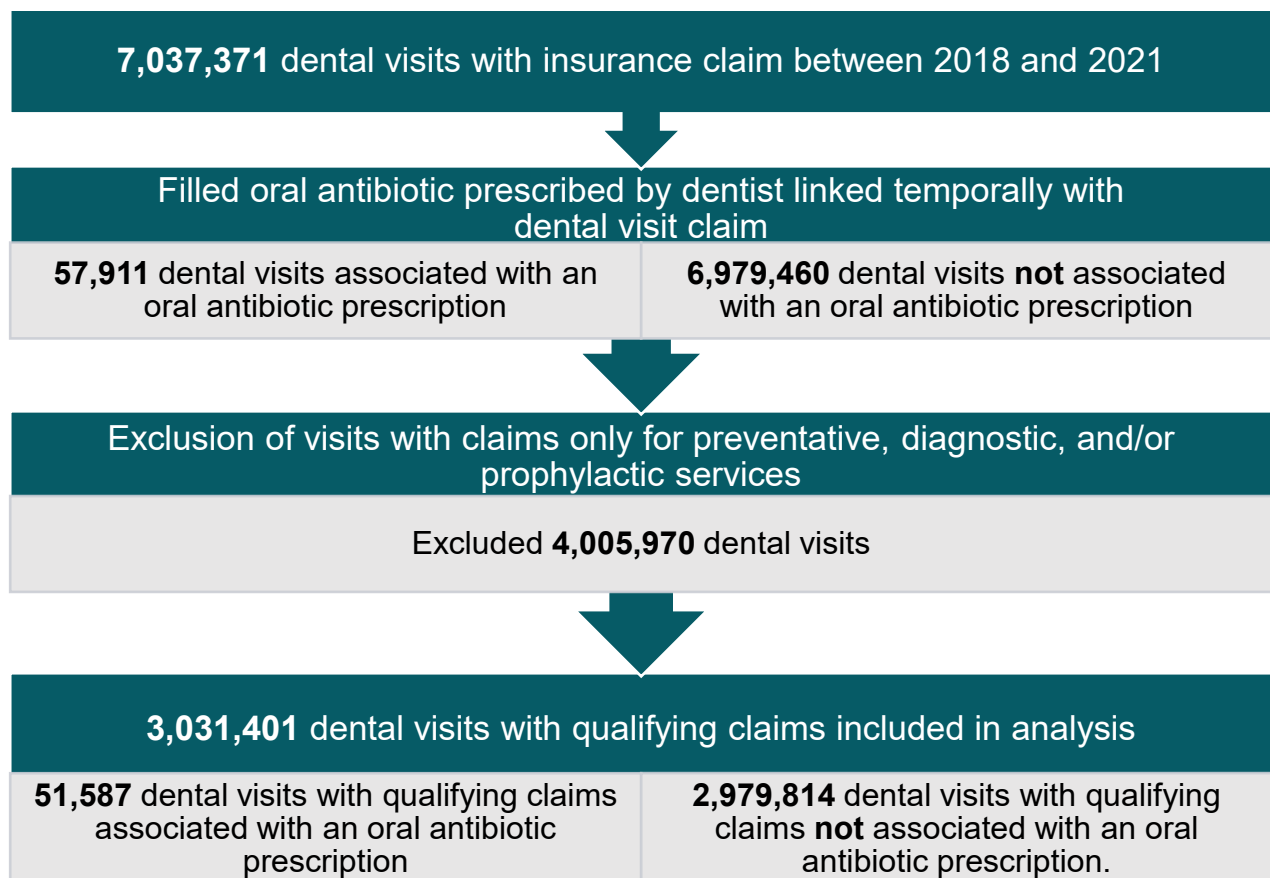
Focusing on qualifying dental services*:

- 818,925 patients received dental care during 3,031,401 visits included in this report.
- 41,679 (5.09%) of these patients had an oral antibiotic prescribed by their dentist either three days before or after their visit.

*Qualifying claims include adjunctive general services and major procedures (including endodontics, implant, maxillofacial prosthetics, oral and maxillofacial surgery, orthodontics, periodontics, prosthodontics [removable and fixed], and restorative services).

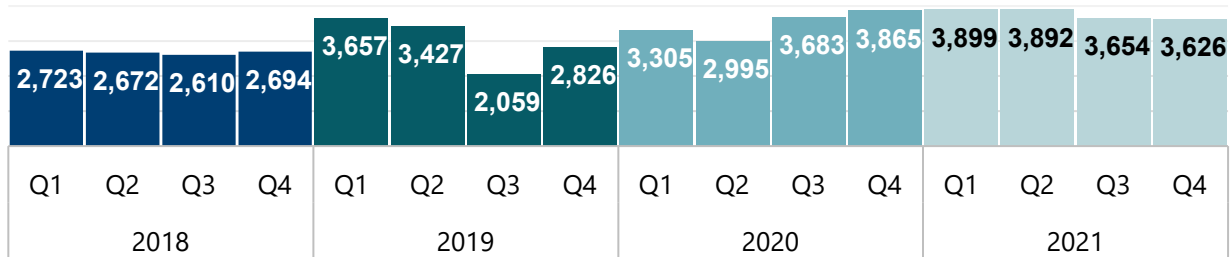
Over 3 million dental visits with qualifying claims were included in this analysis.

FIGURE 1. Flowchart illustrating inclusion of qualifying dental services.



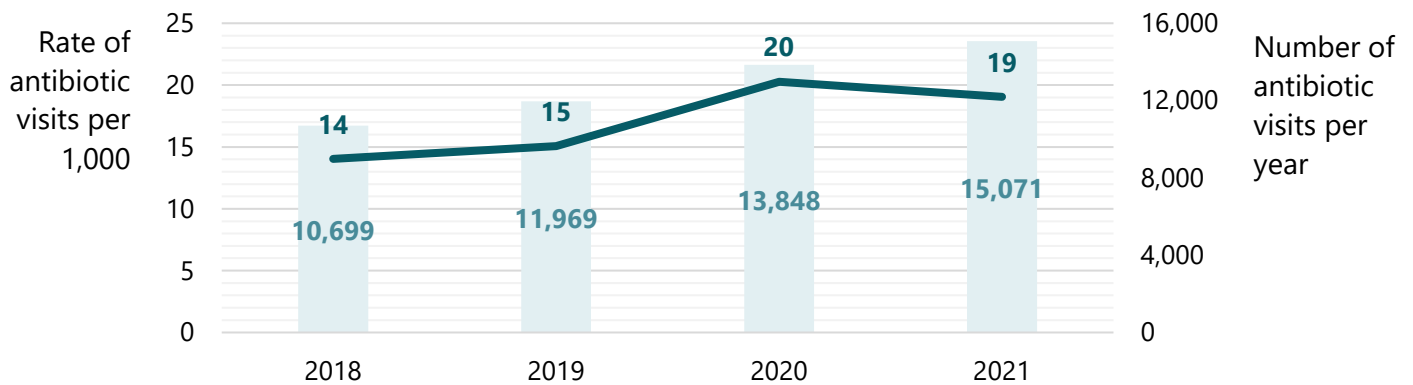
Total prescribing by dentists increased from 2018 to 2021.

FIGURE 2. Number of oral antibiotic prescriptions for qualifying dental services by quarter, Q1–Q4 2018–2021.



The rate and number of dental antibiotic visits increased from 2018 to 2021.

FIGURE 3. Number and rate of dental visits with antibiotic prescription per 1,000 visits, 2018–2021.



Penicillins were the most commonly prescribed antibiotic associated with qualifying dental services.

FIGURE 4. Total number of antibiotic prescriptions by therapeutic class, 2018–2021.



Of dental visits associated with an antibiotic prescription, 1.43% were associated with multiple antibiotic prescriptions. Clindamycin, penicillin VK, azithromycin, and amoxicillin-clavulanate rounded out the remaining top five most prescribed antibiotics.

Within antibiotic types, amoxicillin was the most commonly prescribed agent.

TABLE 1. Dental antibiotic visits per 1,000 visits by antibiotic class, 2018–2021.

Antibiotic class	Antibiotic	Antibiotic visits x 1,000				Total antibiotic visits
		2018	2019	2020	2021	
	All	14.04	15.06	20.27	19.05	51,587
Penicillins	Amoxicillin	8.09	9.18	12.88	12.42	32,086
	Amoxicillin-clavulanate	0.53	0.57	0.87	0.91	2,164
	Dicloxacillin	0.00	0.00	0.00	0.00	2
	Penicillin VK	2.26	2.15	2.41	2.14	6,766
Lincosamides	Clindamycin	2.26	2.24	2.88	2.50	7,445
Macrolides	Azithromycin	0.66	0.69	0.93	0.83	2,342
	Clarithromycin	0.00	0.00	0.01	0.01	15
	Erythromycin	0.01	0.01	0.01	0.01	22
Cephalosporins	Cephalexin	0.23	0.19	0.25	0.22	671
	Cefuroxime	0.00	0.00	0.00	0.00	5
	Cefaclor	0.00	0.00	0.00	0.00	3
	Cefpodoxime	0.00	0.00	0.00	0.00	2
	Cefdinir	0.00	0.00	0.00	0.00	3
Nitroimidazole	Metronidazole	0.14	0.13	0.21	0.19	502
Tetracyclines	Doxycycline	0.08	0.10	0.12	0.10	301
	Minocycline	0.00	0.00	0.00	0.00	5
	Tetracycline	0.00	0.01	0.00	0.00	7
Antifungal	Fluconazole	0.05	0.04	0.07	0.05	148

Surgical root treatments and the treatment of infections were services that resulted in the lowest proportion of antibiotic prescriptions.

FIGURE 5. Percentage of dental antibiotic visits by dental service type, 2018–2021.

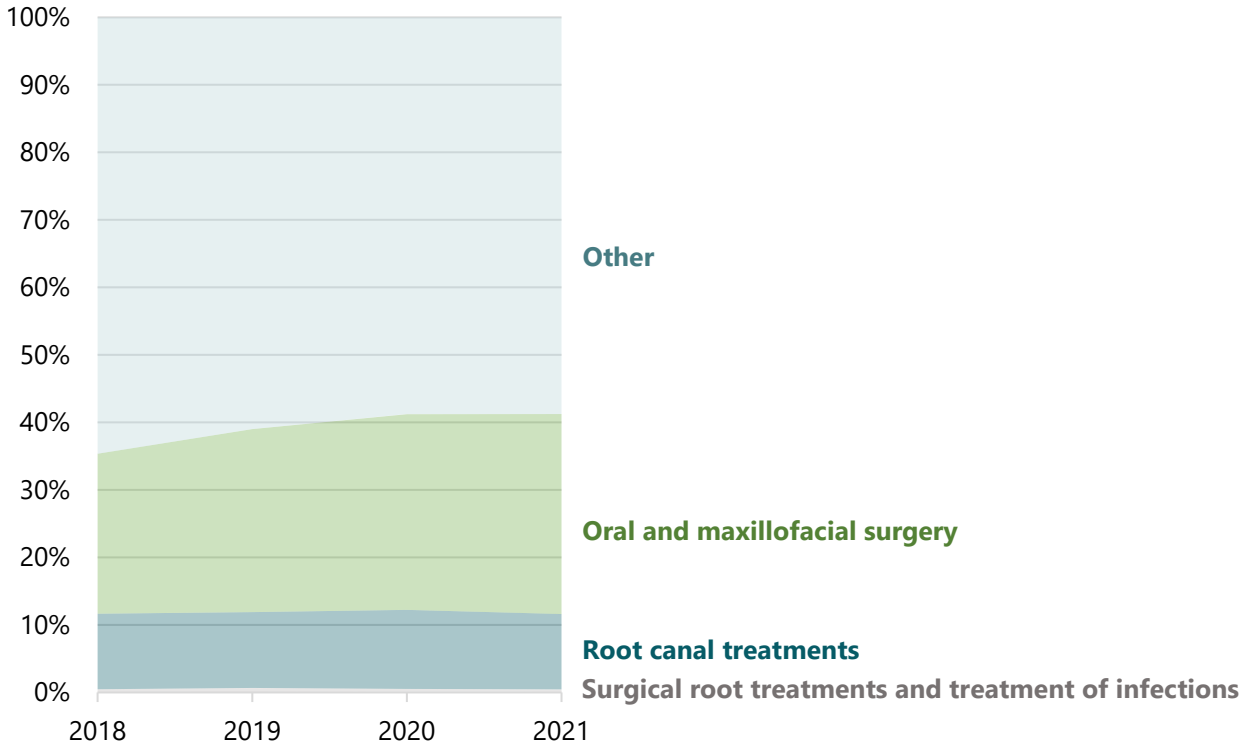


TABLE 2. Percentage of dental antibiotic visits by dental service type, 2018–2021.

Dental service type	2018	2019	2020	2021
Other	64.65%	60.99%	58.78%	58.78%
Oral and maxillofacial surgery	23.70%	27.09%	28.99%	29.61%
Root canal treatments	11.15%	11.27%	11.69%	11.15%
Surgical root treatments	0.33%	0.44%	0.40%	0.35%
Treatment of infections	0.16%	0.21%	0.14%	0.10%

TABLE 3. Descriptors for dental procedures that comprise the “other” category, 2018–2021.

Code description	2018	2019	2020	2021
Limited oral evaluation, problem focused	0.84	0.70	1.08	0.88
Intraoral, complete series of radiographic images	0.33	0.31	0.43	0.40
Intraoral, periapical first radiographic image	3.99	3.90	5.26	4.78
Amalgam, one surface, primary or permanent	0.14	0.08	0.10	0.10
Amalgam, two surfaces, primary or permanent	0.13	0.11	0.10	0.12
Amalgam, three surfaces, primary or permanent	0.06	0.06	0.07	0.07
Resin-based composite, two surfaces, anterior	0.07	0.05	0.06	0.05
Resin-based composite, one surface, posterior	0.03	0.03	0.04	0.04
Resin-based composite, two surfaces, posterior	0.04	0.05	0.03	0.05
Crown, porcelain/ceramic substrate	0.06	0.06	0.08	0.06
Crown, full cast high noble metal	0.03	0.05	0.05	0.05
Core buildup, including any pins when required	0.14	0.11	0.15	0.14
Periodontal maintenance	0.26	0.29	0.34	0.37
Comprehensive orthodontic treatment of the adolescent dentition	0.02	0.01	0.01	0.00
Comprehensive orthodontic treatment of the adult dentition	0.00	0.01	0.00	0.01

Prescriptions by dental specialty

Visits with oral surgeons, endodontists, and periodontists resulted in the highest incidence of antibiotic prescriptions.

FIGURE 6. Dental antibiotic visits per 1,000 visits by dental specialty, 2018–2021.

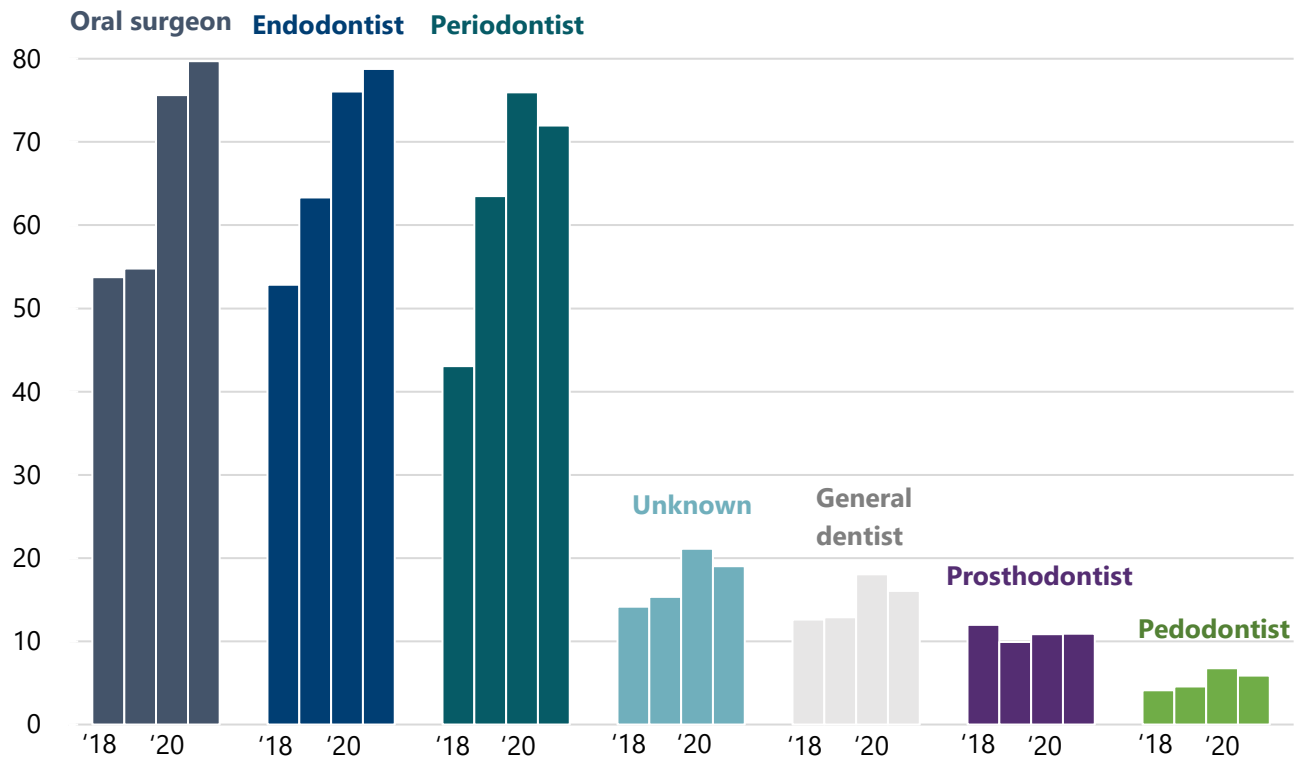


TABLE 4. Dental antibiotic visits per 1,000 visits by dental specialty, 2018–2021.

	Dental specialty							
	Oral surgeon	Endodontist	Periodontist	Unknown	General dentist	Prosthodontist	Pedodontist	Oral maxillofacial radiologist
2018	53.74	52.84	43.06	14.16	12.61	11.97	4.11	0.14
2019	54.80	63.33	63.49	15.34	12.88	9.92	4.57	0.14
2020	75.64	76.06	75.96	21.12	18.04	10.85	6.76	0.07
2021	79.72	78.77	71.97	19.02	16.05	10.91	5.88	0.06

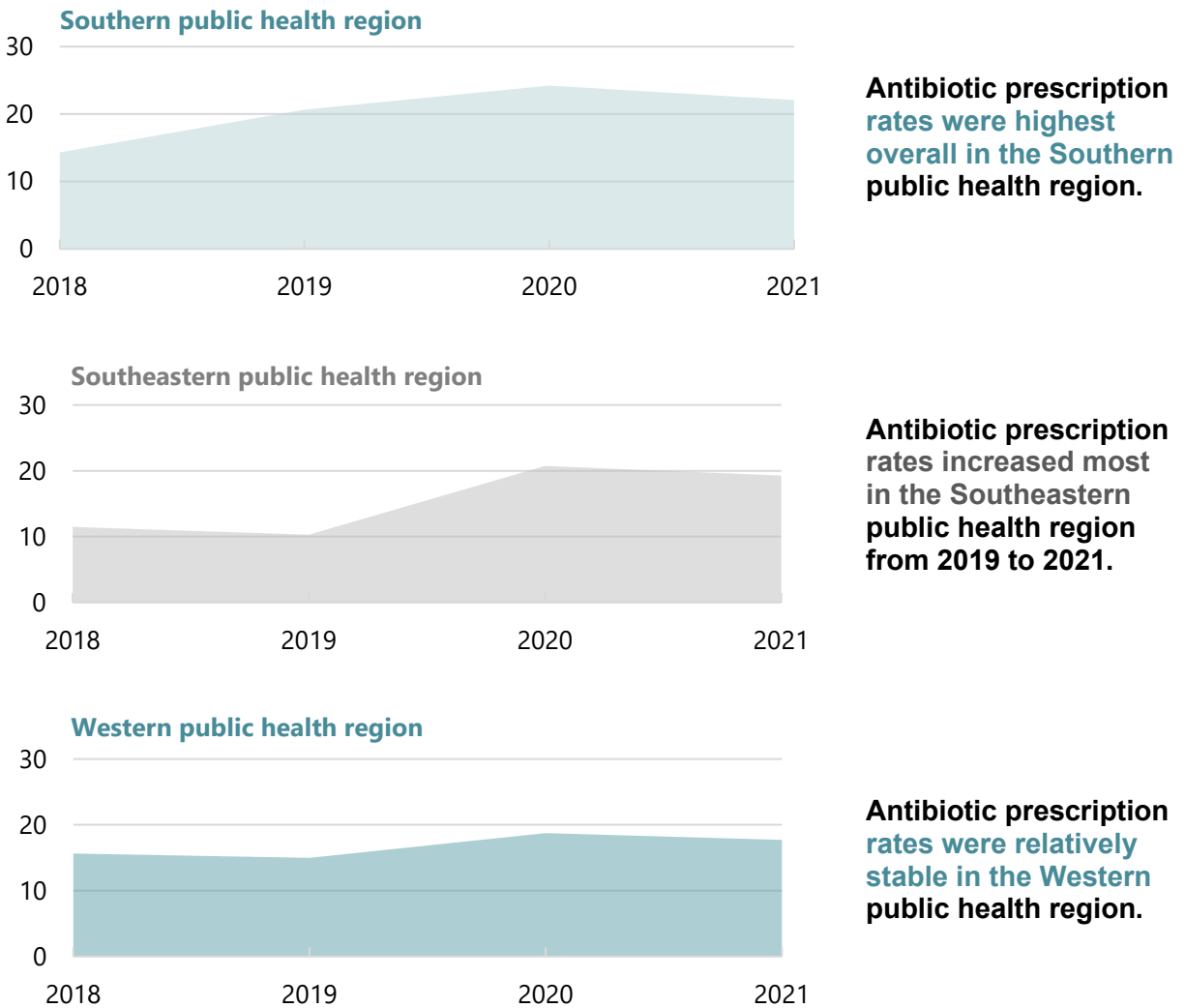
Attributes of patients receiving antibiotic prescriptions

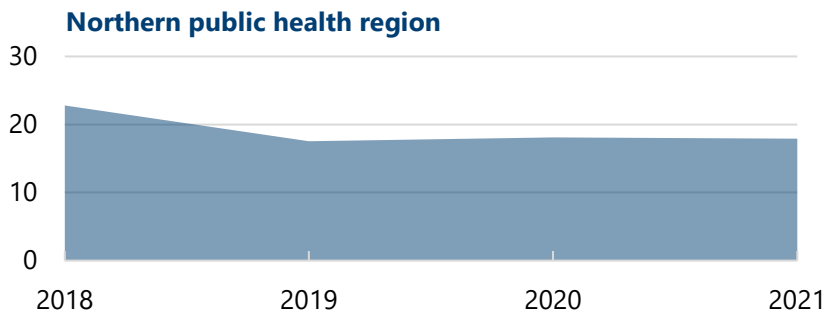
Key findings:

- 818,925 Delta Dental of Wisconsin members had at least one dental claim.
- 41,679 (5.09%) Delta Dental of Wisconsin members had at least one antibiotic prescription claim.

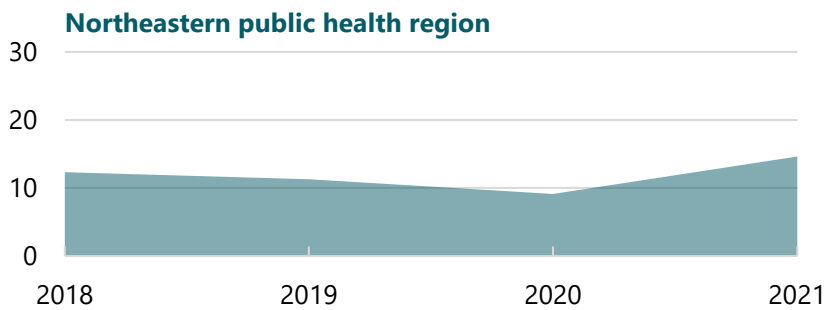
Antibiotic prescription rates varied by public health region ([map in Appendix B](#)).

FIGURE 7. Dental antibiotic visits per 1,000 visits by Wisconsin public health region, 2018–2021.





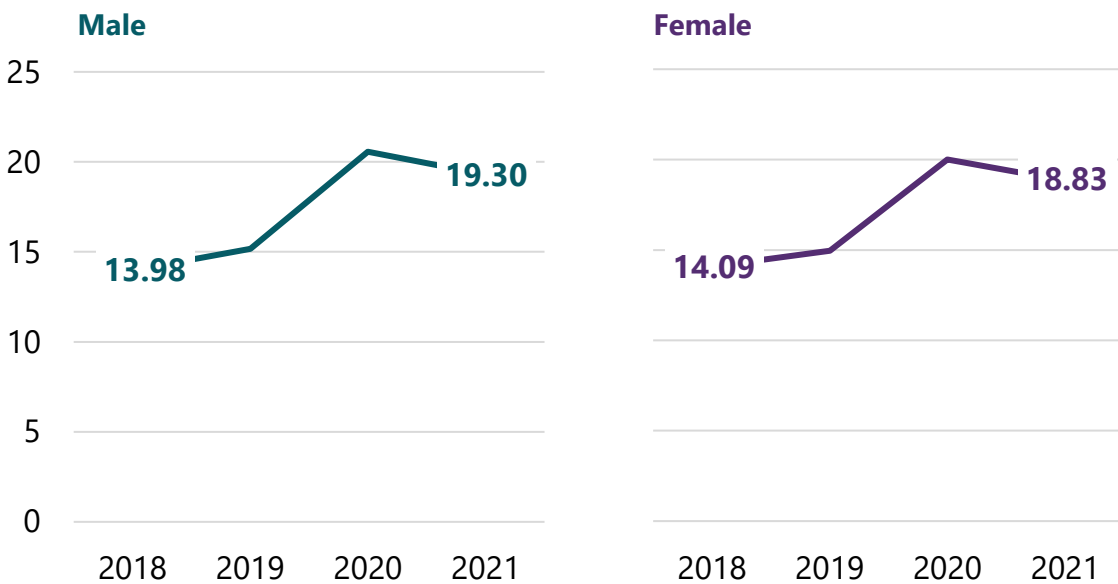
Antibiotic prescription rates decreased in the Northern public health region from 2018 to 2021.



Antibiotic prescription rates were lowest overall in the Northeastern public health region.

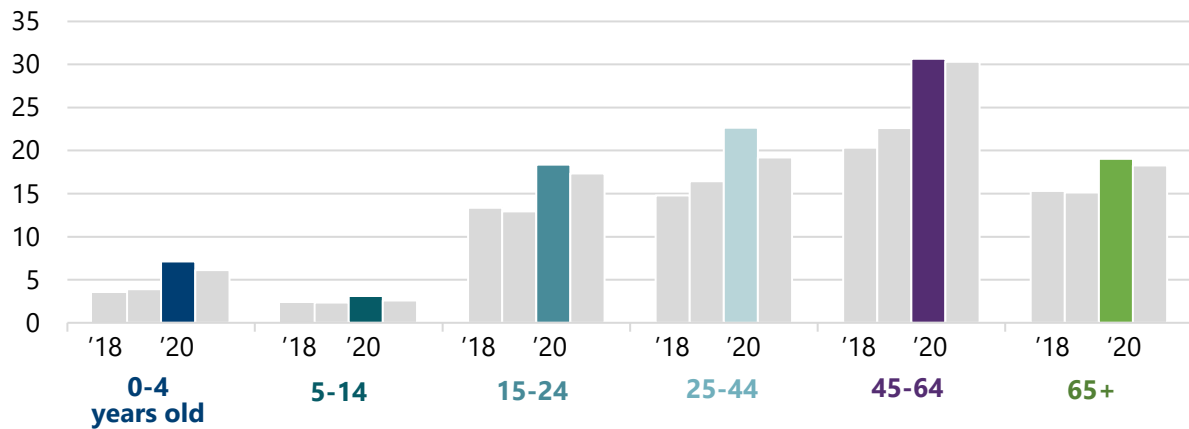
Dental antibiotic visit rates for both males and females increased from 2018–2021.

FIGURE 8. Dental antibiotic visits per 1,000 by patient gender, 2018–2021.



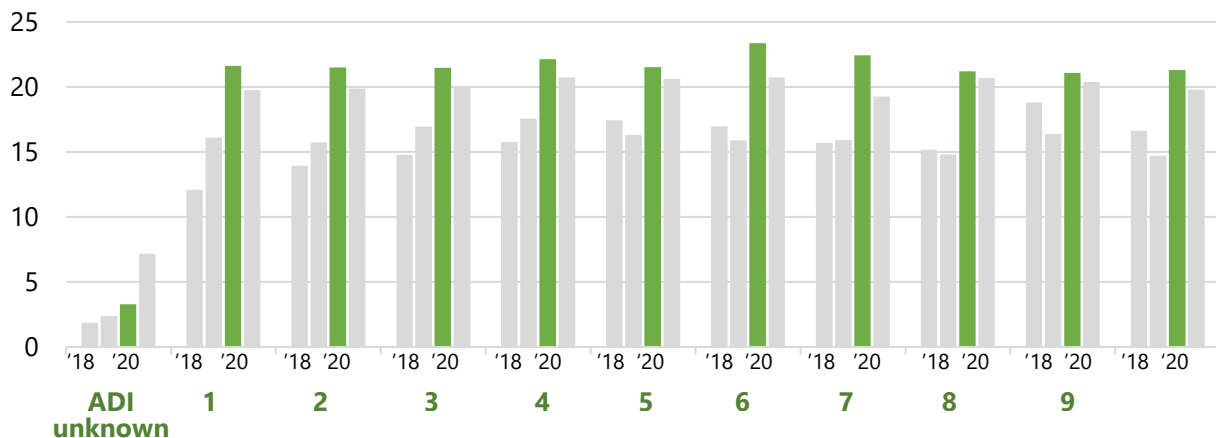
Dental antibiotic visit rates were highest in 2020 across all age groups.

FIGURE 9. Dental antibiotic visits per 1,000 by patient age, 2018–2021.



Antibiotic prescriptions were highest in 2020 for all area deprivation index (ADI) scores.

FIGURE 10. Dental antibiotic visits per 1,000 by ADI, 2018–2021.



Note: 8.2% of members do not have an ADI (labeled “ADI unknown”).

For Wisconsinites who received dental care and antibiotics through insurance, antibiotic use did not differ significantly across ADI deciles.

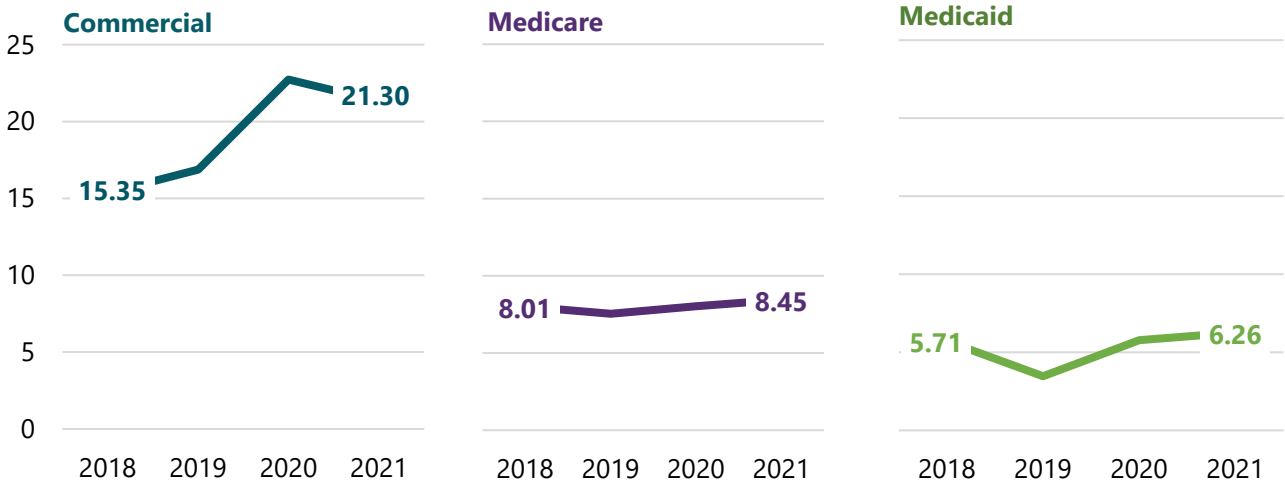
What is the area deprivation index (ADI)?

The ADI ranks neighborhoods by level of socioeconomic disadvantage using factors such as income, education, employment, and housing quality⁶. Neighborhoods are grouped in deciles, with 1 representing the least disadvantaged and 10 the most disadvantaged neighborhoods. ADI was assigned using the patient’s address. More information can be found on the [University of Wisconsin Center for Health Disparities Research](#).

Prescriptions by payer

Dental antibiotic visits increased across all payers.

FIGURE 11. Dental antibiotic visits per 1,000 by payer, 2018–2021.

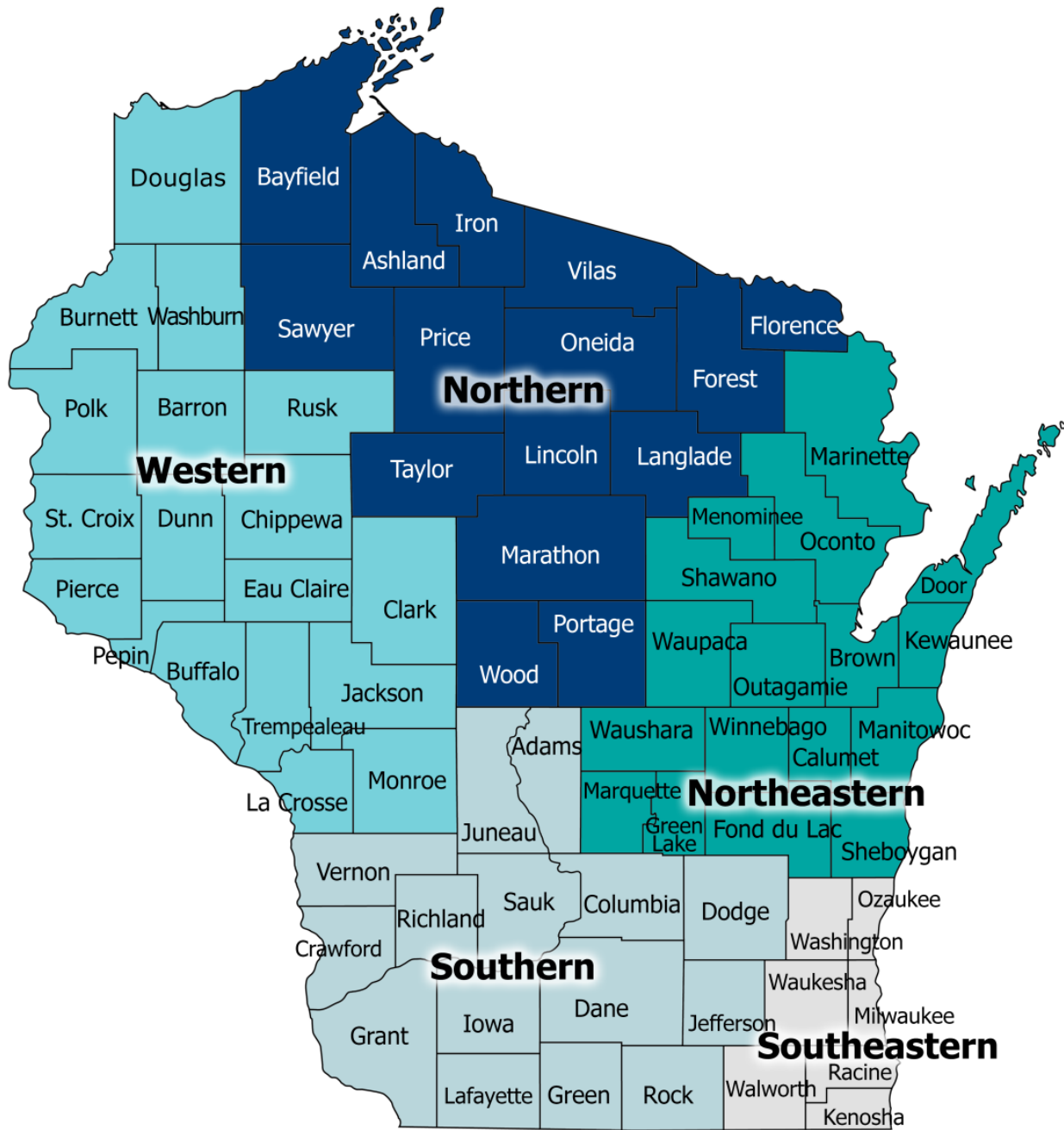


Appendix A

TABLE A1. Hierarchy of dental service categories for association of antibiotic prescriptions.

Service category	Attributing hierarchy
Oral and maxillofacial surgery	1
Root canal treatments	2
Surgical root treatments	3
Treatment of infections	4
Other	5

Appendix B



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

Contributors

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

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