HHS Public Access

Author manuscript

Clin Infect Dis. Author manuscript; available in PMC 2022 July 19.

Published in final edited form as:

Clin Infect Dis. 2020 April 10; 70(8): 1781–1787. doi:10.1093/cid/ciz910.

Antibiotic Prescribing Variability in a Large Urgent Care Network: A New Target for Outpatient Stewardship

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Abstract

Improving antibiotic prescribing in outpatient settings is a public health priority. In the United States, urgent care (UC) encounters are increasing and have high rates of inappropriate antibiotic prescribing. Our objective was to characterize antibiotic prescribing practices during UC encounters with a focus on respiratory tract conditions. This was a retrospective cohort study of UC encounters in the Intermountain Healthcare network. Among 1.16 million UC encounters, antibiotics were prescribed during 34% of UC encounters and respiratory conditions accounted for 61% of all antibiotics prescribed. Fifty percent of respiratory encounters received antibiotics, yet

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

the variability at the level of the provider ranged from 3% to 94%. Similar variability between providers was observed for respiratory conditions where antibiotics are not indicated and first-line antibiotic selection for sinusitis, otitis media, and pharyngitis. These findings support the importance of developing antibiotic stewardship interventions specifically targeting UC settings.

Summary:

We describe antibiotic prescribing in a large network of urgent care (UC) clinics. The high volume of infectious diseases encounters and extreme provider variability in antibiotic prescribing frequency and quality highlight the importance of antibiotic stewardship interventions specifically targeting UC.

Keywords

antibiotic stewardship; urgent care; telemedicine; pediatric urgent care

INTRODUCTION

Most human antibiotic use occurs in outpatient settings[1,2]. At least 30% of these prescriptions are thought to be unnecessary[3] and contribute to avoidable harms and costs. These consequences include antibiotic resistant infections, *Clostridioides difficile* infections[4], and adverse drug effects[5]. As such, improving antibiotic prescribing in outpatient settings is a public health priority and a growing body of evidence exists about effective outpatient stewardship interventions[6–11].

The United States is experiencing a rapid change in healthcare delivery with a dramatic increase in outpatient encounters in non-traditional healthcare settings including urgent care (UC) clinics, retail clinics and telemedicine[12,13]. These settings may have certain advantages including expanded hours, walk-in appointments, and lower cost and shortened wait times compared to emergency departments. These settings are well suited to care for patients with uncomplicated low acuity conditions (e.g. acute respiratory conditions), to meet patient expectations for rapid and convenient care, and to lower the burden of acute care encounters in primary care clinics. Similar to national trends, UC and telemedicine encounters in the Intermountain Healthcare (IH) system have been increasing over the past 10 years[14].

Despite these secular trends, most stewardship interventions have focused on primary care settings and not UCs.[6–11] Compared to primary care settings, UCs have unique features including high volumes with rapid patient turnaround, limited communication with primary care providers, rotating UC providers limiting the cohesiveness of a clinic team, and potentially different patient expectations. These factors may require adaptations from the design of stewardship interventions developed for primary care. One recent study indicated that across all healthcare settings, in aggregate, UCs have both the highest percentage of visits resulting in antibiotic prescriptions and the highest rate of inappropriate prescribing for respiratory tract infections making UCs a high priority target for stewardship interventions.[15]

Our objective was to characterize antibiotic prescribing practices during UC encounters within a large integrated healthcare system with a focus on prescribing for respiratory tract infections overall and appropriate use across specific conditions. Secondary objectives were to characterize clinic and provider-level variation in prescribing practices and patient satisfaction. This work will provide insight into the appropriate targets and design for stewardship interventions tailored for UC.

METHODS

Study design and setting

This was a retrospective cohort study of UC encounters in the IH system from August 1, 2017 through June 29, 2019 (23 months). IH is a nonprofit, vertically integrated, healthcare delivery system that includes 24 hospitals, >185 outpatient clinics, >1,500 clinicians, and a health insurance plan with over 850,000 covered lives throughout Utah and Idaho. IH operates 38 UC clinics, which include 32 clinics providing care for patients of all ages ("InstaCare") and six providing care exclusively to children < 18 years old ("KidsCare"). InstaCare and KidsCare clinics are predominantly staffed by physicians; KidsCare is exclusively staffed by pediatricians. In addition, IH operates a telemedicine UC clinic ("Connect Care") where patients access clinicians for low acuity conditions via electronic devices, primarily staffed by advanced practice providers (APPs). IH's institutional review board approved this retrospective study with a waiver of informed consent.

Data collection

Medical training information (physician [MD/DO] or APP) for all UC clinicians was obtained via IH's human resources database. Patient demographics, obtained for each UC encounter, included age, sex, and race. Demographic data, diagnoses assigned, and antibiotic prescriptions were extracted electronically from the system-wide electronic health record.

Classification of UC encounters

To characterize the distribution of diagnoses and antibiotic prescribing for UC encounters, all *International Classification of Diseases, 10th Revision, Clinical Modification* (ICD10) codes were obtained for each UC encounter. The top 1,000 most commonly used ICD10 codes during UC encounters were then categorized into mutually exclusive clinical categories. An additional 401 related codes were also added for completeness. These related codes were part of relevant ICD 10 code categories (e.g., J01 Acute Sinusitis) but were not identified in the top 1000 ICD10 codes (e.g., J01.40 acute unspecified pansinusitis). Clinical categories included: skin and skin structure (skin), gastroenterology (GI), genitourinary (GU), respiratory/inner ear (respiratory), and other. Each ICD10 code within each category was further subcategorized and assigned into tiered groups based on whether antibiotics are indicated using a previously developed system: Tier 1 - antibiotics are almost always indicated (e.g., pneumonia, urinary tract infection, group A streptococcal pharyngitis), Tier 2 - antibiotics may be indicated (e.g. sinusitis, acute otitis media [AOM], cutaneous abscess), and Tier 3 - antibiotics not indicated (e.g. bronchitis, nausea).[3] The 1,401 ICD10 codes collectively account for over 97% of all ICD10 codes used in UC (Appendix). When two or more ICD10 codes within the same clinical category were assigned for the same encounter,

the diagnosis was based on the code with the lowest tier (e.g. Tier 1). If multiple codes from the same tier were present, the diagnosis was based on the first listed ICD10 code. We excluded visits with ICD10 codes from two or more clinical categories (e.g. respiratory and skin). In addition, we excluded encounters where the provider was unknown or for providers with <25 encounters during the study period.

Antibiotic prescriptions

Up to two antibiotic prescriptions generated or administered during UC encounters were captured as electronic orders. Our focus was on systemic (oral or parenteral) antibiotic prescriptions, and therefore topical and inhaled antibiotic formulations were excluded.

Patient satisfaction

To assess patient satisfaction, we analyzed data from IH's routinely collected patient satisfaction survey. Patient satisfaction scores were available through December 31, 2017. All IH UC patients received an automated patient satisfaction survey after their UC encounter. The Consumer Assessment of Healthcare Providers and Systems (CAHPS®) - Clinician & Group Survey (CG-CAHPS) assess patients' experiences with health care providers and staff in the UC office.[16] The survey includes a question asking the patients to rate their provider on a scale from 0 to 10 (0 being the "worst provider possible" and 10 being the "best provider possible").

Outcomes

For all UC encounters, we determined the distribution by clinical categories, distribution by tiers and the percentage of encounters where antibiotics were prescribed overall and within each clinical category. The primary study outcomes were the percent of respiratory encounters with an antibiotic prescription at the clinic and provider level. Secondary outcomes included the percentage of encounters with a Tier 3 respiratory diagnosis with an antibiotic prescription (ideal percentage of 0%) and use of first-line recommended antibiotics for selected respiratory conditions (higher is better) during encounters where an antibiotic was prescribed. The conditions of interest were AOM, sinusitis and pharyngitis (streptococcal and unspecified). We defined first-line antibiotics as penicillin or amoxicillin for pharyngitis and amoxicillin or amoxicillin/clavulanate for acute sinusitis and AOM based on local and national guidelines. For each outcome we determined the aggregate percentage during the study period as well the variation by individual clinics and providers. For the analysis of patient satisfaction scores, we compared the mean scores for Tier 2 and Tier 3 respiratory encounters between those where antibiotics were and were not prescribed.

Statistical Analysis

Descriptive statistics reported central tendencies as medians and interquartile intervals (IQI) for metric variables and as proportion and size for categorical variables. Inferential analyses used multivariable regression analysis with outcome-appropriate distribution families and link functions. Variance decomposition was measured as the intraclass correlation coefficient (ICC) from a three-level hierarchical logistic model accounting for the encounter, provider and clinic. Comparisons between settings were conducted as separate multivariate logistic

regression analyses using InstaCare as the reference category. Bootstrapped 95% confidence intervals (CIs) were derived for comparison of mean patient satisfaction scores. Statistical analyses were conducted in R version 3.5.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Overall Urgent Care Encounters

During the 23-month period there were a total of 1,251,915 UC encounters. We excluded 63,235 (5.1%) encounters with diagnoses from multiple clinical categories, 22,932 (1.8%) with unknown providers and 1,899 (0.2%) with providers that had <25 encounters during the study period yielding 1,163,849 UC encounters for the final analysis (Figure 1). Of these, 1,043,040 (89.6%) encounters were in InstaCare, 83,356 (7.2%) in KidsCare, and 37,453 (3.2%) in Connect Care. There were 888 providers identified during the study period, 396 of whom had at least 25 encounters. Of these, there were 292 physicians (73.7%), 66 APPs (16.7%), and 38 (9.6%) without medical training information available.

Patient Demographics

The median age of patients seeking care in UC was 30 years (IQI: 15 to 48) and varied by setting. The median age of KidsCare was 6 years (IQI: 2 – 11) (Table 1). Most InstaCare and Connect Care encounters were for patients between the ages of 1 and 65 (accounting for 87.8% and 97.0% of encounters, respectively).

Urgent Care Visit Diagnoses and Overall Antibiotic Prescribing

The most common clinical category for UC encounters was respiratory (41.8%) with skin and GU encounters representing 13.7% and 8.1%, respectively (Table 1). Across all clinical categories, 40.9% of UC visits included a Tier 1 or Tier 2 diagnosis, representing conditions where antibiotics are potentially warranted (42.0% in InstaCare, 41.8% in Connect Care, and 41.6% in KidsCare). Overall, 34.1% (n = 396,825) of UC visits included an antibiotic prescription order or an administered antibiotic (34.9% in Instacare, 32.6% in Connect Care, and 24.6% in KidsCare) (Table 1). The most commonly prescribed antibiotics were amoxicillin (27.9%), cephalexin (11.0%), and doxycycline (9.8%) (Table S1 in Supplementary Appendix). Parenteral antibiotics were prescribed in 5.3% of encounters where an antibiotic was prescribed (83% ceftriaxone). Among UC visits where an antibiotic was prescribed, 61.1% (n = 242,651) were categorized as respiratory, 18.0% (n = 71,455) were GU, 13.9% (n=55,079) were skin, 3.0% (n = 11,937) were other, 2.3% (n = 9,312) were GI, and 1.6% (n = 6,391) were unclassified.

Antibiotic Prescribing in Respiratory Encounters

Among all respiratory encounters, 44,727 (9.2%) were Tier 1; 242,343 (49.9%) were Tier 2; and 189,991 (40.9%) were Tier 3 (Table 2). Antibiotics were prescribed for 96.6% of Tier 1 encounters, 64.8% of Tier 2 and 21.3% of Tier 3. Of all respiratory antibiotic prescriptions, 64.7% were for Tier 2 conditions and 17.5% were for Tier 3 conditions (Table 2). The most commonly prescribed antibiotics were amoxicillin (44.6%), doxycycline (14.0%), and azithromycin (12.7%) (Table S2 in Supplementary Appendix).

Antibiotic Prescribing Variability in Respiratory Encounters—Overall, 49.9% of respiratory encounters were prescribed an antibiotic. The variability in respiratory antibiotic prescribing by clinic and provider is shown in Figure 2A/B, respectively. By clinic, the median percent of all respiratory encounters with antibiotics prescribed was 51.0% (IQI 42.6 to 54.3), ranging from 31.0% to 84.4%. Antibiotic prescribing for respiratory conditions was lower at KidsCare clinics (38.7% of encounters, $p<0.001$) and Connect Care (44.4%, $p<0.001$), compared to InstaCare (51.3%). By provider, a median of 47.2% (IQI 36 to 56.8) of respiratory encounters received antibiotics, ranging from 3.3% to 94.1% of respiratory encounters. The ICC for providers (0.105) was higher than for clinics (0.0026) indicating that a greater proportion of variation was explained by providers than clinics.

Antibiotic Prescribing Variability in Tier 3 Respiratory Encounters—Overall, 21.3% of encounters for Tier 3 respiratory were prescribed an antibiotic. The variability in antibiotic prescribing for Tier 3 respiratory conditions by clinic and provider is shown in Figure S1 A/B in the Supplementary Appendix. By clinic, the median percent of Tier 3 respiratory encounters that received antibiotics was 21.7% (IQI 12.9 to 25.0), ranging from 1.2% to 67.9%. The percent of Tier 3 respiratory encounters receiving antibiotics was lower at KidsCare clinics (8.5% of encounters, $p<0.001$) and Connect Care (1.2%, $p<0.001$), compared to InstaCare clinics (23.5%). By provider, a median of 15.0% (IQI 6.6 to 27.7) Tier 3 respiratory conditions received antibiotics ranging from 0.25% to 83.3%. The ICC for providers (0.247) was higher than for clinics (0.0459) indicating that a greater proportion of variation was due to providers than clinics.

First-Line Antibiotic Prescribing Variability in Pharyngitis, Sinusitis, and AOM —For encounters where patients were diagnosed with pharyngitis, sinusitis, or AOM and an antibiotic was prescribed, 69.2% received a first-line antibiotic. The variability in first-line antibiotic prescribing by clinic and provider is shown in Figure S2 A/B in the Supplementary Appendix. By clinic, a median of 70.6% (IQI 65.9 to 73.8) of encounters for these conditions received first-line antibiotics, ranging from 49.3% to 87.8%. The percent of encounters for these conditions with first-line antibiotics was higher at KidsCare clinics (85.5%, $p<0.001$) and lower at Connect Care (59.3%, $p<0.001$) compared to InstaCare clinics (68.4%). By provider, a median of 75.0% (IQI 66.8 to 81.9) of encounters for these conditions had first-line antibiotics prescribed, ranging from 14.4% to 96.7%. The ICC for providers (0.0867) was higher than for clinics (0.0101).

Patient Satisfaction

During the 5-month period where patient satisfaction survey and antibiotic prescribing data were available, 10,179 surveys were completed for encounters for Tier 2 and Tier 3 respiratory conditions. Among these, antibiotics were prescribed in 5,239 (51%) encounters. The mean satisfaction score for visits where an antibiotic was prescribed was slightly higher (8.68, 95% CI: 8.64, 8.73) compared to visits where an antibiotic was not prescribed (8.33, 95% CI: 8.27, 8.38).

DISCUSSION

In a large network of UCs, 34% of visits resulted in antibiotic prescriptions and respiratory conditions accounted for the majority (61%). For respiratory conditions specifically, antibiotics were prescribed half of the time, yet variability at the level of the provider ranged from prescribing antibiotics during as few as 3% to as many as 94% of encounters. Additionally, substantial variability existed among individual providers in appropriate prescribing of antibiotics, including antibiotic use for conditions that never warrant antibiotics and use of first-line antibiotics. Collectively these findings support the importance of integrating antibiotic stewardship principles into UC settings and developing interventions specifically targeting UC settings.

Many outpatient stewardship interventions have focused on reducing unnecessary antibiotic prescribing for conditions for which antibiotics are completely unnecessary.[7,8,11] However, our findings highlight the importance of “Tier 2” respiratory conditions including pharyngitis, sinusitis and AOM. Collectively these accounted for more than half of all antibiotic prescriptions, whereas by comparison, Tier 3 respiratory conditions accounted for fewer than 1 in 5. Stewardship interventions that target Tier 2 respiratory conditions have the potential for substantial impact through ensuring appropriate diagnosis to reduce unnecessary antibiotic use, utilizing delayed prescriptions for sinusitis and AOM, and promoting appropriate antibiotic selection.

Overall antibiotic prescribing in the IH UC setting is similar to results from a national study (34% of visits for IH UC versus 39% nationally).[17] However, we observed tremendous variability in all respiratory antibiotic prescribing metrics at the level of the individual prescriber such that the highest prescribing clinicians prescribe antibiotics nearly five times as often as the lowest prescribing clinicians. The substantial between-clinician variability in appropriateness metrics, such as prescribing for Tier 3 respiratory conditions (ideally very low) and use of first-line antibiotics (ideally very high), demonstrates that variability in appropriate prescribing also exists. These findings suggest that peer-comparison stewardship interventions, used successfully in primary care, could be used in UC and may need to be more intensively targeted towards selected clinicians with poor performance.

Patient satisfaction is important in all healthcare settings. In our data, the mean satisfaction scores were slightly higher during visits with antibiotics prescribed compared to not, a trend seen in other outpatient settings[18–21]. These differences were so small that they can be used to reassure providers in our system that improving prescribing is unlikely to meaningfully impact patient satisfaction.

In respiratory encounters, we found that overall antibiotic prescribing was lower and measures of appropriateness higher in KidsCare compared to InstaCare. Additionally, overall and Tier 3 respiratory prescribing were also lower in Connect Care than Instacare. Differences in overall antibiotic prescribing between settings could be explained by differences in case mix and comorbidity profiles among InstaCare, KidsCare, and Connect Care. Prior studies are consistent with our findings and indicate that pediatricians prescribe antibiotics less often than other specialties.[22,23] On the other hand, the relatively lower

prescribing rates during telemedicine visits for Tier 3 respiratory conditions differs from that reported from recent studies.[24,25] One potential explanation is that our study focuses on care within an integrated care delivery network where incentives to prescribe antibiotics may be different than in other telemedicine settings[26]. Additionally, even though the IH UC network has not participated in a dedicated system-wide antibiotic stewardship intervention, IH has a strong culture of antibiotic stewardship[27–30] which may partly explain differences in antibiotic prescribing practices compared to national studies.

Our study has limitations which may limit generalizability. Compared to national averages, antibiotic prescribing rates are relatively low both in this geographic region[31] and in the IH system which could lead to an underestimate of the extent to which inappropriate antibiotic occurs in UC settings. IH is an integrated care delivery system which may lead to different practice patterns than in other types of UCs due to differences such as physician compensation models and patient access to care. Our unit of analysis for antibiotic prescribing was the electronic prescription and this did not enable distinction between immediate and delayed prescriptions, nor did this capture actual antibiotic fills. Thus, we may have over-estimated actual antibiotic consumption. In addition, we did not assess the concordance of billed ICD10 codes and clinical diagnosis or account for laboratory confirmation of group A Streptococcus which limits our ability to assess whether antibiotics were truly justified. For the analysis of first-line antibiotics, we did not account for recent antibiotic use or allergy, which affect antibiotic selection and may have led to an underestimate of appropriateness.

In conclusion, we found in a large network of UC clinics, most encounters are for infectious disease conditions and that substantial variability in antibiotic prescribing practices and appropriateness exists at the level of individual providers. These findings will require additional study to identify predictors of antibiotic prescribing variability that would be amenable to stewardship interventions. Several urgent care organizations, such as the Urgent Care Association, have made commitments to improve antibiotic use.[30] Engagement of these industry partners will be critical to the success of stewardship initiatives in UC. Because UC encounters are rapidly growing nationwide, the design and implementation of stewardship strategies specifically tailored to UC settings through partnership between the UC and stewardship communities is an urgent priority.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding:

This work supported by the Centers for Disease Control and Prevention Safety and Healthcare Epidemiology Prevention Research Development (SHEPheRD) [contract number 200-2016-91799].

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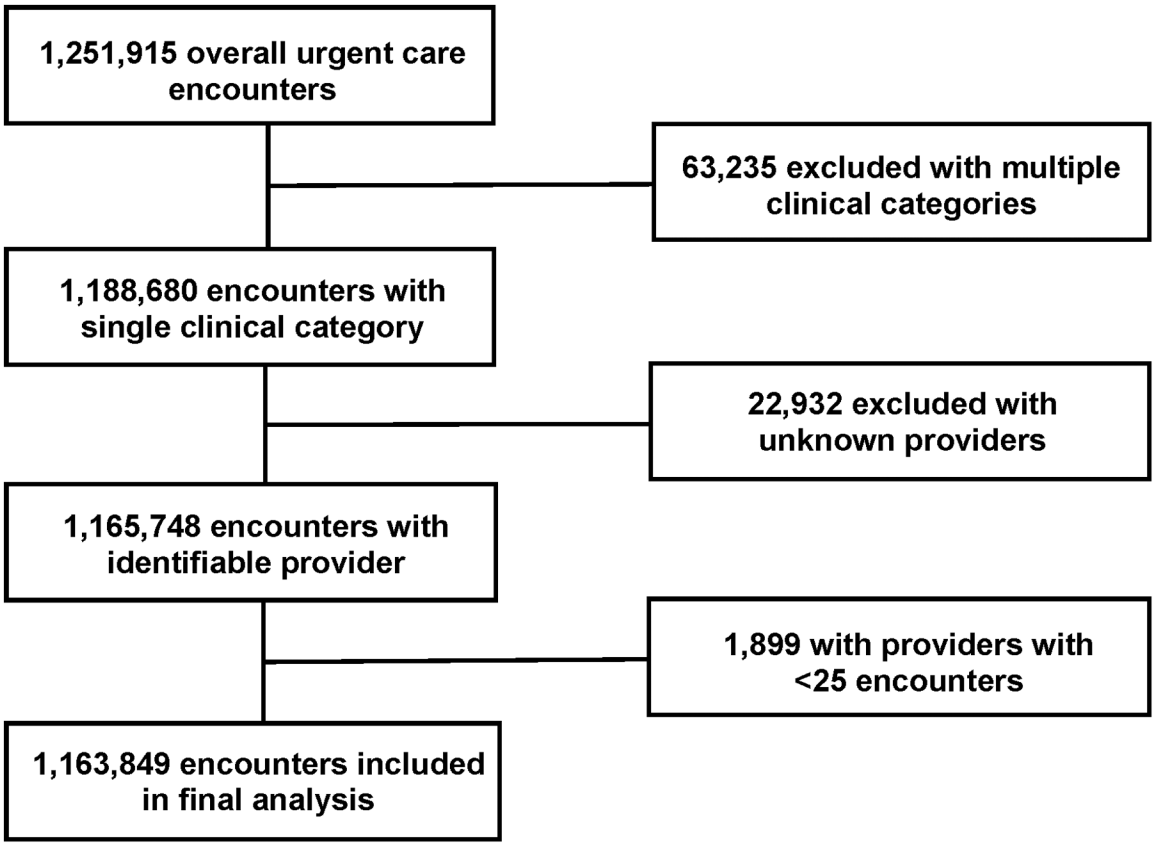

Figure 1.
Flow chart illustrating criteria used to exclude selected urgent care encounters to derive final study dataset.

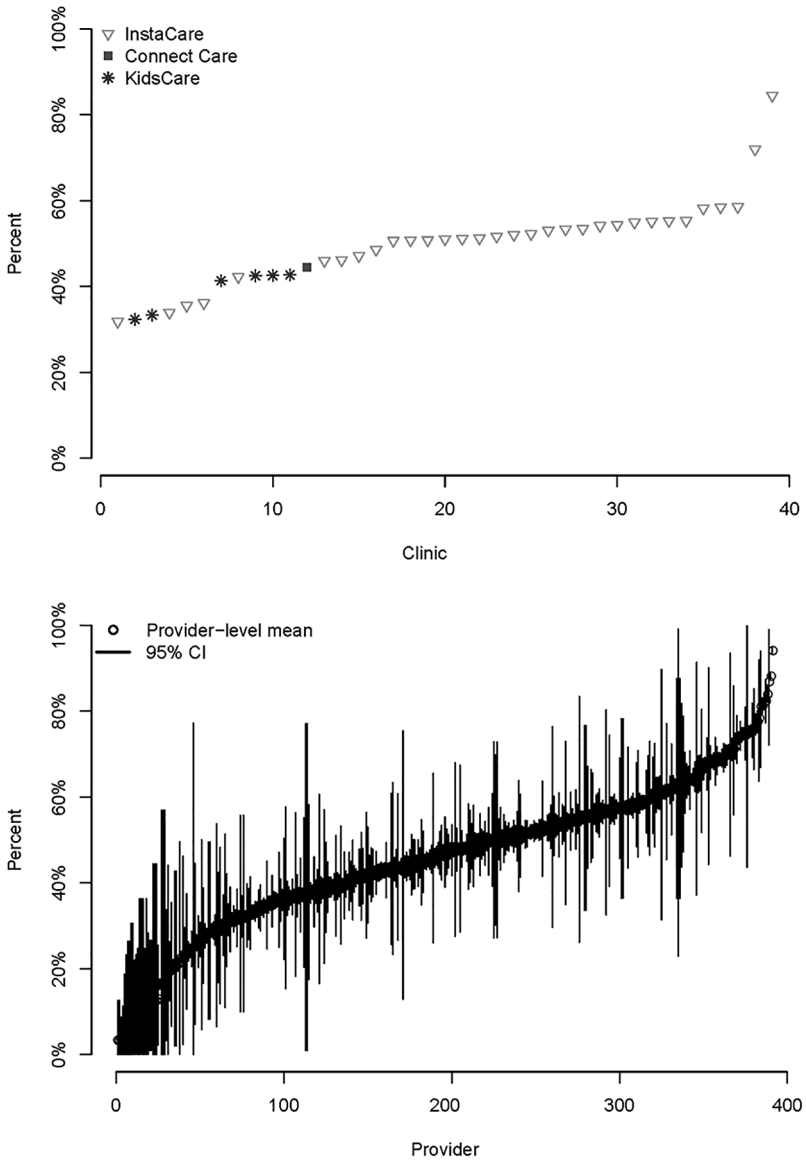

Figure 2.

A/B. The percentage of urgent care encounters for respiratory conditions with an antibiotic prescription by individual clinics (A) and individual providers (B).

Footnote:

Figures represent 39 total clinic sites (32 Instacare [all ages], 6 Kidscare [<18 years] and 1 Connect Care [telemedicine]) and 396 providers. Respiratory conditions defined in the Appendix. Vertical lines represent 95% confidence intervals.

Table 1:

Patient demographics and clinical distribution of Intermountain's urgent care encounters

	Total N = 1,163,849	InstaCare N = 1,043,040	Connect Care N = 37,453	KidsCare N = 83,356
Encounter Level Patient Demographics				
White	83.6% (n=973,289)	84.3% (n=878,835)	83.4% (n=31,221)	75.9% (n=63,233)
Female	56.7% (n=659,663)	57% (n=594,868)	64.2% (n=24,030)	48.9% (n=40,765)
Patient age, median	30 (IQI 15–48) *	32 (IQI 19–50)	33 (IQI 19–43)	6 (IQI 2–11)
Physician Provider	90% (n=104,451) *	92.5% (n=961,057)	0.5% (n=205)	100% (n=83,189)
Advanced Practice Provider	10% (n=115,542) *	7.5% (n=78,294)	99.5% (n=37,248)	0% (n=0)
Encounter Level Clinical Categories				
Respiratory	41.8% (n=486,061)	40.8% (n=426,070)	47% (n=17,621)	50.8% (n=42,370)
Skin	13.7% (n=159,009)	13.8% (n=143,831)	12.4% (n=4,635)	12.6% (n=10,543)
GU	8.1% (n=93,855)	8.4% (n=87,149)	12.1% (n=4,541)	2.6% (n=2,165)
GI	6.3% (n=73,823)	6.4% (n=66,665)	5.7% (n=2,132)	6% (n=5,026)
Other	25.3% (n=294,261)	25.8% (n=269,250)	18.3% (n=6,862)	21.8% (n=18,149)
Unclassified	4.9% (n=56,840)	4.8% (n=50,075)	4.4% (n=1,662)	6.1% (n=5,103)
Tier 1	11.9% (n=135,113)	12.3% (n=125,018)	8.7% (n=3,229)	8.6% (n=6,866)
Tier 2	30.1% (n=341,050)	29.7% (n=302,337)	33.1% (n=12,271)	33% (n=26,442)
Tier 3	55.6% (n=630,846)	55.6% (n=565,610)	54.7% (n=20,291)	56.1% (n=44,945)
Encounter Level Antibiotic Prescribing Rate				
Total antibiotic prescribing Rate	34.1% (n=396,825)	34.9% (n=364,097)	32.6% (n=12,208)	24.6% (n=20,520)

* 4 encounters were missing patient age data and 3,856 encounters were missing provider specialty data

Tier 1: Antibiotics are almost always indicated (e.g., pneumonia)

Tier 2: Antibiotics may be indicated (e.g., sinusitis)

Tier 3: Antibiotics not indicated (e.g., bronchitis)

IQI = Interquartile Interval

Table 2:

Distribution of respiratory encounters and antibiotic prescribing practices among Intermountain's urgent care clinics

	Total - Respiratory N = 486,061	InstaCare - Respiratory N = 426,070	Connect Care - Respiratory N = 17,621	KidsCare - Respiratory N = 42,370
Distribution of respiratory encounter types				
Tier 1	9.2% (n=44,727/486,061)	9.4% (40,090/426,070)	0.3% (47/17,621)	10.8% (4,590/42,370)
Tier 2	49.9% (n=242,343/486,061)	49.9% (212,432/426,070)	53.8% (9,484/17,621)	48.2% (20,427/42,370)
Tier 3	40.9% (n=198,991/486,061)	40.7% (173,548/426,070)	45.9% (8,090/17,621)	41% (17,353/42,370)
Respiratory encounter antibiotic prescribing rates				
Total Respiratory Prescribing rates	49.9% (242,651/486,061)	51.3% (218,445/426,070)	44.4% (7,829/17,621)	38.7% (16,377/42,370)
Tier 1	96.6% (43,187/44,727)	96.5% (38,686/40,090)	31.9% (15/47)	97.7% (4,486/4,590)
Tier 2	64.8% (157,078/242,343)	65.4% (138,948/212,432)	81.3% (7,715/9,484)	51% (10,415/20,427)
Tier 3	21.3% (42,386/198,991)	23.5% (40,811/173,548)	1.2% (99/8,090)	8.5% (1,476/17,353)
Respiratory tier distribution among respiratory encounters prescribed an antibiotic				
Tier 1	17.8% (43,187/242,651)	17.7% (38,686/218,445)	0.2% (15/7,829)	27.4% (4,486/16,377)
Tier 2	64.7% (157,078/242,651)	63.6% (138,948/218,445)	98.5% (7,715/7,829)	63.6% (10,415/16,377)
Tier 3	17.5% (42,386/242,651)	18.7% (40,811/218,445)	1.3% (99/7,820)	9% (1,476/16,377)

Tier 1: Antibiotics are almost always indicated (e.g., pneumonia)

Tier 2: Antibiotics may be indicated (e.g., sinusitis)

Tier 3: Antibiotics not indicated (e.g., bronchitis)