Low-Value Care for Acute Sinusitis Encounters: Who's Choosing Wisely?

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ABSTRACT

Objectives: To assess acute sinusitis (AS) encounters in primary care (PC), urgent care (UC), and emergency department (ED) settings for adherence to recommendations to avoid low-value care.

Study Design: A retrospective, observational study of adult AS encounters (2010-2012) within a large integrated healthcare system.

Methods: We compared ED and UC encounters with PC visits, adjusting for differences in patient characteristics. Primary outcomes: adherence to recommendations to avoid antibiotics and a computed tomography (CT) scan of the face, head, or sinuses. Secondary outcomes: length of symptoms and adherence with AS recommendations.

Results: Of 152,774 AS encounters, 89.2% resulted in antibiotics and 1.1% resulted in a CT scan. Compared with PC encounters, ED encounters were less likely to result in antibiotics (adjusted odds ratio [AOR], 0.57; 95% CI, 0.50-0.65) but more likely to result in a CT scan (AOR, 59.4; 95% CI, 51.3-68.7), while UC encounters were more likely to result in both antibiotics (AOR, 1.12; 95% CI, 1.08-1.17) and CT imaging (AOR, 2.4; 95% CI, 2.1-2.7). Chart review of encounters resulting in antibiotics found that 50% were inappropriately prescribed for symptoms of ≤7 days' duration (95% CI, 41%-58%), while 35% were appropriately prescribed for symptoms of ≥14 days' duration (95% CI, 27%-44%). Only 29% (95% CI, 22%-36%) of encounters were consistent with guideline-adherent care.

Conclusions: AS encounters in an integrated health system infrequently result in CT imaging, but antibiotic treatment is common. Differences exist across acute care settings, but improved antibiotic stewardship is needed in all settings.

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Acute sinusitis (AS) affects over 30 million individuals each year in the United States, leading to $5.8 billion in direct healthcare costs.[1,2] There are clear practice guidelines based on decades of evidence to assist providers in the evaluation and treatment of AS.[3-6] However, prior studies suggest that the guidelines have not been effectively translated into routine practice,[3,7,8] even now that a number of strategies have been shown to improve antibiotic stewardship.[9-11] The American Academy of Family Practice, the American Academy of Asthma, Allergy, and Immunology, and the American Academy of Otolaryngology have all included recommendations for AS in their "top 10" and "top 15" lists of low-value practices that should be questioned, as part of the Choosing Wisely campaign of the American Board of Internal Medicine Foundation.[12-14] Adherence with the Choosing Wisely recommendations for AS has not been reported, and a better understanding would highlight the success of the campaign, or conversely, identify opportunities for improvement.

A clear understanding of current practices requires awareness of how AS is treated in different acute care settings. There is a need to better understand and coordinate acute care services in order to accomplish the triple aim of improving the patient care experience and improving population health, while reducing the per capita cost of healthcare.[15,16] Better documentation of variation in practices across care settings will help to identify best practices and target areas for improvement. Additionally, a better understanding of guideline adherence within different settings will have important ramifications for future policies to efficiently coordinate and improve acute care services.

Our study aims to describe AS practices within an integrated delivery system, measuring adherence with Choosing Wisely recommendations to limit low-value health services. We compare how AS encounters and treatment patterns differ among primary care (PC), urgent care (UC), and emergency

Take-Away Points

Acute sinusitis (AS) impacts millions annually and presents an opportunity to assess and improve the quality of care individuals receive. Our study is the first to report computed tomography (CT) and antibiotic prescribing practices for acute sinusitis comparing different care settings. Our primary results are summarized below:

- Less than 1% of patients receive CT imaging contrary to recommendations.
- Nine in 10 initial AS encounters result in antibiotics.
- Primary care orders fewer CT scans and antibiotics than urgent care.
- Primary care orders fewer CT scans but more antibiotics than the emergency department.
- All settings could significantly improve antibiotic stewardship for AS.

department (ED) settings, and report evidence-based improvement targets for each.

METHODS

We performed a retrospective, observational study of all initial AS encounters (*International Classification of Diseases, Ninth Revision, Clinical Modification* [*ICD-9-CM*] code 461.x) for adults from 2010 to 2012 within Kaiser Permanente Southern California (KPSC), a large integrated healthcare system that provides healthcare for 3.6 million members of a capitated, prepaid health plan.

Within KPSC, there are 105 PC clinics staffed by approximately 1500 physician providers. PC clinics are not equipped for walk-in appointments, but same-day appointments are accommodated whenever possible. There are 21 UC clinics, and variation in the types of providers who staff these clinics depends on the geographic area—they can be staffed by designated UC providers, primary care providers, emergency providers, or a combination of these, including a total of approximately 150 providers. UC clinics do not require appointments, but some accommodate pre-arranged visits. There are 14 EDs within the health system staffed by approximately 370 physicians. In these EDs, appointments are not required, nor accommodated and patients are seen first come first serve based on triaged illness severity. Because of differences such as location, scheduling, provider training, imaging availability, and patient self-selection, we looked for variation in AS treatment across these 3 care settings. The study was approved by the KPSC Institutional Review Board.

We excluded encounters for patients aged <18 years, encounters resulting in hospital admission, follow-up encounters, or encounters for immunocompromised patients. Follow-up AS encounters were defined as those with a prior visit for AS in the 30 days before the index visit. "Immunocompromise" was defined as the presence of a diagnostic code for any of the following in the 12 months prior to the encounter: chronic liver disease (*ICD-9-CM* code 571), end-stage renal disease (*ICD-9-CM* code 585.6), congestive heart failure (*ICD-9-CM* code 428), immune disorders (*ICD-9-CM* code 279), malignant neoplasms (*ICD-9-CM* codes 140-165, 170-176, 179-209 and 235-239), common rheumatologic disorders frequently treated with immunosuppressing medications (*ICD-9-CM* codes 714, 710, 555.9 and 556).

We identified outcomes by using structured data from electronic health and administrative records collected during routine clinical care and operations. The 2 primary outcomes for analysis were: 1) the filling of an antibiotic prescription at a pharmacy within our integrated system, and 2) receiving a computed tomography (CT) scan of the face, sinuses, or head within 7 days of the initial AS encounter. We reviewed pharmacy records to capture the filling of a prescription for any antibiotic classified by the generic product identifier. Additionally, a specific analysis of the commonly prescribed and recommended antibiotics assessed the number of encounters resulting in prescriptions for amoxicillin, amoxicillin clavulanate, cefuroxime, cephalexin, clindamycin, trimethoprim-sulfamethoxazole, doxycycline, or azithromycin. To capture all CT scan use associated with the evaluation of AS, we included the following Current Procedural Terminology codes: 70450, 70460, 70470, 70486, 70487, and 70488.

Descriptive analysis assessed the proportion of encounters resulting in antibiotics or CT imaging in aggregate by year, practice setting, hospital service area, and provider. Bivariate and multivariate logistic regression was used to perform 3 separate analyses to assess either receipt of antibiotics, CT, or both as the primary outcome. We compared the ED and UC settings with the PC setting. Multivariate analysis accounted for patient-level variables such as age, gender, Elixhauser comorbidity score, health system membership, fever during encounter, poverty, and education.[17] Poverty and education were derived from our research data warehouse using zip code linked to census information. The poverty threshold was a household income less than $34,575 annually based on 2012 HHS guidelines.[18] The education threshold used for analysis was based on encounters for patients with less than a high school education or those with a high school diploma or higher education.

Chart review was performed on 300 randomly selected AS encounters using stratified random sampling (100 in each care setting) of encounters that resulted in filling of an antibiotic prescription, the performance of a CT scan, or both. A specifically trained member of the research team performed manual chart reviews to ensure the ac-

curacy of the structured data analysis, as well as to specifically determine the length of reported symptoms and to categorize encounters as guideline adherent, nonadherent, or indeterminate based on Choosing Wisely recommendations. We defined adherence as any visit during which a patient had an abnormal physical exam (including facial swelling/erythema, vision changes, or abnormal neurologic findings) or had a clear complicating comorbidity. Immunocompetent patients with uncomplicated physical exams and comorbidities were categorized as adherent if symptoms were documented to be present for at least 14 days,[6] nonadherent if symptoms were present for less than or equal to 7 days,[19] and indeterminate if symptoms were present for between 8 and 13 days or if the length of symptoms was not documented. Encounters were also classified as indeterminate if the patient was diagnosed with multiple problems and it was unclear if CT imaging or antibiotics were ordered for a different condition.

To ensure data quality, all ambiguous cases were discussed with clinically trained members of the research team until consensus was achieved. Additionally, 15 charts were reviewed by a separate research team member, blinded to initial review to assess inter-rater reliability (93% agreement, $\kappa = 0.86$). Chart review results were analyzed using survey sampling methods to obtain weighted estimates of population proportions, along with 95% CIs for both weighted and sample statistics, for the length of symptoms of patients seeking care and guideline adherence, where both the total proportions and the variances were weighted by the sampling fractions.[20,21]

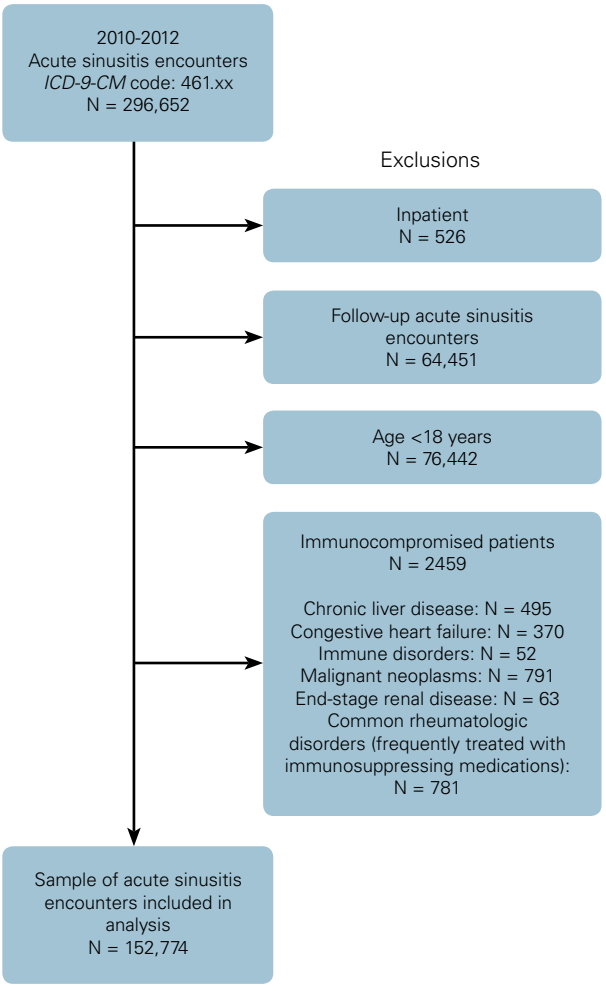
RESULTS

A total of 296,652 clinical encounters from 2010 to 2012 had an AS diagnosis. After excluding hospital encounters (n = 526), follow-up encounters (n = 64,451), pediatric visits (n = 76,442), and encounters for immunocompromised patients (n = 2459), our sample consisted of 152,774 encounters (**Figure**). Most AS encounters occurred within PC clinics (77%), followed by UC centers (22%) and the ED (1%). The median age of patients was 46 years (interquartile range, 34-58 years), 67.5% were female, and the mean Elixhauser comorbidity score was 1.5 (SD ± 1.6). There were some differences among patients seen in different settings (**Table 1**). Specifically, patients seen in PC settings had higher Elixhauser comorbidity scores and were more likely to be members of the health plan, but were less likely to have fever or to live in a high-poverty or low-education neighborhood.

Of the 152,774 initial AS encounters, 1.1% received a CT scan (**Table 2**). Evaluating CT scans by practice setting showed markedly greater use in the ED (25.1%) compared with either the PC (0.6%) or UC (1.4%) settings. After adjustment for patient characteristics, CT imaging was almost 60 times more likely in the ED compared with PC (adjusted odds ratio [AOR], 58.2; 95% CI, 50.4-67.2), and use of CT was more than twice as likely in UC settings than PC settings (AOR, 2.5; 95% CI, 2.2-2.8).

Antibiotics were filled for 89.2% of initial AS encounters, and the most commonly prescribed antibiotics were amoxicillin, azithromycin, and trimethoprim-sulfamethoxazole (Table 2). Stratified by practice setting, the ED patients filled the fewest prescriptions (72.8%), followed by PC (89.3%) and UC (89.8%) patients. After adjustment,

Figure. Criteria Used for Acute Sinusitis Encounters and Exclusion Criteria Resulting in the Study Population Used for Analysis



ICD-9-CM indicates *International Classification of Diseases, Ninth Revision, Clinical Modification.*

Table 1. Sample Population Evaluated for Acute Sinusitis From 2010 to 2012[a]

	Emergency Department N = 1807	Primary Care Clinic N = 118,119	Urgent Care N = 32,848	Total N = 152,774
Age, median (IQR)	41 (29-54)	47 (35-58)	44 (32-56)	46 (34-58)
Gender (% female)	1089 (60.3%)	80,655 (68.3%)	21,407 (65.2%)	103,151 (67.5%)
Elixhauser comorbidity score, mean ± SD	1.3 ± 1.7	1.5 ± 1.6	1.3 ± 1.5	1.5 ± 1.6
Nonmembers (%)	408 (22.6%)	1276 (1.1%)	427 (1.3%)	2111 (1.4%)
Fever[b] (%)	64 (3.5%)	1990 (1.7%)	943 (2.9%)	2997 (2.0%)
Poverty[c,d] (%)	257 (14.2%)	9868 (8.4%)	4173 (12.7%)	14,298 (9.4%)
Education[c] (high school or more) (%)	1384 (76.6%)	98,039 (83.0%)	26,016 (79.2%)	125,427 (82.1%)

IQR indicates interquartile range.
[a]Encounters are stratified by practice setting for comparison purposes as well as summarized in the aggregate.
[b]Vital sign data were available for 99% of encounters.
[c]Income and education data was available for 98% of patients.
[d]Proportion of encounters with patients who had household income less than $34,575 (based on 2012 federal poverty thresholds).

ED patients were roughly 40% less likely to obtain antibiotics (AOR, 0.57; 95% CI, 0.50-0.65) than patients seen in PC settings, and UC patients were approximately 10% more likely to receive antibiotics than PC patients (AOR, 1.12; 95% CI, 1.08-1.17) (Table 3).

Results for encounters that resulted in ordering of both antibiotics and CT imaging were similar to results for CT imaging alone. The ED patients were more than 50 times more likely to receive both CT imaging and antibiotics than patients seen in PC (AOR, 54.6; 95% CI, 46.8-63.6), and UC patients were more than twice as likely as PC patients to receive both interventions (AOR, 2.4; 95% CI, 2.2-2.8) (Table 3).

Based on detailed chart reviews, we determined that 50% of filled antibiotic prescriptions were for patients with symptoms of ≤7 days' duration (95% CI, 41%-58%), indicating nonadherence with Choosing Wisely recommendations. Only 35% of antibiotic prescriptions were for patients with symptoms of ≥14 days' duration (95% CI, 27%-44%). For encounters receiving CT scans, we found overall that 38% (95% CI, 22%-54%) were concordant with recommendations, with 44% (95% CI, 24-64) concordant in PC, 16% (95% CI, 1%-31%) in UC, and 32% (95% CI, 13%-51%) in the ED. Overall, only 29% (95% CI, 22%-36%) of encounters were characterized by guideline-concordant use of both antibiotics and CT imaging. Patients received guideline-concordant care in 30% of PC encounters (95% CI, 21%-39%), 26% of UC encounters (95% CI, 17%-35%), and 16% of ED encounters (95% CI, 9%-23%) (Table 4).

DISCUSSION

In this large observational study, we found high rates of adherence to Choosing Wisely recommendations to avoid unnecessary CT imaging in patients with uncomplicated AS within most settings of our health system, though there was room for improvement in the ED and UC settings. Of greater concern, we found that antibiotic prescribing for AS was extremely common across all settings, and that at least half of the prescriptions appeared to be unnecessary based on current treatment recommendations. We demonstrated that care provided for patients with AS differs across the PC, UC, and ED settings, in part reflecting differences in patient characteristics and clinical presentations. Lastly, we found differences in the length of time patients have experienced AS symptoms before seeking care in each of the acute care settings.

We are unaware of other research describing the proportion of patients receiving CT scans for AS; therefore, our findings create a new baseline for comparison. Although the use of CT imaging was uncommon overall, we found that unnecessary CT imaging was significantly worse in the ED and UC settings compared with PC. This finding is highly relevant, given current efforts by many to curb unnecessary CT imaging. Characteristics of patients seeking care in the ED and UC settings compared with PC may account for differences in clinical decision making among these settings. Those seen in the ED or UC had a shorter duration of symptoms, but may have had more severe symptoms, as indicated by the higher propor-

Table 2. Description of the Patients with a Primary Diagnosis of Acute Sinusitis Who Were Prescribed Antibiotics or Received a CT Scan

	Emergency Department n = 1807	Primary Care Clinic n = 118,119	Urgent Care n = 32,848	Total n = 152,774
Total prescribed antibiotics (%)	72.8	89.3	89.8	89.2
Amoxicillin	20.4	42.8	36.5	41.2
Amoxicillin clavulanate	19.8	7	7	7.2
Cefuroxime	0.8	2.4	4.8	2.9
Clindamycin	2.5	0.7	1.6	0.9
Trimethoprim-sulfamethoxazole	8.9	9.7	9.1	9.6
Doxycycline	2.9	9.9	8	9.4
Azithromycin	15.6	13.6	12.5	13.4
Total CT scans within 7 days of diagnosis (%)	25.1	0.6	1.4	1.1
Head CT	22.4	0.3	1.2	0.8
Face CT	1.6	0	0	0[a]
Sinus CT	2.7	0.3	0.2	0.3

CT indicates computed tomography.
[a]Twenty-nine face CT scans were ordered in the emergency department (1.6%); 29 of 152,774 is less than 0.1%, so the percentage listed is 0.0%.

tion of patients with fever at the time of the visit. Additionally, a higher proportion of poor and less educated patients sought care in the ED and UC. This understanding may help with prioritizing quality improvement efforts and in developing strategies to address gaps in care based on the clinical setting.

Our results regarding use of antibiotics are similar to those from previous studies, which showed that approximately 80% of AS patients received antibiotics in Europe and the United States.[7,8] What can be done to limit inappropriate antibiotic prescribing and imaging? Integrating clinical decision aids within the electronic health record (EHR) may be one sustainable strategy to improve AS antibiotic practices.[9,11,22] As policy makers establish "meaningful use" of EHRs, the integration of evidence-based clinical decision aids to target common acute illnesses such as AS should be considered. Other possible interventions include physician education, audit and feedback on provider performance, academic detailing, and departmental quality targets. This research was performed in conjunction with providers and administrators as an example of embedding research with the intent to improve practice. Efforts are already underway to implement an intervention to improve antibiotic stewardship for AS in order to eliminate unnecessary adverse events, decrease antibiotic resistance, and improve affordability.

The age-old problem of inappropriate antibiotic prescribing may be partly due to the difficulty in differentiating bacterial infections from more common viral illnesses. To help clinicians identify patients who are likely to benefit from antibiotics for AS, the most pragmatic and evidence-based approach is to focus on the patient's length of symptoms. In our study, none of the 300 chart review encounters reported abnormal physical exam findings or worrisome clinical features. Only 28% to 49% of PC encounters (16%-34% for UC and 5%-17% for ED) involve patients with symptoms of longer than 14 days' duration. Since more harm than benefit is expected from antibiotics for patients who have had symptoms for less than 14 days,[6] this can help clinician leaders and administrators to develop an evidence-based target for a system-level standard. Because some patients do benefit from antibiotics, while the majority do not, our findings can help clinical leaders and administrators to develop an evidence-based target for the proportion of AS encounters that are likely to benefit from antibiotics.

Limitations

Our study is a retrospective, observational one and the limitations inherent in this design are applicable. Specifically, there is a risk of selection bias, as our cohort reflects the physician decision to diagnose the patient with acute sinusitis. Also, although we designed our study to adjust for as many of the measurable patient characteristics as possible, we cannot rule out residual confounding due to unmeasured variables.

Our study limited its assessment to the treatment of patients with clinically diagnosed AS, without describing the difficulty and ambiguity that may play a role in the diagnosis of AS. Examples of other conditions that may present with similar symptoms but result in different *ICD-9-CM*

Table 3. Results From the Multivariate Analysis Comparing Care Settings for Initial Acute Sinusitis Encounters Resulting in the Following Primary Outcomes: Receiving Antibiotics, Computerized Tomography, or Both

	Antibiotics		CT Scan		Both	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Urgent care vs primary care	1.12	1.08-1.17	2.46	2.18-2.78	2.44	2.15-2.78
Emergency department vs primary care	0.57	0.50-0.65	58.18	50.37-67.19	54.59	46.84-63.63
Age	1.01	1.01-1.01	1.02	1.01-1.02	1.02	1.01-1.02
Female vs male	0.97	0.93-1.00	0.79	0.71-0.88	0.76	0.68-0.85
Elixhauser comorbidity score	1.01	1.00-1.02	1.05	1.02-1.09	1.04	1.01-1.08
Non-KP member	0.41	0.35-0.47	0.76	0.52-1.11	0.45	0.27-0.73
Febrile	2.00	1.71-2.33	1.27	0.93-1.73	1.36	0.99-1.89
Impoverished	1.02	0.96-1.08	1.29	1.09-1.51	1.34	1.13-1.59
Education (HS+)	1.01	1.01-1.01	0.99	0.99-1.00	0.99	0.99-1.00

AOR indicates adjusted odds ratio; CT, computerized tomography; HS, high school; KP, Kaiser Permanente.

Table 4. Weighted Proportions (and 95% CIs) of Randomly Selected Acute Sinusitis Encounters Treated in Different Care Settings

Adherence Type	Emergency Department	Primary Care	Urgent Care	Weighted Total by Type
Antibiotics	0.14 (0.05-0.24)	0.32 (0.19-0.45)	0.34 (0.21-0.48)	0.32 (0.22-0.43)
CT	0.32 (0.13-0.51)	0.44 (0.237-0.643)	0.16 (0.01-0.31)	0.38 (0.22-0.54)
Both	0.04 (0.0-0.12)	0.12 (0.0-0.25)	0.2 (0.04-0.36)	0.14 (0.03-0.24)
Total adherence[a]	0.16 (0.09-0.23)	0.30 (0.21-0.39)	0.26 (0.172-0.348)	0.29 (0.22-0.36)

CT indicates computed tomography.
[a]Total adherence aggregates all charts reviewed in each setting reporting the proportion of encounters resulting in recommended acute sinusitis care (n = 100 per setting).
Rows indicate adherence to antibiotic prescribing recommendations, to imaging recommendations, or to both recommendations, as determined by medical record review.

diagnoses include chronic sinusitis, upper respiratory infection, nasopharyngitis, and viral syndrome. If an individual has an underlying chronic headache syndrome, such as migraine, they may be more likely to be given a sinusitis diagnosis. Even when an accurate diagnosis of AS is made, there is no gold standard to confirm that the infection is bacterial and would therefore respond to antibiotics. We excluded patients with the most common immunosuppressed conditions in our system, but this is not a comprehensive list of immunosuppressing conditions. Additionally, we restricted our analysis of imaging tests to CT and did not include other imaging modalities such as plain radiography. We judged CT utilization to be of greatest interest in our study, due to its widely prevalent use, relatively high cost, and nontrivial exposure to ionizing radiation.

We did not measure how often acute sinusitis might have been managed by telephone and/or secure e-mail. These types of encounters represent a substantial number of patient contacts, and therefore patterns of antibiotic usage and CT imaging from these types of encounters may differ from our reported findings. We also chose to focus on antibiotics filled, instead of prescribed. It is likely that more patients were prescribed antibiotics than actually filled them at pharmacies captured within our data set, especially for nonmember encounters. Focusing on filled antibiotic prescriptions indicates a true cost to the health system, and increases the likelihood those patients took the medications. This strategy also avoids capturing encounters where providers may have recommended the wait-and-watch approach, in which providers prescribe antibiotics but instruct patients to fill the prescription only if symptoms persist beyond an explicit time period.

In summary, our findings show that overall CT imaging for acute AS is uncommon, but improvement is

needed in antibiotic prescribing practices. Patients and presentations differ depending on the acute care setting, and most patients are seen in primary care. UC orders more CT scans and antibiotics than primary care, while ED patients receive fewer antibiotics but CT imaging is much more likely. Overall, antibiotic prescribing warrants improvement in all settings, and based on our findings we recommend the following as quality improvement targets for AS antibiotic prescribing rates for initial encounters: ED below 20%, PC less than 50%, and UC under 35%.

CONCLUSIONS

Within a large integrated health system, AS encounters rarely result in unnecessary CT imaging, but unwarranted antibiotic prescribing is prevalent and contrary to published guidelines and Choosing Wisely recommendations. Compared with PC encounters, UC encounters are more likely to result in ordering of antibiotics and CT imaging, while ED encounters are less likely to receive antibiotics but much more likely to order low-value CT imaging. Targeted implementation strategies are needed to translate Choosing Wisely antibiotic recommendations into practice to optimize antibiotic stewardship for AS.

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