

# » Antibiotic Prescribing in Outpatient Settings in Oregon



# Acknowledgments

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# Executive summary

Unnecessary antibiotic use causes increases in *Clostridium difficile*, antibiotic-resistant organisms, and the need for expensive treatment regimens. Though recent data in Oregon point to encouraging declines in unnecessary antibiotic use for treatment of respiratory infections, other data suggest areas still ripe for intervention. Nearly half of uncomplicated bronchitis cases received antibiotics, though the majority of such infections are viral. Adherence to recent guidelines for limiting use in acute otitis media (AOM) in children and sinusitis in adults, which are the most common conditions for antibiotic prescriptions, could lead to significant declines in antibiotic use. Lastly, broad-spectrum agents are often used both for conditions for which amoxicillin would be more appropriate and for conditions unlikely to benefit from antibiotics.

# Background

Antimicrobial resistance continues to pose serious health threats. At least 2 million people acquire serious infections, with 23,000 of those dying each year, from antibiotic-resistant bacteria in the United States.<sup>1</sup> Although multidrug-resistant Gram-negative bugs spreading through intensive care units capture headlines, excessive use of antibiotics in outpatient settings contributes to unnecessary costs and avoidable adverse events, while simultaneously promoting the development of antibiotic-resistant infections.<sup>2,3</sup> Outpatient settings in the U.S. are home to more than 60% of national antibiotic expenditures. Respiratory conditions, including many where antibiotics are not indicated, remain the most common diagnoses leading to antibiotic prescriptions in children and adults.<sup>4-10</sup>

Since its inception in 2001, the Oregon Alliance Working for Antibiotic Resistance Education (AWARE) has collaborated with academic, health-system, industry, and community partners to promote judicious use of antibiotics for respiratory infections. Based in the Oregon Health Authority (OHA), Oregon AWARE has explored two methodologies to monitor antibiotic use in Oregon: 1) voluntary reporting by health plans; and 2) an OHA database containing medical and pharmacy claims collected from health insurance payers for residents of the State of Oregon. The objectives of this monitoring are to evaluate the impact of AWARE activities and to identify areas needing intervention.

# Methods

## Voluntary Reporting by Health Plans (2008–2015)

In 2008 AWARE began collecting monthly outpatient antibiotic prescription data voluntarily submitted by a group of Oregon health insurers; numbers of courses of oral antibiotics by class, and numbers of enrolled members are received monthly. We use these to calculate monthly and annual rates of oral antibiotic use overall and by antibiotic class. By 2015, 10 health plans with 2.1 million members, representing 52% of the Oregon population, were participating.

## All Payer All Claims Database (2011–2013)

In 2009 the Oregon Legislative Assembly passed a bill creating an all-payer, all-claims (APAC) database to measure the quality, quantity, and cost of health care in Oregon. The database contains medical claims, pharmacy claims, and enrollment data on approximately 2.6 million Oregonians covered by commercial health insurance carriers, licensed third-party administrators, pharmacy benefit managers, Medicaid managed care organizations, Medicaid fee-for-service, and Medicare parts C and D.

We queried medical claims from 2011–13 for outpatient visits for acute respiratory tract infections (ARTIs). We excluded visits with chronic pulmonary diseases (asthma, chronic bronchitis, emphysema, and COPD), other infectious diseases that could necessitate treatment with antibiotics (urinary tract infections, skin and soft tissue infections, and sexually transmitted infections), or any patient seen in the previous 30 days for ARTI. The outpatient medical claims were then linked with pharmacy claims for antibiotic prescriptions within three days of the visit.

We calculated the proportion of index visits in which an antibiotic prescription was filled within three days for each of several ARTIs: acute otitis media (AOM), sinusitis, pharyngitis, bronchitis, and upper respiratory infection (URI). We estimated monthly rates of antibiotic prescribing by dividing the numbers of visits in which antibiotic prescriptions were filled each month by the number of members enrolled that month in health plans contributing data to APAC. Lastly, we classified antibiotics used to treat ARTIs as either narrow- (penicillin, ampicillin, amoxicillin or any first generation cephalosporin) or broad-spectrum (all other antibiotic classes, including amoxicillin-clavulanate).

# Results

In 2015, the annual rate of oral antibiotic use among the 2,106,154 Oregonians covered by our participating health insurers was 40 courses per 100 members. Since 2008, there has been a 29% decline in oral antibiotic use in these plans, and an 8% decline between 2014 and 2015 (Figure 1). Figure 2 shows antibiotic use by class by month for 2013-2015: antibiotic use increased in the winter months, probably indicating prescriptions for respiratory infections. Although use of fluoroquinolones and cephalosporins seemed level throughout the year, the most commonly used drug class in winter months, after penicillins, was macrolides.

**Figure 1. Oral antibiotic prescriptions per member per month, voluntary reporting by health plans, Oregon, 2008-2015**

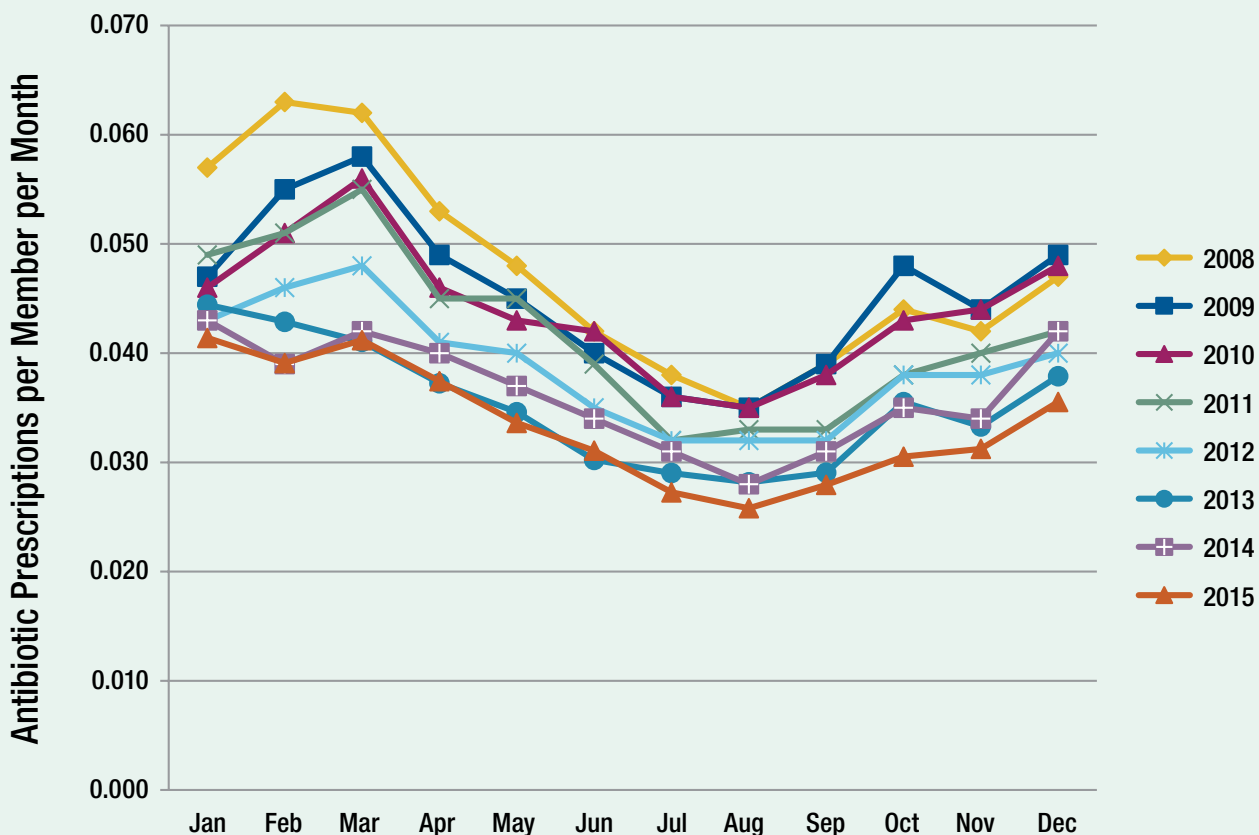
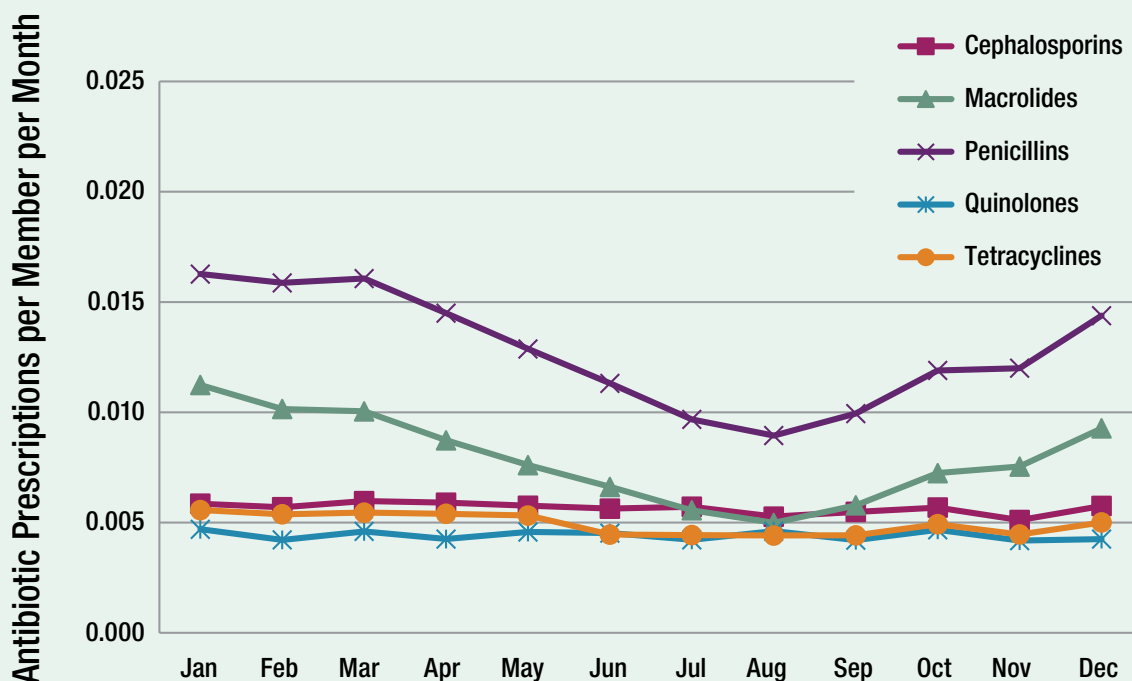


Figure 2. Oral antibiotic prescriptions by class, voluntary reporting by health plans, Oregon, 2013-15



The APAC data showed little variation in the percentage of patients filling prescriptions during that three-year time period, with small increases for AOM and sinusitis, and declines for pharyngitis, bronchitis and URI (Figure 3). However, evaluation of annual rates of antibiotic use during 2011–2013 reveals decreases in rates of patients filling prescriptions for all ARTIs, particularly pharyngitis (Table 1). Rates of antibiotic use in children under age 18 years had the biggest declines, ranging from a 23% drop in use for AOM to a 41% decline in use for pharyngitis. Among adults, the decreases were more modest, ranging from 5% (AOM) to 31% (pharyngitis).

## What Gets Treated Most Often?

The highest rates of antibiotic use (a better indicator for volume of use) in children were for AOM (Figure 4); rates of antibiotic use for AOM in 2013 (74.1/1,000) were more than twice as high as for the next leading indication (pharyngitis, 27.9/1000). Adults were most likely to receive antibiotics for sinusitis (23.6/1,000) and bronchitis (18.4/1,000) (Figure 5).



Table 1. Average annual rates of antibiotic prescriptions filled for upper respiratory tract infections, children and adults, Oregon All Payer All Claims Database, 2011-2013.

	Average annual rates of antibiotics prescribed for each condition (prescriptions/1000 members)			Percent change between 2011 and 2013
	2011	2012	2013	
<b>Children</b>				
Acute otitis media	95.6	73.2	74.1	-23%
Sinusitis	27.0	22.7	19.7	-27%
Pharyngitis	46.9	31.6	27.9	-41%
Bronchitis	16.6	11.5	10.6	-36%
Upper Respiratory Infection	15.3	10.9	10.2	-33%
<b>Adults</b>				
Acute otitis media	6.3	5.8	5.9	-5%
Sinusitis	28.3	26.1	23.6	-17%
Pharyngitis	14.6	10.7	10.1	-31%
Bronchitis	22.4	19.1	18.4	-18%
Upper Respiratory Infection	7.6	7.3	7.0	-8%

Figure 3. Percentage of patients filling prescriptions for URTIs, Oregon, 2011-2013

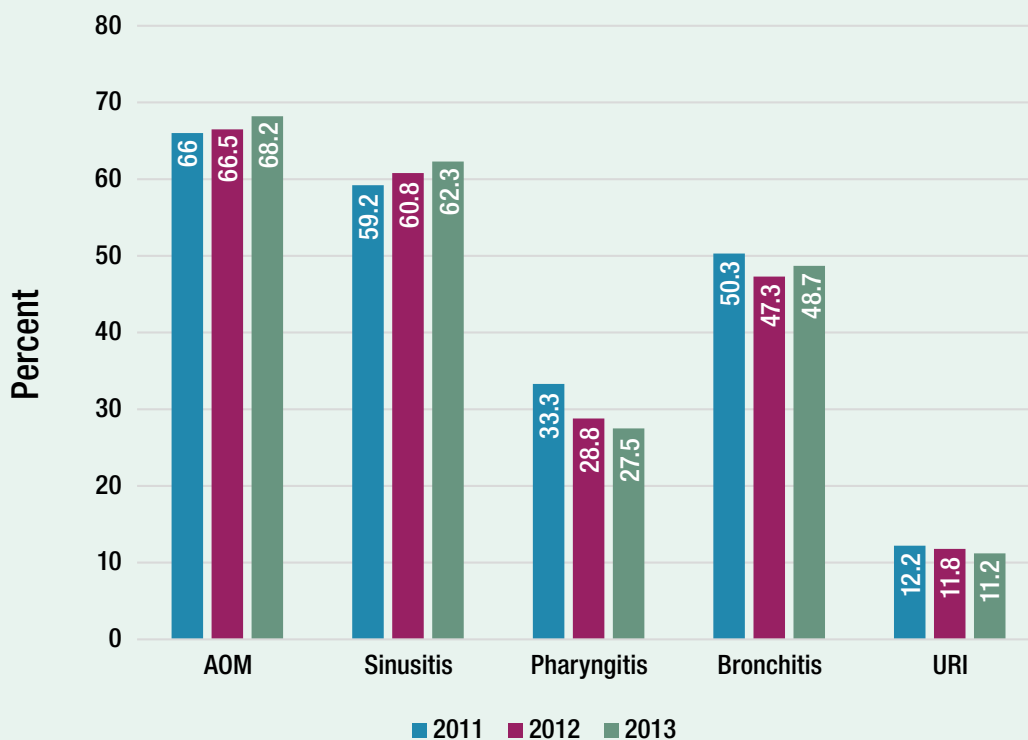


Figure 4. Rates of antibiotic use (courses/1,000) for AOM, sinusitis, pharyngitis, bronchitis, and URI in children, Oregon, 2011-2013

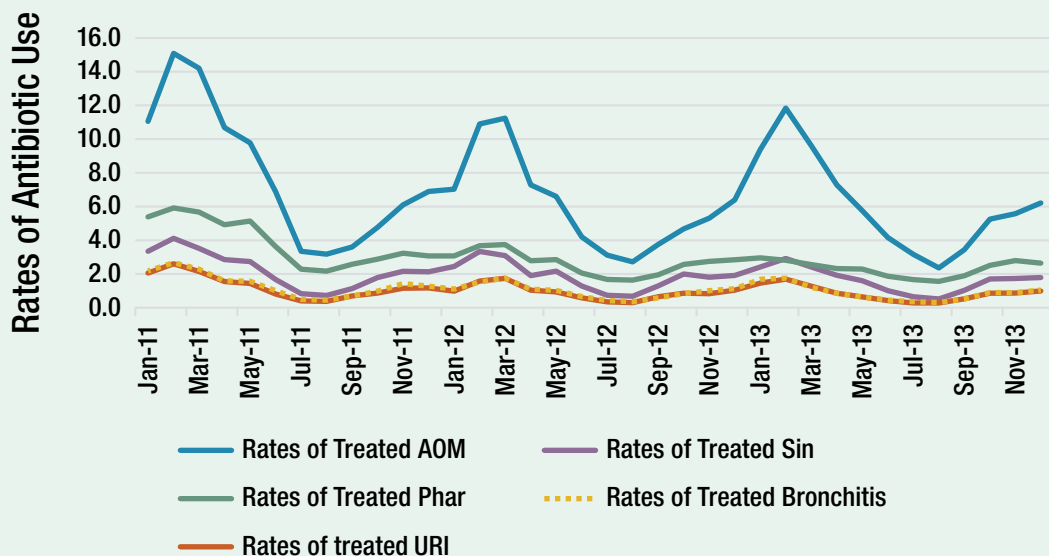
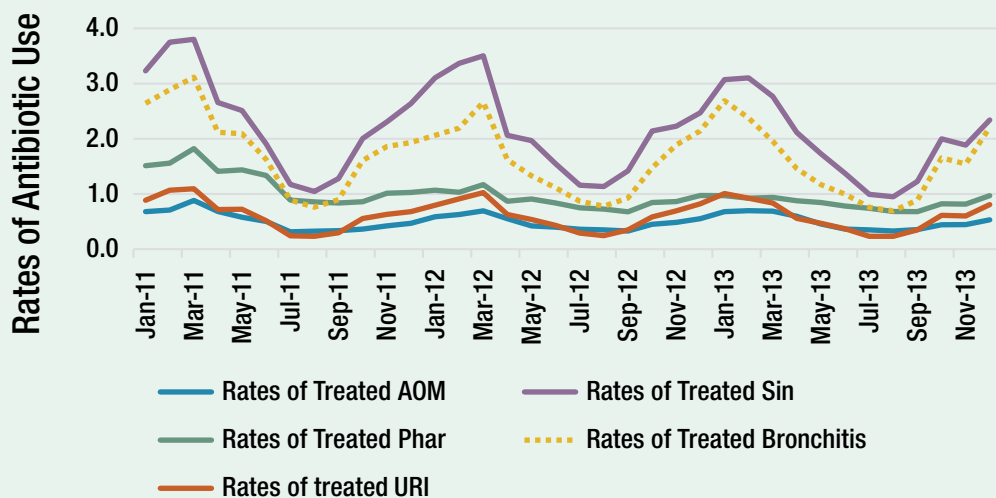


Figure 5. Rates of antibiotic use (courses/1,000 members) for AOM, sinusitis, pharyngitis, bronchitis, and URI, adults, Oregon, 2011-2013



## Risk Factors

Figure 6 shows the proportion of patients receiving antibiotics by age group in 2013: in general, the proportion receiving antibiotics declines with age for acute otitis media, sinusitis, and pharyngitis. The effect is less pronounced for bronchitis, and is reversed for URI, where the probability of obtaining an antibiotic increases with age. Figures 7 and 8 depict antibiotic prescribing by geography and payer status in 2013. There is little variation in antibiotic prescribing between practices in rural and urban settings, with the exception of slightly higher percentages of prescriptions filled in rural settings for pharyngitis and URI. Markedly higher percentages of prescriptions are filled by Medicaid patients than by privately insured and Medicare patients for all ARTIs except for URIs.

Figure 6. Proportion of patients filling antibiotic prescriptions, by age group, Oregon, 2013

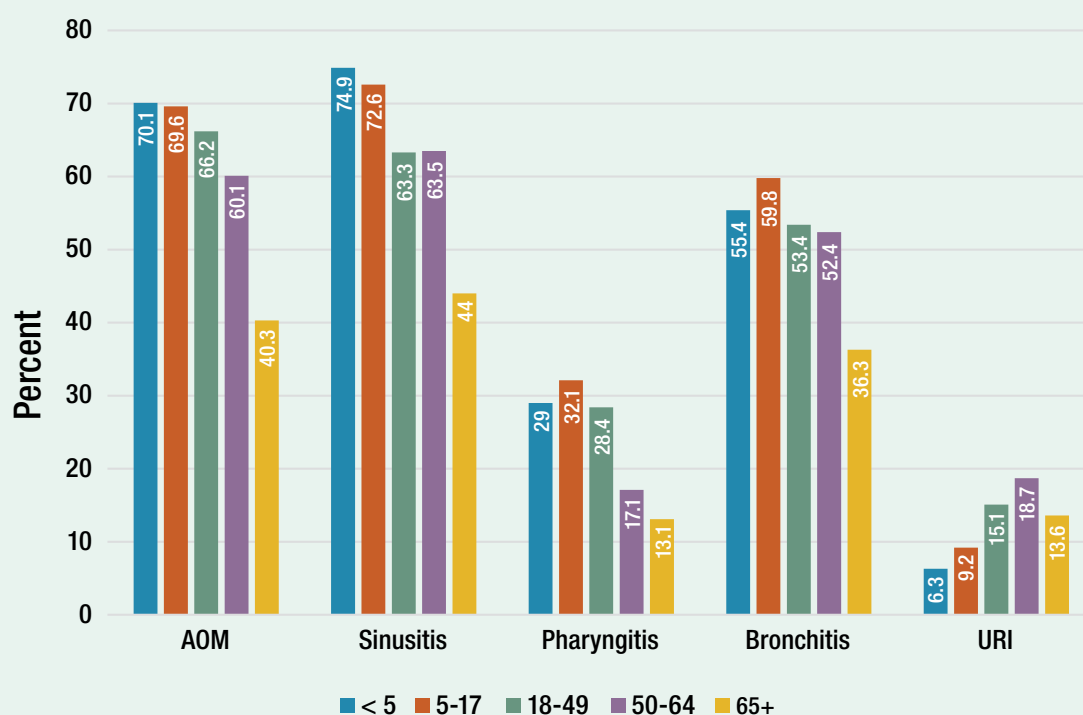


Figure 7. Proportion of patients filling antibiotic prescriptions, by rural vs urban residence, Oregon, 2013

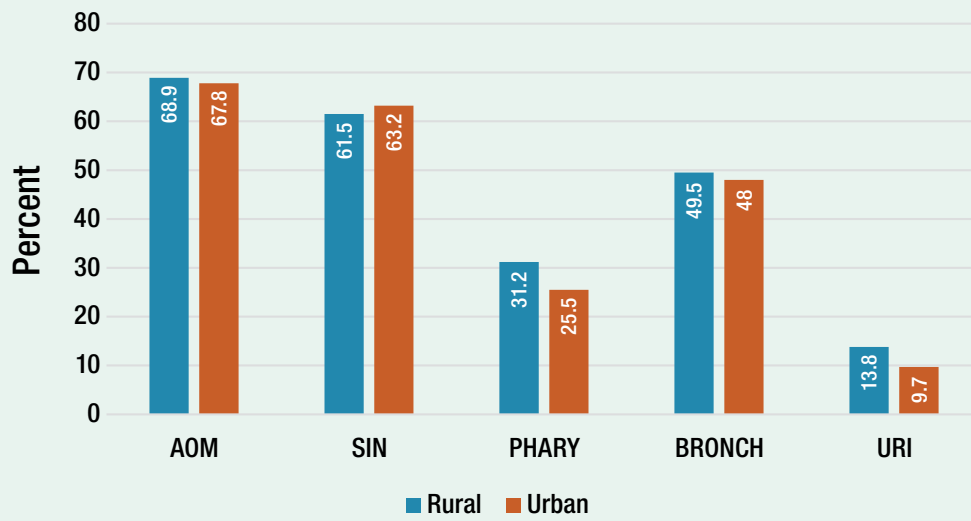
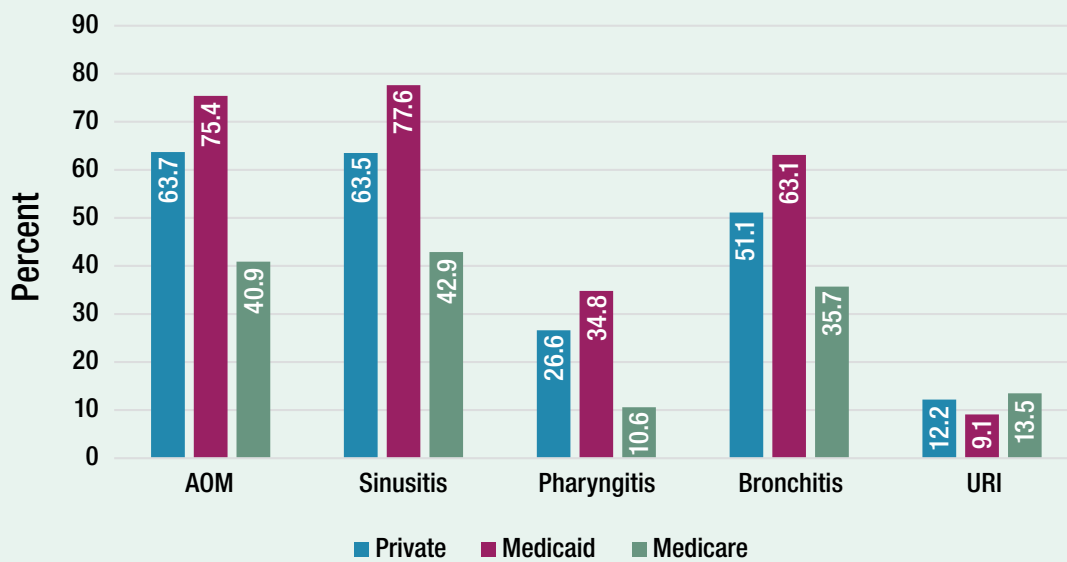


Figure 8. Proportion of patients filling antibiotic prescriptions, by payer, Oregon 2013



# Misuse of Broad-Spectrum Drugs

Figure 9 shows the proportion of patients receiving prescriptions for broad-spectrum agents among those who filled an antibiotic prescription in 2013. Broad-spectrum use increases with age for all types of ARTIs until age 65 (Figure 10). Bronchitis is most commonly treated with a broad-spectrum agent, with 91% of those filling antibiotic prescriptions receiving a broad-spectrum antibiotic, followed by URI (72%) and sinusitis (69%). Table 2 provides data on classes of drugs used in 2013: most patients with AOM and pharyngitis received narrow-spectrum agents, although patients filling prescriptions for sinusitis were more likely to receive amoxicillin-clavulanate or azithromycin. Azithromycin was the antibiotic most commonly used for bronchitis (69%) and URIs (49%), clinical syndromes for which antibiotics are rarely warranted.

**Figure 9. Broad vs. narrow spectrum antibiotic use among patients filling antibiotic prescriptions, Oregon, 2013**

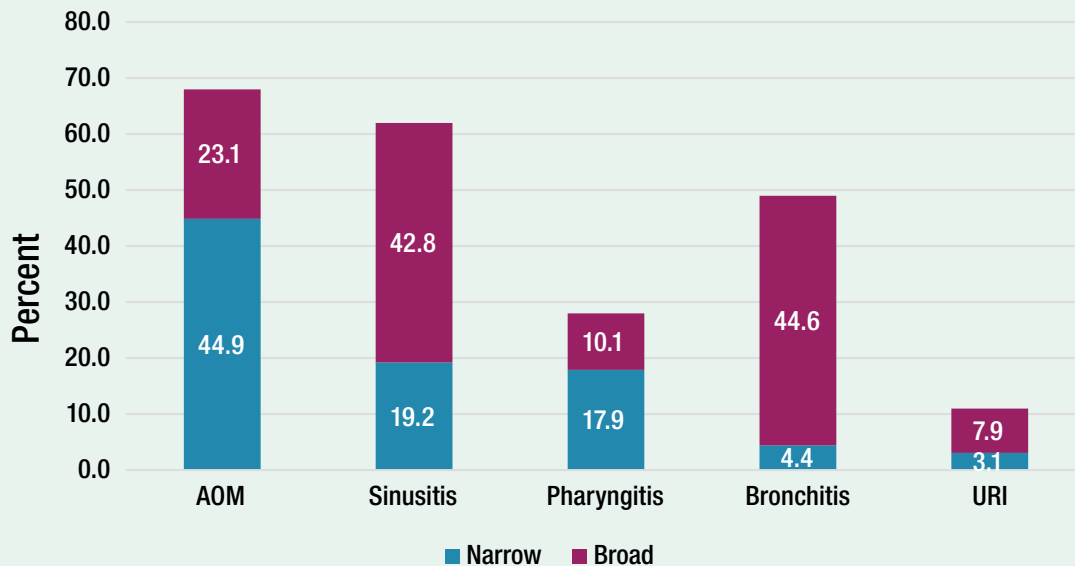


Figure 10. Broad spectrum antibiotic use among patients filling antibiotic prescriptions, Oregon, 2013

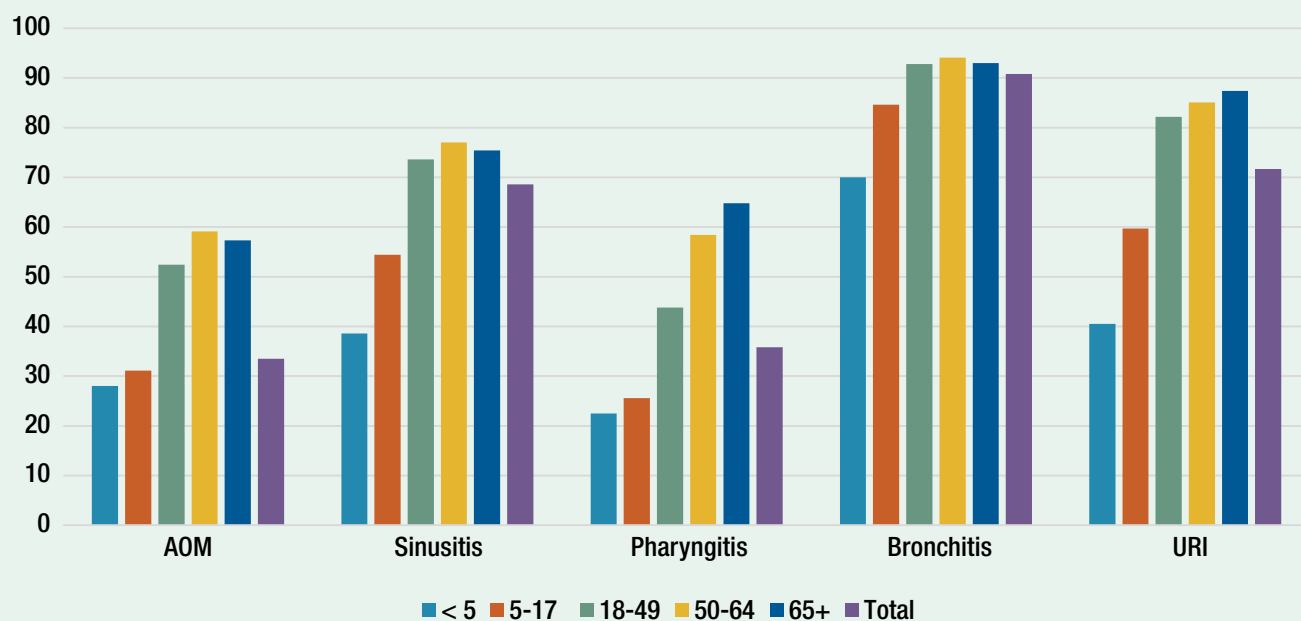


Table 2. Antibiotic or antibiotic class used to treat upper respiratory tract infections, Oregon, 2013.

Antibiotic Class	AOM (n*=64,291)	Sinusitis (n=57,935)	Pharyngitis (n=38,656)	Bronchitis (n=41,722)	URI (n=20,281)
<b>Narrow-spectrum beta lactams†</b>	66.5%	31.4%	64.2%	9.2%	28.3%
<b>Amoxicillin-clavulanate</b>	11.3%	26.0%	7.2%	5.7%	8.7%
<b>Azithromycin</b>	12.0%	25.2%	21.1%	69.4%	48.8%
<b>Fluoroquinolones</b>	0.5%	3.0%	0.9%	3.6%	2.7%
<b>Second-generation and above cephalosporins</b>	7.6%	6.0%	2.5%	1.9%	3.4%
<b>All other broad-spectrum agents</b>	2.1%	8.4%	4.1%	9.4%	8.1%

\* n indicates number of patients filling an antibiotic prescription for that condition

† Includes penicillin, ampicillin, amoxicillin, and first-generation cephalosporins

# Summary

Recent trends in antibiotic use in Oregon are encouraging. Data from voluntary health insurer reporting show steady declines in overall use since 2008, whereas data from APAC show ARTI decreases between 2011 and 2013. Additionally, the data are helpful in identifying targets for further intervention: sinusitis and bronchitis are the biggest sources of antibiotic use in adults, and AOM is the most common condition for which antibiotics are used in children. We should prioritize reducing broad-spectrum antibiotics in bronchitis, since its etiology is rarely bacterial.

Fewer medical claims for diagnoses help explain the seemingly contradictory finding that the proportion of patients treated for AOM and sinusitis rose slightly between 2011 and 2013 at the same time that rates of antibiotic use decreased for both conditions. This is explained by fewer medical claims for those diagnoses in the same time period. Since the proportion of infections treated was roughly the same over the three years, the actual volume of antibiotic use fell. Since guidelines on the management of sinusitis and AOM published in 2012 and 2013,<sup>11,12</sup> respectively (as well as previous versions of those guidelines), have emphasized careful assessment of symptoms and physical findings before recommending antibiotic use for both conditions, it may be that Oregon clinicians are adhering to stricter criteria for treating these conditions. So even if the proportion treated stays the same, the volume of antibiotic use falls, presumably along with antibiotic resistance.

There are limitations to the methods of tracking antibiotic use presented here. Neither of the two systems captures all patients in Oregon, and selection bias could result if non-monitored patients have different rates of antibiotic use than those covered by one of the plans participating in our voluntary reporting system or submitting data to APAC. Specifically for APAC data, another limitation is the use of un-validated administrative diagnostic code data (without resources to validate the diagnoses of ARTIs through medical-record reviews); this could result in the misclassification of ARTIs, and we are unable to assess the severity of illnesses or gauge the appropriateness of treatment of individual encounters. Lastly, APAC data do not tell us the proportion of patients for whom the clinician *prescribed* an antibiotic; they tell us only about patients who actually *filled* prescriptions. These proportions cannot be compared to estimates published from the National Ambulatory Care Survey (NAMCS), since that surveillance system captures what the clinician prescribed for the patient — which can be expected to exceed the number filled.

In summary, data from two different surveillance systems suggest that oral antibiotic use is declining in Oregon, point to areas in which antibiotics still seem to be used inappropriately, and suggest messages to clinicians that could lead to still further improvements in antibiotic prescribing. First, for pediatric patients, for whom the most common indication is AOM, adherence to published criteria for deciding which patients diagnosed with AOM warrant antibiotic therapy is a key to reducing unnecessary antibiotic use in children. For adults, the age group most commonly receiving antibiotics for sinusitis and bronchitis, the key objectives should be to limit the prescription of antibiotics for sinusitis to patients who meet IDSA criteria for antibiotic treatment; and not use antibiotics for acute bronchitis in persons without chronic lung disease. Lastly, guidelines for both sinusitis and AOM suggest that amoxicillin or, if beta-lactamase-producing *Haemophilus influenzae* is suspected, amoxicillin-clavulanate, be considered the agent of choice. The APAC data confirm that broad-spectrum agents, particularly macrolides, are overused. More appropriate choices of first-line agents will prevent the emergence of difficult-to-treat, antibiotic-resistant infections.



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