



## REPORT

# ANALYZING REGIONAL AND PRODUCT LINE VARIATIONS ACROSS HEDIS® ANTIBIOTIC USE MEASURES

*Antibiotic resistance is an ongoing global challenge, with increasing incidence in the United States. A major contributor to antibiotic resistance is inappropriate prescribing. Tracking and monitoring antibiotic use for respiratory conditions can help to ensure antibiotics are being prescribed correctly. The National Committee for Quality Assurance (NCQA), with funding from The Pew Charitable Trusts, used the current literature and all four antibiotic prescribing Healthcare Effectiveness Data and Information Set (HEDIS®)<sup>1</sup> measures to develop this report on findings related to antibiotic prescribing variation across geographic regions and product lines. This report aims to identify and explain the gaps in literature and research for both appropriate and inappropriate antibiotic prescribing.*



## SECTION 1: HEDIS ANTIBIOTIC USE MEASURES

NCQA has four publicly reported HEDIS quality measures that assess health plan performance on antibiotic use. Measure data in this report were sourced from HEDIS Measure Year (MY) 2022 (which includes data collected from health plans January 1 – December 31, 2022). Data were collected from 39 states, including the District of Columbia but no other US territories (Table 1). The plans in this report have reportable rates and only operate in one region (multi-regional plans were excluded). Values are indicative of the level of performance for each measure (Table 2). This report used the US Census Regions and Divisions to categorize geographic regions when evaluating antibiotic utilization in the United States (Table 1).

**TABLE 1. US Census Regions and Divisions**

CENSUS REGION								
Northeast		Midwest		South			West	
CENSUS DIVISION								
New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
INCLUDED STATES								
Connecticut	New Jersey	Indiana	Iowa	Delaware	Alabama	Arkansas	Arizona	Alaska
Maine	New York	Illinois	Kansas	District of Columbia	Kentucky	Louisiana	Colorado	California
Massachusetts	Pennsylvania	Michigan	Minnesota	Florida	Mississippi	Oklahoma	Idaho	Hawaii
New Hampshire		Ohio	Missouri	Georgia	Tennessee	Texas	New Mexico	Oregon
Rhode Island		Wisconsin	Nebraska	Maryland			Montana	Washington
Vermont			North Dakota	North Carolina			Utah	
			South Dakota	South Carolina			Nevada	
				Virginia			Wyoming	
				West Virginia				

<sup>1</sup> HEDIS® is a registered trademark of the National Committee for Quality Assurance (NCQA).

**TABLE 2. HEDIS Antibiotic Measures**

MEASURE	DESCRIPTION	HIGHER RESULTS INDICATE...	DOMAIN
Antibiotic Utilization for Respiratory Conditions (AXR)	The percentage of episodes for members 3 months of age and older with a diagnosis of a respiratory condition that resulted in an antibiotic dispensing event.	Overall prescription rate for respiratory related diagnoses	Utilization Measure
Avoidance of Antibiotic Treatment for Acute Bronchitis/ Bronchiolitis (AAB)	The percentage of episodes for members ages 3 months and older with a diagnosis of acute bronchitis/ bronchiolitis that did not result in an antibiotic dispensing event.	Appropriate treatment for bronchitis/bronchiolitis (the percentage of episodes that were not prescribed an antibiotic)	Effectiveness of Care
Appropriate Treatment for Upper Respiratory Infection (URI)	The percentage of episodes for members 3 months of age and older with a diagnosis of upper respiratory infection that did not result in an antibiotic dispensing event.	Appropriate treatment for upper respiratory infection (the percentage of episodes that were not prescribed an antibiotic)	Effectiveness of Care
Appropriate Testing for Pharyngitis (CWP)	The percentage of episodes for members 3 years and older where the member was diagnosed with pharyngitis, dispensed an antibiotic, and received a group A streptococcus (strep) test for the episode.	Completion of the recommended testing required to merit antibiotic treatment for pharyngitis.	Effectiveness of Care

Antibiotic Utilization for Respiratory Conditions (AXR) is a HEDIS utilization measure with first-year data collected during MY 2022. AXR represents the percentage of all respiratory antibiotics prescribed, capturing both appropriate and inappropriate prescribing. The other three measures (Appropriate Testing for Pharyngitis [CWP], Appropriate Treatment for Upper Respiratory Infection [URI], Avoidance of Antibiotic Treatment for Acute Bronchitis/Bronchiolitis [AAB]) are effectiveness of care measures which means: their results cannot be directly compared with AXR results.

Effectiveness of care measures consider appropriate prescribing and thus can directly translate to good performance or room for improvement. AXR can be used in conjunction with CWP, URI and AAB to compare respiratory antibiotic prescribing trends. Total respiratory antibiotic prescribing, compared with performance on CWP, URI or AAB, and focuses on appropriate prescribing for certain conditions, allows us to observe prescribing trends over time and predict how much of the total rate is attributable to inappropriate prescribing.

**Figure 1. Antibiotics Measure Rate Distribution by Measure and by Product Line**  
**Measurement Year 2022, Total Indicator Only**

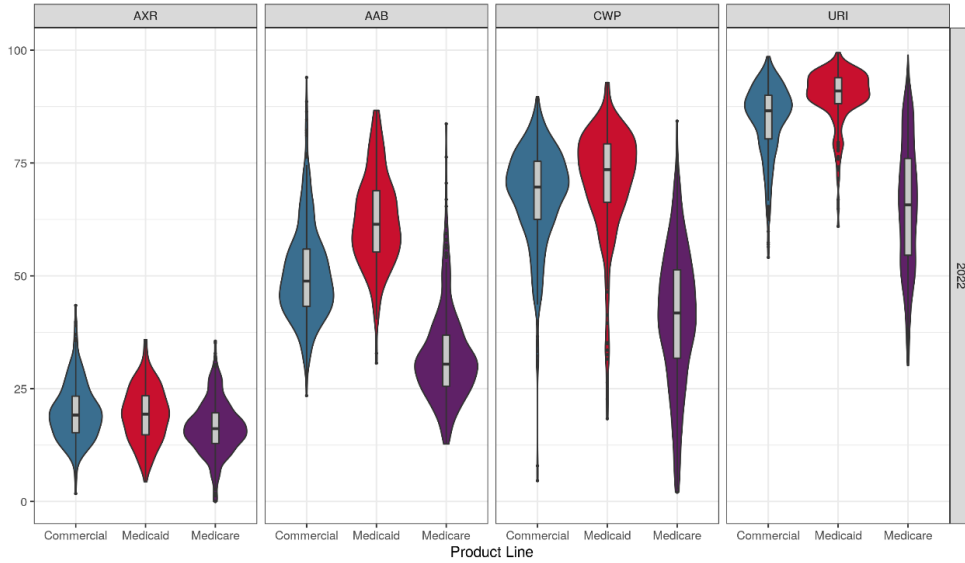


Figure 1 illustrates measure performance differences between product lines for all four measures in MY 2022. For the AXR measure, performance across product lines is similar, with a slightly lower average for Medicare. For the AAB, CWP and URI measures, performance for the Medicare product line is significantly lower than for Commercial and Medicaid. For the CWP and URI measures, performance for the Medicare population has a high degree of variability (data spread).

**Figure 2. Medicare Antibiotics Measure Rate Distribution by Measure and by Region**  
**Measurement Year 2022, Total Indicator Only**

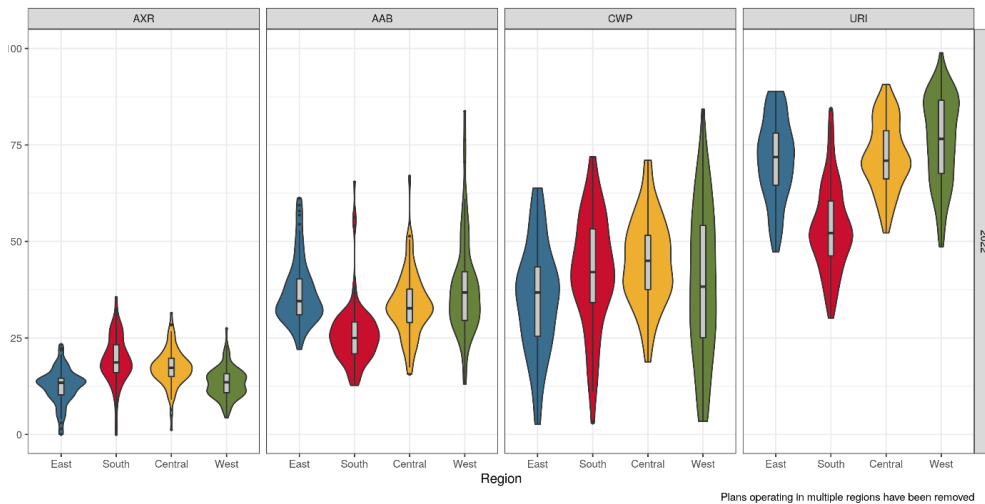


Figure 2 illustrates measure rate distribution, for Medicare across the four US census regions. For the AAB and URI measures, the South region demonstrates significantly lower performance. For the CWP and URI measures, there is a high degree of variability in all regions, with the most variability being in the West region.

**Figure 3. Medicaid Antibiotics Measure Rate Distribution by Measure and by Region**  
**Measurement Year 2022, Total Indicator Only**

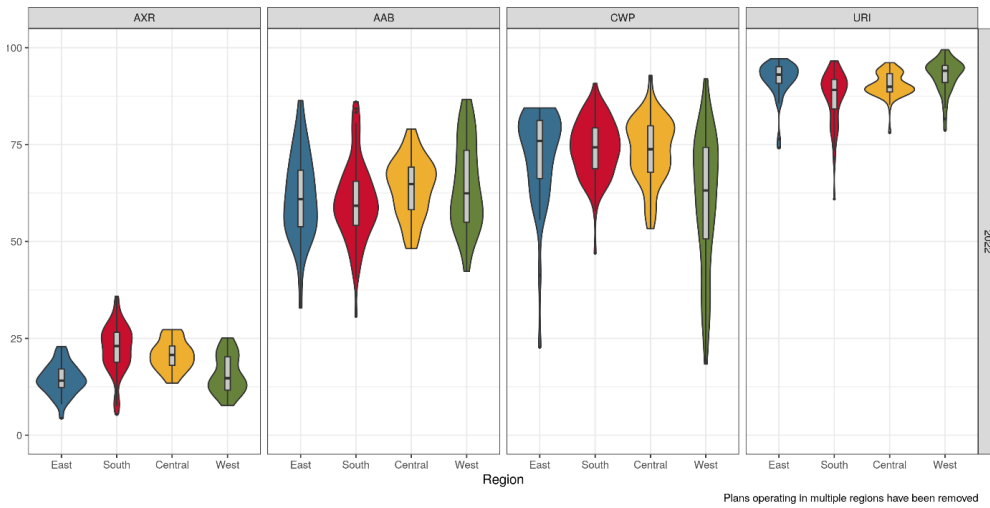


Figure 3 illustrates the measure rate distribution for the Medicaid product line across the four US census regions. There is a high degree of variability for the AAB and CWP measures, and less variability between data points for AXR and URI. The East and West regions have the highest level of variability for CWP.

**Figure 4. Commercial Antibiotics Measure Rate Distribution by Measure and by Region**  
**Measurement Year 2022, Total Indicator Only**

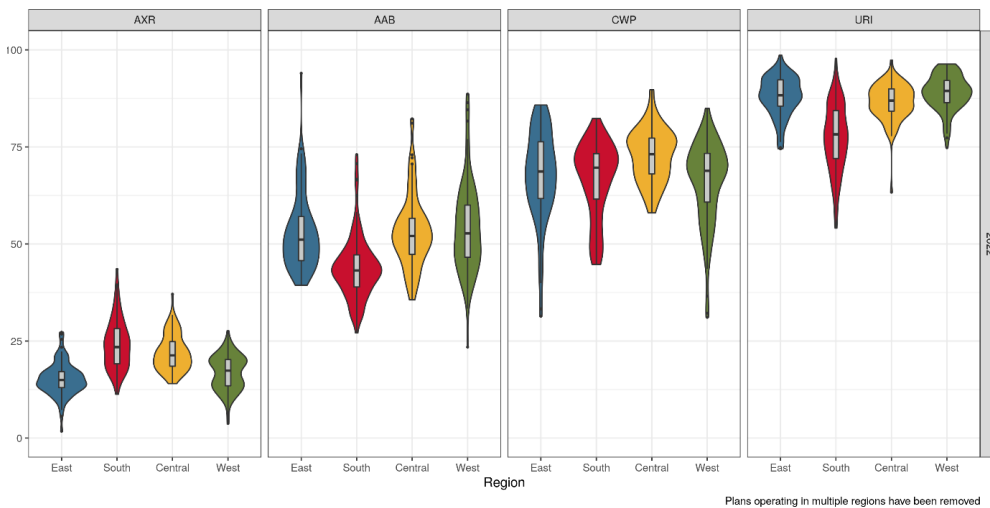


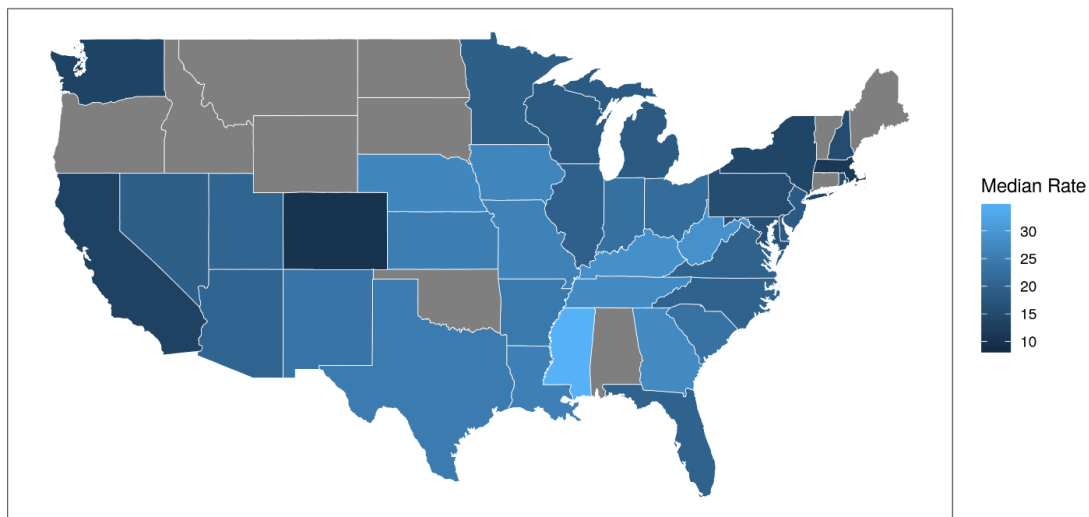
Figure 4 illustrates the measure rate distribution for the Commercial product line across all the four US census regions. The Commercial and Medicaid AXR performance show similar distribution.

**TABLE 3. AXR Mean Measure Performance Across US Census Regions by Product Line**

	<b>COMMERCIAL</b>	<b>MEDICARE</b>	<b>MEDICAID</b>
Northeast	15.1	12.5	14.4
Midwest	22.0	17.4	22.3
South	24.1	19.3	20.6
West	16.8	13.4	15.7

Table 3 highlights the average antibiotic utilization rates of regions and product lines for the AXR measure, where a higher or lower rate does not indicate better or worse performance, but rather, antibiotic utilization for respiratory conditions across a plan’s membership.

**Figure 5. Medicaid AXR Mean Rates by State**  
Measurement Year 2022, Total Indicator Only



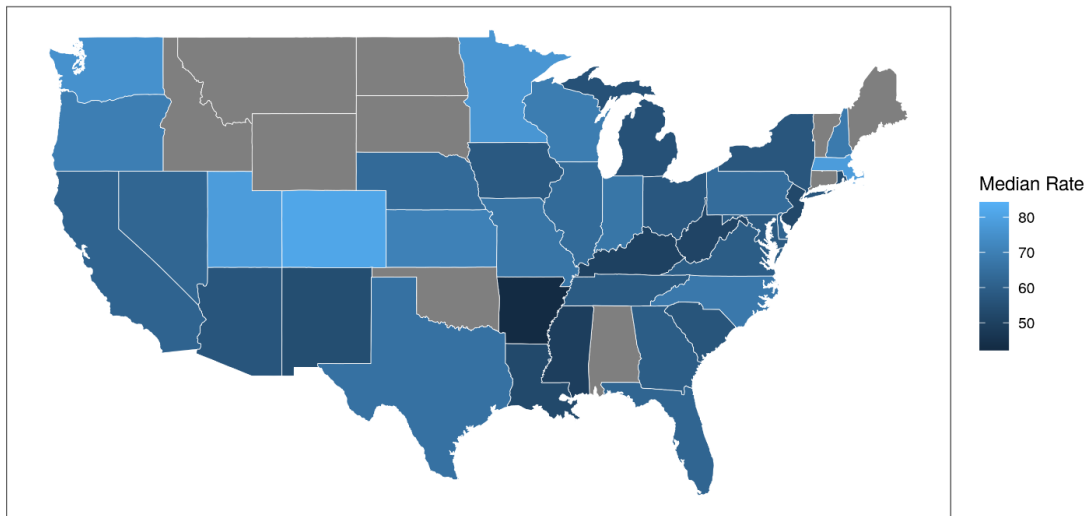
States in gray are unavailable in the HEDIS data for this measure

**TABLE 4. AAB Mean Measure Performance Across US Census Regions by Product Line**

	COMMERCIAL	MEDICARE	MEDICAID
Northeast	52.6	36.5	56.2
Midwest	52.4	33.7	55.7
South	43.7	26.3	53.1
West	53.5	39.1	60.8

Table 4 highlights the average performance rates of regions and product lines for the AAB measure, where higher rates indicate better performance. The lowest performance rate was seen in the South for the Medicare population, and the highest was seen in the West for the Medicaid population.

**Figure 6. Medicaid AAB Mean Rates by State**  
Measurement Year 2022, Total Indicator Only



States in gray are unavailable in the HEDIS data for this measure

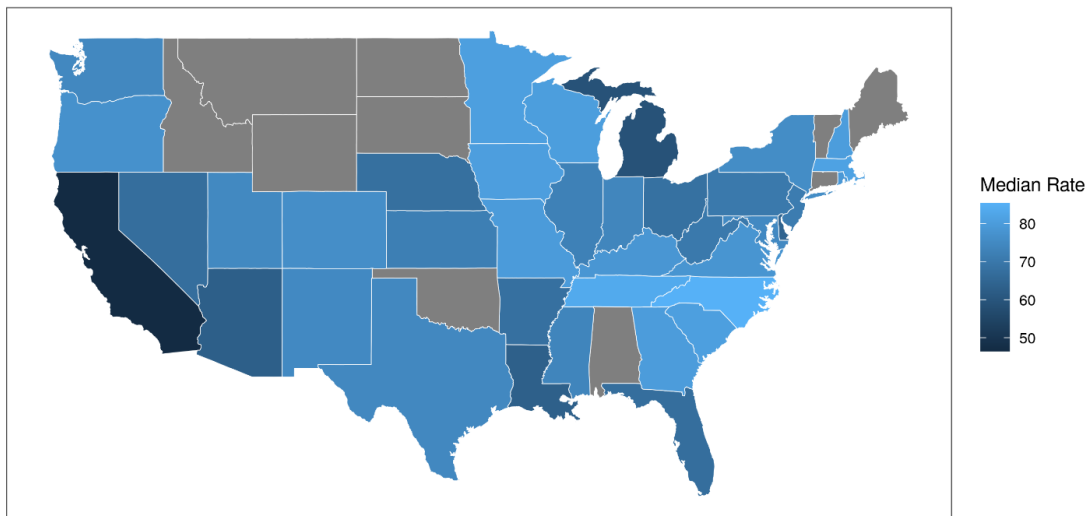
**TABLE 5. CWP Mean Measure Performance Across US Census Regions by Product Line**

	COMMERCIAL	MEDICARE	MEDICAID
Northeast	63.7	35.4	58.6
Midwest	68.1	45.6	62.2
South	63.1	42.7	64.0
West	61.0	38.5	51.3

Table 5 highlights the average performance rates of regions and product lines for the CWP measure, where higher rates indicate better performance. The lowest performance rate was seen in the Northeast, among the Medicare population, and the highest performance rate was seen in the Midwest, among the Commercial population. The Midwest and South regions performed similarly for most product lines, with a slightly higher average for the Midwest.

**Figure 7. Medicaid CWP Mean Rates by State**

Measurement Year 2022, Total Indicator Only



States in gray are unavailable in the HEDIS data for this measure



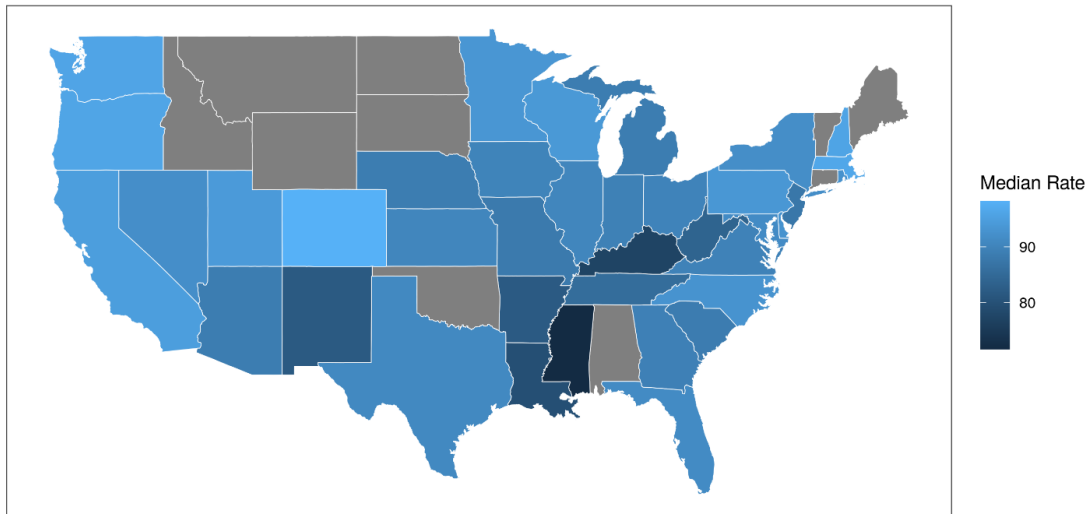
**TABLE 6. URI Mean Measure Performance Across US Census Regions by Product Line**

	COMMERCIAL	MEDICARE	MEDICAID
Northeast	84.2	70.4	85.0
Midwest	83.3	72.0	85.7
South	73.2	52.9	79.1
West	86.5	76.2	89.1

Table 6 highlights the average performance rates of regions and product lines for the URI measure, where higher rates indicate better performance. The lowest performance rate was seen in the South, among the Medicare population, and the highest performance rate was seen in West, among the Medicaid population.

**Figure 8. Medicaid URI Mean Rates by State**

Measurement Year 2022, Total Indicator Only



States in gray are unavailable in the HEDIS data for this measure

**TABLE 7. AXR Mean Measure Performance by State Among Medicaid Plans**

STATE	NUMBER OF PLANS THAT REPORTED ON AXR	MEAN
Arizona	3	18.3
Arkansas	4	19.5
California	11	12.8
Colorado	4	9.5
Delaware	2	15.3
District of Columbia	5	7.4
Florida	8	17.5
Georgia	3	26.7

Hawaii	4	11.2
Illinois	4	17.8
Indiana	4	21.1
Iowa	2	21.1
Kansas	3	20.5
Kentucky	6	26.2
Louisiana	5	23.5
Maryland	9	15.5
Massachusetts	6	10.7
Michigan	8	17.6
Minnesota	1	17.6
Mississippi	2	29.4
Missouri	2	27.6
Nebraska	2	22.1
Nevada	2	19.0
New Hampshire	3	13.8
New Jersey	5	17.0
New Mexico	3	18.5
New York	11	12.0
North Carolina	4	17.3
Ohio	4	19.8
Pennsylvania	12	14.8
Rhode Island	2	14.2
South Carolina	5	20.8
Tennessee	3	26.8
Texas	21	23.1
Utah	5	18.3
Virginia	6	17.6
Washington	5	12.2
West Virginia	3	26.8
Wisconsin	13	16.3

Table 7 describes the average (mean) performance of the AXR measure in Medicaid plans in each respective state. Because AXR is a new HEDIS measure, there is only one year of data. Publicly reported data will begin in MY 2023. Historically, HEDIS rates for first-year reporting are lower. URI, AAB and CPW have been publicly reported for over 10 years; thus, plans have had more time to improve on rates for these measures, versus for AXR. AXR measure values are relative antibiotic utilization for respiratory conditions across a plan's membership. When used in conjunction with other antibiotic measures, AXR can provide additional information about prescribing as a whole, in contrast to specific conditions that may be more prevalent for seniors or pediatric populations. The District of Columbia illustrates the lowest average rate (7.4), while Mississippi illustrates the highest (29.4). Most state averages follow the trends suggested in the literature: many Southern US Census states have higher rates than the three other regions.



## SECTION 2: LITERATURE REVIEW

### Methodology

The literature review considered the current landscape of antibiotic prescribing for respiratory illness in the US, in comparison to HEDIS data from 2022. By considering geographic and product line differences, this report can identify areas of health inequity across the US. The literature review included articles from 2004–2024 and was conducted on PubMed and Google Scholar databases using the following key terms: antibiotic stewardship, regional variation, geographic variation, product line, Medicaid, commercial, Medicare, antibiotic resistance, HEDIS. There were few articles from 2015–2024, which is a potential limitation of this review.

#### 2a. Variation in Antibiotic Prescribing by Geography

The highest prescribing rates for antibiotics related to respiratory conditions were observed in the South (21.4% of patients per annual quarter used an antibiotic) throughout the literature,<sup>1</sup> with one study noting that 9 of 15 Southern states make up the list of the 10 highest antibiotic-prescribing states nationwide.<sup>1–4</sup> Widespread overuse of antibiotics is suggested to be from providers with high prescribing habits, beyond the evidence of overuse found in all studied regions, even for those with the lowest prescribing rates.<sup>5,6</sup> As of 2024, Kentucky had the highest antibiotic prescription rate (1,281 prescriptions per 1,000 patients).<sup>7,8</sup> This translates to about one antibiotic prescription per person annually in that state.<sup>5</sup>

The lowest antibiotic prescribing rates (348 prescriptions per 1,000 patients) were observed in the Western states, representing 7 of the 10 lowest prescribing states in 2019.<sup>2</sup> Approximately half of the highest antibiotic-prescribing providers (48%) operate in the South; these providers contribute to about half of the region’s annual antibiotics prescriptions.<sup>9</sup> Both adults and children in the South receive higher than average rates of antibiotic prescriptions.<sup>6,10</sup> A reason for observed regional differences has not been identified, though studies hypothesize it may be attributable to regional differences in provider prescribing habits, such as fewer prescriptions for preventive care.<sup>11</sup> The literature notes a recurring need for future research into rural versus non-rural prescribing.<sup>8,12</sup>

## **2b. Variation in Antibiotic Prescribing by Product Line**

While geographic regions appear to have different antibiotic prescribing trends for respiratory conditions, health plan product lines were also suspected of having different rates even when geographic regions were constant. As part of HEDIS data collection, the four measures are reported and calculated for Commercial, Medicaid and Medicare product lines. Population differences within each product line can affect the health of vulnerable populations, such as seniors using Medicare, or pediatric populations using Medicaid. As of 2024, there is limited published information about trends of antibiotic prescribing across product lines, which may vary due to availability of primary care and prevention services, as the literature suggests.<sup>13</sup>

Clinicians who see more Medicare and/or Medicaid patients may also be higher prescribers, and thus, may have the greatest potential to reduce overuse by implementing stewardship strategies.<sup>13,14</sup> In one analysis, 25% of antibiotics prescribed for outpatients were not associated with a provider visit, bypassing antimicrobial stewardship processes.<sup>13</sup> It is also possible that health literacy plays a role in antibiotic stewardship, as parents insured through Medicaid were more likely to trust advertisements and social media posts related to coughs and colds, and less likely to trust of their child’s physician or Centers for Disease Control (CDC) posts.<sup>15</sup> More than 50% of West Virginia’s pediatric population is enrolled in Medicaid, and that state also has high antibiotic prescribing rates.<sup>16</sup> Nationwide, Medicaid patients account for 21%–28% of annual antibiotic prescriptions,<sup>13</sup> a staggering amount, considering that the number of patients using Medicaid services in the entire country is about 60 million annually—as of 2024, about 18% of the total US population. From 2012–2017, Kentucky’s total Medicaid antibiotic spending increased from \$14.6 million to \$16.8 million, with an average enrollee cost of about \$55 per year.<sup>8,17</sup>

## SECTION 3: FINDINGS

While our literature review informed our analysis of antibiotic prescribing across US geographic regions and states, we found limited data about product line variation and impact on prescribing practices. The difference in antibiotic prescribing among product lines investigated through the antibiotic HEDIS measures illustrates a meaningful performance difference between Medicare plans (in all regions) versus the Commercial and Medicaid plans for AAB, CWP and URI. Performance across product lines for AXR was similar.

While variation in antibiotic prescribing can be due to physician experience and practice environment, or to the health system, it can also be due to physicians' unique prescribing patterns and patient preferences.<sup>18</sup> To some extent, lower performance (higher prescribing rates) may be attributed to the older Medicare population, where antibiotics may be more readily prescribed as a preventative measure. Further, individuals in Medicare plans in the South may have highest antibiotic prescription rates due to other complicated and prevalent health issues, such as cardiovascular disease, diabetes or obesity,<sup>7</sup> reflecting overall care disparities in that region. Greater variability in performance was observed in Medicare plans, suggesting that different states and plans within Medicare have different prescribing habits, or that Medicare patients have a larger variability in their need for antibiotics related to respiratory illness, despite federally mandated antibiotic stewardship initiatives for acute care hospitals that participate in Medicare/Medicaid.<sup>19</sup>

### 3a. Variation in Antibiotic Prescribing by Geography within HEDIS

In addition to the literature review, NCQA leveraged HEDIS data to highlight variations in prescribing trends across health plans and to analyze the difference by geographic region and product line. Regional variation in prescribing trends was observed for all four measures. The New England census division had the highest performance rates for CWP and URI, and the Pacific had the lowest.<sup>3</sup> The lowest performance was observed across all census divisions for AAB, with the New England division showing the lowest results. Data suggest that prescribing attitudes for acute bronchitis (AAB measure) may be different from upper respiratory (URI measure) or pharyngitis (CWP measure). The AXR measure may be used for comparison between the AAB, URI and CWP measures to examine individual plan performance for overall respiratory illness antibiotic prescribing, and as a comparative tool that contrasts overall respiratory antibiotic prescribing with prescribing for certain illnesses.

The literature showed consistent trends for the South, which had the highest antibiotic prescribing rates compared to other regions. In contrast, Western states have the lowest prescribing rates, consistent with our data findings. These results can be most clearly interpreted from the overall spread (variability) of the data in contrast to their comparable mean values (Figures 2–4).

Tables 3–7 describe average health plan performance for the four antibiotic measures by geography and product line in MY 2022. Figures 5–8 show corresponding mapping of performance rates, by state, for the Medicaid product line based on availability of data. State figures focus on the Medicaid product line, due to unavailability of HEDIS (not enough data were reported to allow analysis of Medicare and Commercial product lines). AXR was represented state by state, instead of regionally, to assess additional plan granularity for overall respiratory trends, whereas the AAB, CWP and URI measures were represented regionally to analyze prescribing trends for different respiratory conditions across primary care physician prescribing rates across regions.

### 3b. Variation in Antibiotic Prescribing by Product Line Within HEDIS

Our review of the literature revealed a limited amount of research on variation in antibiotic prescribing among the three product lines, highlighting a need for more research on this topic. Information obtained suggests that plans and providers with more Medicare/Medicaid patients may prescribe antibiotics at a higher rate than their Commercial plan counterparts,<sup>17</sup> whether or not prescribing was appropriate. Based on HEDIS MY 2022 data, Medicare trends appear to align with findings in the literature<sup>13</sup> (Medicare patients receive more antibiotic prescriptions than Commercial patients). Figures 1–4 show rate distributions for the total indicator line of each of the four measures by product line. (Refer to Appendix A for plan count.) What cannot be determined through HEDIS data is why there are higher levels of antibiotic prescribing among Medicare and Medicaid product lines. Due to the general population enrolled in Medicare and Medicaid, it can be inferred that patients are unhealthier (due to comorbidities or care disparities) and may require more antibiotics than the general Commercial population. Thus, prescribing practices would not reflect the health plan or regional practitioner and should be considered when interpreting results.

## SECTION 4: POLICY IMPLICATIONS

Understanding geographic variation in antibiotic prescribing is limited by a paucity of data in the published literature. In fact, this report was limited by unavailability of published data over the past 10 years. It is probable that antibiotic prescribing policies and practices changed during that time. For example, the Centers for Medicare and Medicaid Services (CMS) implemented strategies to promote antibiotic stewardship, and in 2019 made revisions to its 2016 ruling that hospitals and nursing facilities develop and implement antibiotic stewardship programs to reduce inappropriate antibiotic use.<sup>21</sup> This initiative was created to promote a national standard for antibiotic use.<sup>21,22</sup> The CDC partnered with key health care stakeholders to improve health and control the cost of care through its 6 | 18 Initiative.<sup>23</sup> One key area CDC is focused on improving through this initiative is antibiotic use—specifically by having providers, hospitals and skilled nursing facilities utilize the Core Elements of Outpatient Antibiotic Stewardship, a framework for improving how antibiotics are prescribed by clinicians and used by patients.<sup>24</sup> And the National Action Plan for Combating Antibiotic-Resistant Bacteria (CARB) has planned strategic actions for the US government to take from 2020-2025, focusing on controlling the spread of resistant infections and reducing the need for antibiotics.<sup>19,20</sup>





## SECTION 5: CONCLUSION

The lack of recent literature on antibiotic prescribing indicates a need for continued investigation nationwide, and specifically in regions where evidence suggests inappropriate prescribing practices are prevalent (e.g., in the South). While the lack of publicly available information is a potential limitation of this report, the absence of research and literature suggests an even greater need to study and monitor antibiotic prescribing trends nationwide, to support vulnerable populations and minimize antibiotic resistance. The AXR measure can help health plans, track and monitor antibiotic use for respiratory conditions to ensure they are prescribed appropriately. Understanding variations in performance in the HEDIS suite of antibiotic measures is an opportunity to identify areas for improvement across performance levels. NCQA has created an [antibiotics website](#) that includes a list of high-performing health plans that meet HEDIS-defined criteria of smart prescribing and overuse prevention.<sup>25</sup>

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**APPENDIX A.****Plan Count for Figures 1-4**

	<b>PRODUCT LINE</b>	<b>REGION</b>	<b>AAB</b>	<b>AXR</b>	<b>CWP</b>	<b>URI</b>
<b>1</b>	Commercial	USA	404	398	394	415
<b>2</b>	Medicaid	USA	228	205	227	232
<b>3</b>	Medicare	USA	406	506	358	489
<b>4</b>	Commercial	Northeast	92	94	92	94
<b>5</b>	Commercial	South	118	118	116	120
<b>6</b>	Commercial	Midwest	84	85	84	88
<b>7</b>	Commercial	West	94	92	93	97
<b>8</b>	Medicaid	Northeast	40	39	42	42
<b>9</b>	Medicaid	South	85	86	87	88
<b>10</b>	Medicaid	Midwest	52	43	52	52
<b>11</b>	Medicaid	West	48	37	45	47
<b>12</b>	Medicare	Northeast	74	91	62	80
<b>13</b>	Medicare	South	121	153	111	148
<b>14</b>	Medicare	Midwest	76	109	62	93
<b>15</b>	Medicare	West	73	97	63	97

