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A Multisite Collaborative to Decrease Inappropriate Antibiotics in Urgent Care Centers

Amanda Nedved, MD^a, Melody Fung, MPH^b, Destani Bizune, MPH^c, Cindy M. Liu, MD, MPH, PhD^b, Jill Obremskey, MD, MMHC^d, Katherine E. Fleming-Dutra, MD^c, Rana F. Hamdy, MD, MPH, MSCE^{e,f}, Amanda Montalbano, MD, MPH^a

^aDivision of Urgent Care, Children's Mercy Kansas City, University of Missouri-Kansas City School of Medicine, Kansas City, Missouri

^bAntibiotic Resistance Action Center, Department of Environmental and Occupational Health, Milken Institute School of Public Health, George Washington University, Washington, District of Columbia

^cDivision of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

^dTennessee Department of Health, Nashville, Tennessee

^eDivision of Infectious Diseases, Children's National Hospital, Washington, District of Columbia

^fDepartment of Pediatrics, School of Medicine and Health Sciences, George Washington University, Washington, District of Columbia

Abstract

BACKGROUND: Urgent care (UC; a convenient site to receive care for ambulatory-sensitive) centers conditions; however, UC clinicians showed the highest rate of inappropriate antibiotic prescriptions among outpatient settings according to national billing data. Antibiotic prescribing practices in pediatric-specific UC centers were not known but assumed to require improvement. The aim of this multisite quality improvement project was to reduce inappropriate antibiotic prescribing practices for 3 target diagnoses in pediatric UC centers by a relative 20% by December 1, 2019.

METHODS: The Society of Pediatric Urgent Care invited pediatric UC clinicians to participate in a multisite quality improvement study from June 2019 to December 2019. The diagnoses

Address correspondence to Amanda Montalbano, MD, MPH, University of Missouri-Kansas School of Medicine, Children's Mercy Kansas City, 20300 East Valley View Pkwy, Independence, MO 64057. amontalbano@cmh.edu.

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included acute otitis media (AOM), otitis media with effusion, and pharyngitis. Algorithms based on published guidelines were used to identify inappropriate antibiotic prescriptions according to indication, agent, and duration. Sites completed multiple intervention cycles from a menu of publicly available antibiotic stewardship materials. Participants submitted data electronically. The outcome measure was the percentage of inappropriate antibiotic prescriptions for the target diagnoses. Process measures were use of delayed antibiotics for AOM and inappropriate testing in pharyngitis.

RESULTS: From 20 UC centers, 157 providers submitted data from 3833 encounters during the intervention cycles. Overall inappropriate antibiotic prescription rates decreased by a relative 53.9%. Inappropriate antibiotic prescribing decreased from 57.0% to 36.6% for AOM, 54.6% to 48.4% for otitis media with effusion, and 66.9% to 11.7% for pharyngitis.

CONCLUSIONS: Participating pediatric UC providers decreased inappropriate antibiotic prescriptions from 60.3% to 27.8% using publicly available interventions.

Urgent care (UC) centers are becoming an increasingly popular setting for ambulatory-sensitive conditions.¹ In 2014, a group of pediatric UC clinicians founded the Society of Pediatric Urgent Care (SPUC) with the goal of developing clinical standards for pediatric UC clinicians who provide unscheduled nonemergent care to children when the medical home is not an option.² More than one-third of pediatric patients who present to UC centers report upper respiratory symptoms, including otalgia and pharyngitis, as their chief complaint.³

Inappropriate antibiotic prescribing contributes to increased rates of antibiotic-resistant infections, leading to increased health care costs.⁴ This prescribing practice also puts patients at risk for adverse reactions and drug adverse effects.⁵ In a study of claims data, Palms et al⁶ reported that the highest incidence (45.7%) of inappropriate antibiotic prescribing occurs in UC centers. However, these researchers did not differentiate between general UC and specialized pediatric UC centers. In a separate study, Frost et al⁷ reported that pediatricians are more likely to follow guideline-concordant prescribing practices for pharyngitis and sinusitis and withhold antibiotics for viral respiratory infections compared with nonpediatricians.

Previous antibiotic stewardship quality improvement (QI) studies have encouraged the use of delayed prescriptions in acute otitis media (AOM) to decrease overall antibiotic use in eligible patients in the primary pediatric setting⁸ and emergency department.⁹ Other outpatient studies have coached providers on effectively communicating a treatment plan with families to decrease unnecessary antibiotic prescribing while maintaining positive patient experiences.¹⁰ In their joint statement released in 2020, the American Academy of Pediatrics (AAP) and Pediatric Infectious Diseases Society identified UC centers as an important target for antibiotic stewardship initiatives.¹¹ A leadership team comprising subject matter experts from the SPUC, the Centers for Disease Control and Prevention (CDC), Children's Mercy Kansas City, Children's National Hospital, and the Antibiotic Resistance Action Center designed and led a multisite QI collaborative to achieve a reasonable goal: Decrease the use of inappropriate antibiotics in freestanding pediatric UC centers by a relative 20% from the beginning of the project period to the end.

METHODS

Project Design

In January 2019, the leadership team recruited participants through SPUC e-mails, newsletters, and webinars. The SPUC had a membership of ~500 physicians and advanced practice providers from ~200 UC centers. Although the SPUC supported the project, clinicians did not have to be members to participate in the study. A recruitment webinar in February 2019 provided details for participation: Each institution needed a minimum of 3 providers to each commit to submitting 10 patient encounters per month (or at least 30 charts per month for those with <3 providers participating). As a recruitment incentive, we offered American Board of Pediatrics Maintenance of Certification (MOC) Part 4 credit to eligible pediatricians participating in the study. From March 2019 to May 2019, participants submitted data on 10 sequential patients who received antibiotics to identify the diagnoses for which UC clinicians prescribed antibiotics. From these submissions, 3 target diagnoses were chosen: AOM, otitis media with effusion (OME), and pharyngitis. We chose AOM and pharyngitis because these were the most common diagnoses for which UC clinicians prescribed antibiotics. OME accounted for only 3% of diagnoses to receive antibiotics, but we believed that it was important to evaluate the prescribing practices for OME at the same time as AOM. To minimize participant attrition, we limited the intervention period to 9 months of active participation (March 2019 to December 2019), with the final project evaluation coinciding with submission for MOC credit. Live webinars each month were convened to review the deidentified aggregate results and discuss barriers and successes of the study. Subject matter experts on antibiotic stewardship and QI science provided didactic sessions during the webinars. Attending the webinars was a requirement for participation; however, webinars were recorded, and participants were able to self-report that they had reviewed the recorded version.

Data Collection

The study collection period occurred from June 2019 to November 2019. Each month, there was a 2-week data collection period when participants entered data on antibiotic prescribing practices for sequential cases of diagnosed AOM, OME, or pharyngitis. Clinicians completed data entry on all encounters with these diagnoses until they reached a total of 10 for that month. Data collected included patient demographics, target primary diagnosis, codiagnoses, clinical characteristics (medication allergies and type of reaction, comorbidities, recent health history, diagnostic orders), type of antibiotic prescription (none, during visit, immediate fill, or delayed prescription), and antibiotic prescription information (agent, dose, frequency, and duration). All data were submitted through Research Electronic Data Capture^{12,13} (Supplemental Information 1).

Interventions

The MITIGATE Antimicrobial Stewardship Toolkit: A Guide for Practical Implementation in Adult and Pediatric Emergency Department and Urgent Care Settings^{14,15} served as the source for all the project's interventions. During the first plan-do-study-act (PDSA) cycle, we required all participating sites to sign and post a letter of commitment to antibiotic stewardship.¹⁶ No site reported having a commitment letter posted before the intervention

period. The leadership team collated a menu of intervention choices from publicly available content covering a variety of strategies from which each center could choose to implement during the intervention period, including provider clinical education, provider communication training, parent engagement, and patient engagement tools. Because of the variability of resources available at each UC center, each site had autonomy to choose 2 interventions to implement during the second and third PDSA cycles that would best address the causes they identified for unnecessary antibiotic prescribing (Supplemental Table 3).

Measures

For our primary outcome measure, we evaluated the rate of overall inappropriate antibiotic prescriptions for all target diagnoses. To determine antibiotic appropriateness for each encounter, the leadership team developed algorithms using the 2013 AAP guidelines for AOM, the 2004 American Academy of Otolaryngology-Head and Neck Surgery and AAP joint guidelines for OME, and the 2012 Infectious Diseases Society of America guidelines for group A streptococcal pharyngitis (Supplemental Information 2).¹⁷⁻¹⁹ We used a 3-tiered classification system from previously published literature to determine if antibiotics were appropriate, taking into consideration any associated codiagnoses.²⁰⁻²² Tier 1 diagnoses included conditions for which antibiotics are almost always indicated. Tier 2 diagnoses included conditions for which antibiotics may be indicated, including for AOM and pharyngitis. Tier 3 diagnoses included conditions for which antibiotics are not indicated or the indication is unclear, including OME. Submitted encounters of any of the target diagnoses, including OME, with a codiagnosis in tier 1 or tier 2 were assumed to have been prescribed antibiotics appropriately (Supplemental Information 2A)

We reviewed encounters of uncomplicated AOM for appropriateness. We considered amoxicillin as the appropriate antibiotic agent unless the patient was allergic to penicillin or was codiagnosed with a tier 1 or 2 codiagnosis (eg, conjunctivitis). If the patient received an antibiotic other than amoxicillin, we assumed that the antibiotic agent was appropriate if the patient had any of the following: significant comorbidity (eg, immunosuppression, end-stage liver disease, chronic lung disease), recurrent AOM, or antibiotic use in the past 30 days. We reviewed antibiotic duration according to the patient's age and prescribed antibiotic. Finally, we evaluated the encounter for eligibility in delayed prescribing and if prescription type (immediate vs delayed) was appropriate (Supplemental Information 2B). Due to the limitations of the study design, the scope of the study did not include diagnostic stewardship.

For patients with pharyngitis as their primary diagnosis, we considered any patient with a codiagnosis of viral upper respiratory infection (URI) or who was <3 years of age with a streptococcal test as inappropriately tested. If patients were appropriately tested, we then considered them to be appropriately treated only if the test result was positive. We considered amoxicillin or penicillin as the appropriate antibiotic choice unless a tier 1 or 2 codiagnosis was present or there was a documented penicillin allergy (Supplemental Information 2C).

We also measured the individual rate of inappropriate antibiotics for AOM, OME, and pharyngitis. In secondary analyses, we evaluated which factor in prescribing practices (indication, agent, or duration) contributed to categorization as inappropriate use for each

diagnosis. Additionally, we evaluated the frequency with which participants engaged in best practices for antibiotic prescriptions for AOM and pharyngitis. We evaluated the frequency of AOM encounters that qualified for a period of observation¹⁸ and received delayed antibiotics. For pharyngitis we evaluated how often patients <3 years of age or with a codiagnosis of URI underwent streptococcal testing.

The process measure of live webinar attendance by participants was used to evaluate the level of engagement in the project. For this measure, we evaluated the percentage of participants who attended the live webinar each month. We used the percentage of all encounters that included laboratory (excluding rapid streptococcal antigen testing) or radiology orders as a balancing measure to evaluate if the interventions were resulting in increased resource use.

Analysis

We exported data from Research Electronic Data Capture to Microsoft Excel and SAS version 9.4 (SAS Institute, Cary, NC) for analysis. Demographic characteristics of the patients for each diagnosis were compared using χ^2 test. Because of the short duration of the study and limited number of data points, we used a line graph to trend the rates of inappropriate antibiotic prescriptions for all encounters and for individual diagnoses. We tracked process and balancing measures on line graphs as well. We performed secondary analyses of the data to identify future areas for improvement using line graphs and Pareto charts. We used χ^2 test to detect changes from the beginning of the intervention period to the end. We did not report results at the individual level to decrease reporting bias by participants and preserve anonymity. In previous studies, evaluation at the individual level confounded results through cross contamination of practice changes and increased hesitation in participation.²³ The study team provided participants with feedback using the global deidentified site data during monthly webinars. The institutional review board at Children's Mercy Kansas City determined that this study did not involve research as defined by Department of Health and Human Services regulations.

RESULTS

Participants

Of ~500 members of the SPUC, our recruitment goal was 30 participants. We exceeded this goal with 157 participants in this study. These clinicians serve 20 US institutions with freestanding pediatric UC centers (4 West, 6 Midwest, 7 South, 3 Northeast).

Interventions

The interventions selected for each PDSA cycle are listed in Table 1. Ten sites (50%) chose provider education for at least 1 of their interventions. Sites also chose interventions that included parent engagement (40%), communication training (35%),¹⁰ and social media (30%) during the intervention period.

Demographics

Participants submitted data on 3833 encounters during the intervention period (June to November 2019). Demographics of the encounters are listed in Table 2. AOM was the most common diagnosis (52.0%), followed by pharyngitis (40.9%) and OME (7.1%).

Outcome Measures

At the beginning of the intervention period, 60.3% of all patient encounters resulted in an inappropriate antibiotic prescription. This rate decreased to 27.8% by the end of the intervention period ($P < .01$). The rates of inappropriate antibiotic prescriptions decreased in AOM and pharyngitis from 57.0% and 66.9% to 36.6% and 11.7%, respectively ($P < .01$). The rates of inappropriate antibiotic prescriptions for OME did not decrease ($P = .67$). Because OME was a small proportion of the patient encounters, encounters for AOM and pharyngitis drove the improvement in the overall rates of inappropriate antibiotic prescriptions (Fig 1).

The most common error in prescribing for AOM was inappropriate duration (Fig 2A). Rates of inappropriate duration for AOM encounters improved over time from 49.9% to 26.2% ($P < .01$). However, the rate of inappropriate antibiotic choice ($P = .11$) and type of prescription ($P = .75$) did not improve (Fig 2B). AOM encounters with delayed antibiotic prescriptions made up 8.1% of encounters at the beginning of the intervention period and increased to a high of 15.9% during PDSA cycle 3; however, the improvement was not sustained and was 10.0% by the end of the intervention period (Fig 2C).

For pharyngitis, the most common factor contributing to inappropriate prescriptions was antibiotic choice (Fig 3A). This rate improved over time from 52.4% to 3.6% ($P < .01$). However, the rate of inappropriate testing ($P = .08$) and treating without a test ($P = .18$) did not change significantly (Fig 3B). Sustained improvement also was not seen in inappropriate streptococcal testing for patients with concurrent URI symptoms or < 3 years of age during the intervention period (Fig 3C). Of the 131 encounters with inappropriate streptococcal testing, 28% ($n = 37$) were prescribed an antibiotic.

Process and Balancing Measures

The percentage of participants who attended the live webinar decreased over time, with the lowest attendance at the end of the intervention period (41.0% vs 24.2%) (Fig 4).

The percentage of encounters resulting in laboratory testing (excluding rapid streptococcal antigen testing) remained stable (34.9% vs 36.8%). The percentage of encounters with radiology orders decreased during the intervention period (2.0%–1.0%).

DISCUSSION

In this first multisite pediatric UC QI collaborative, we improved antibiotic prescribing practices in AOM, pharyngitis, and OME using publicly available intervention tools. We show a relative decreased rate of inappropriate antibiotic prescriptions by 53.9%, and the relative rate of inappropriate antibiotic use decreased by 35.8% in AOM and 82.5% in pharyngitis.

Our process measures of webinar attendance did not correlate with the improvement we saw in the outcome measure. Although the webinars provided expert content at the global level, the interventions at the local level may have had a larger impact on the outcome measure. Despite the decrease in live webinar viewing, antibiotic prescribing practices improved with each PDSA cycle, with more appropriate antibiotic choices for pharyngitis encounters and appropriate duration for AOM encounters driving the overall improvement. Although antibiotic choice improved, inappropriate testing in patients with pharyngitis still resulted in 28% of patients being exposed to antibiotics. Continued focus on appropriate testing in pharyngitis should be further explored to overcome barriers to more judicious antibiotic prescribing.

This project did not increase the rate of offering delayed prescriptions for eligible patients diagnosed with AOM to reduce antibiotic use,¹¹ a finding consistent with previous studies revealing that clinicians have been slow to adopt using a period of observation before prescribing antibiotics in mild cases of AOM.²⁴ Because the relationship between the patient and UC provider is limited to the duration of a single visit, UC providers reported hesitancy to delay treatment, citing inability to monitor progression of illness or guarantee follow-up.²⁴ Researchers should explore the barriers to UC providers' limited use of delayed prescribing.

Pediatric UC providers prescribed antibiotics for more than one-half of OME encounters, a prescribing rate similar to that reported by Palms et al.⁶ By the end of the intervention period, inappropriate antibiotic prescriptions for OME had decreased to 48.4%, which is similar to the frequency reported for emergency departments and retail clinics but still higher than medical offices.⁶ Studies have revealed that health care providers are more likely to prescribe antibiotics when none are indicated if they perceive that families are expecting antibiotics.²⁵ However, although some families may expect antibiotics, patient satisfaction scores have been shown to be highest in patients who did not receive antibiotics but were provided positive recommendations for nonantibiotic treatment options, including supportive care and a contingency plan.²⁶ Although accounting for a small portion of encounters, as a never-diagnosis, OME could be explored as a future diagnosis to evaluate integration of watchful waiting as an intervention option in the setting of a pediatric UC to successfully decrease inappropriate use of antibiotics.

Ideally, the project would have lasted an entire year to capture the variation in seasonal illnesses; however, best practice of implementation science demands that the culture and environment be accounted for to successfully complete an intervention.²⁷ Requiring increased attendance (webinars, onsite meetings) and activities (submitting case data, completing education modules) for shift workers in the high-pace, high-volume time of winter respiratory season would have placed undue pressure on the participants and affected their ability to complete the requirements for participation. Our project involved low-reliability interventions²⁸ that challenge the ability to sustain improvement after the project concludes. However, our hope is that this antibiotic stewardship initiative provided a foundation for UC centers to develop their own local antibiotic initiatives that consider the people and systems unique to each UC center.

Although this study involved 20 pediatric UCs across the United States, generalizability may be limited. As with all QI studies, the interventions do not occur in a vacuum. It is possible that there were competing local projects at individual UC centers that may have influenced the results of our multicenter study. However, no centers identified competing projects during the intervention period when we asked for program feedback at the close of the project. In the absence of a national registry, we relied on the integrity of the providers to report their individual prescribing practices to collect data, which is at risk for bias. Participants' prescribing behavior may have been influenced because they knew their prescribing patterns were being monitored or because MOC credit was being offered to eligible participants. We minimized the selection bias by instructing participants to report prescribing practices on 10 sequential encounters with the target diagnoses for each month during the collection period. We also limited the analyses to site-level data, leveraging anonymity at the individual level to improve integrity in reporting.²⁹

Unlike traditional QI studies, ours did not have uniform interventions applied to all settings at the same time. Using methods from implementation and dissemination science, we allowed each UC center to choose the intervention that would best address their identified barriers to appropriate antibiotic prescribing. Because of the relatively resource-poor settings in which our participants practice, we relied on publicly available resources for our interventions. Although these resources have low reliability,²⁸ they are affordable, accessible, and easy to implement without significant investment of finances or time. Our results reveal that low-reliability interventions affected the intended outcome without significant barriers in implementation. However, we recognize that these changes are difficult to maintain because new people enter the system and humans fall back on old habits. Future work is needed to embed these changes into the UC system by incorporating antibiotic stewardship initiatives into local onboarding processes, annual mandatory education, audits, and national benchmarking.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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ABBREVIATIONS

AAP American Academy of Pediatrics

AOM	acute otitis media
CDC	Centers for Disease Control and Prevention
MOC	Maintenance of Certification
OME	otitis media with effusion
PDSA	plan-do-study-act
QI	quality improvement
SPUC	Society of Pediatric Urgent Care
UC	urgent care
URI	upper respiratory infection

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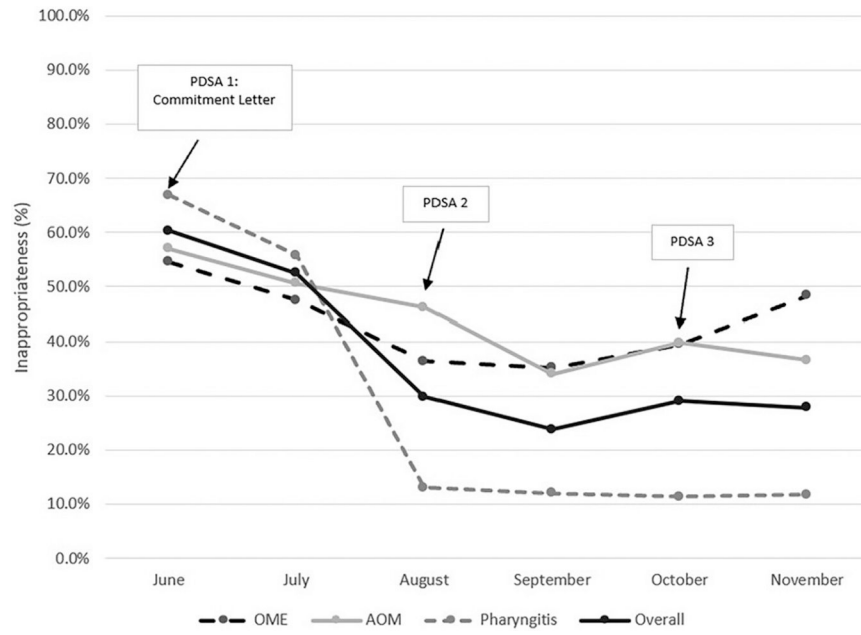


FIGURE 1. Rates of inappropriate antibiotic prescriptions overall and for each target diagnosis by month.

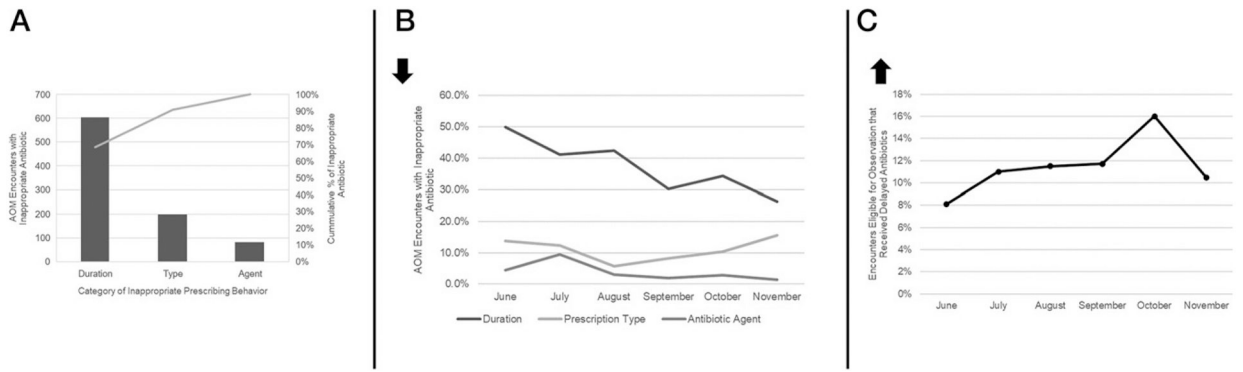


FIGURE 2.

A, Pareto chart of category of inappropriate antibiotic prescriptions for AOM encounters.

B, Rates of inappropriate prescribing behaviors for AOM encounters over time. **C**, Rates

of delayed antibiotics for AOM encounters eligible for a period of observation according to national guidelines.

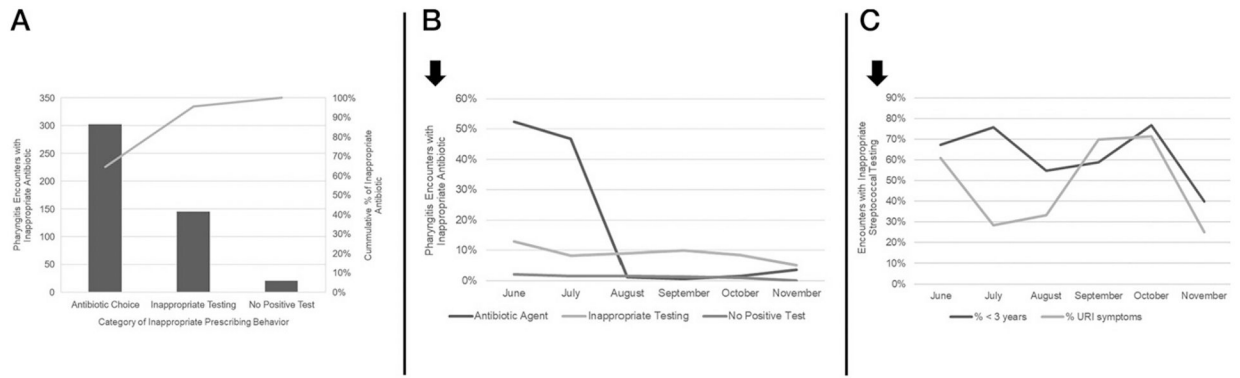


FIGURE 3. **A**, Pareto chart of category of inappropriate antibiotic prescriptions for pharyngitis encounters. **B**, Rates of inappropriate prescribing behaviors for pharyngitis encounters over time. **C**, Rates of streptococcal testing in patients with concurrent URI symptoms or <3 years of age.

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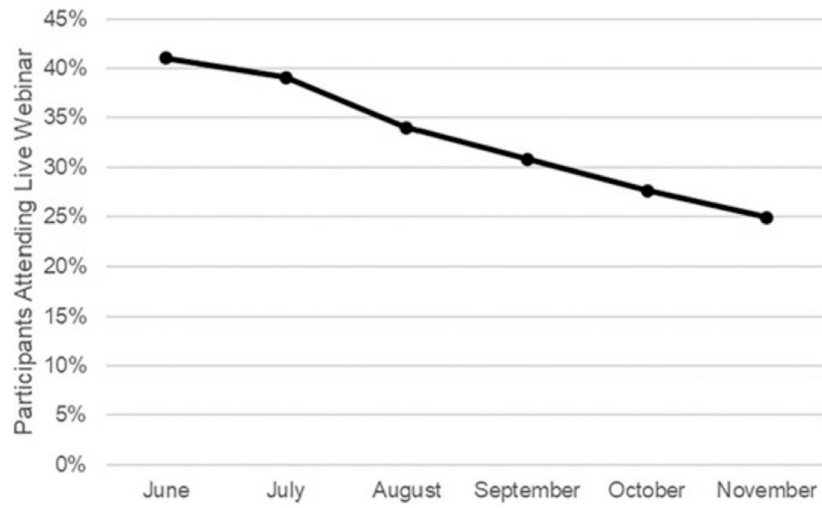


FIGURE 4. Percentage of participants who attended live webinars each month.

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TABLE 1

Intervention Choice and Rates of Inappropriate Antibiotic Use

Site	PDSA Cycle Average, %							Improvement From Baseline, Relative %
	Baseline Average (Jun), %	After Cycle 1 ^a (Jun-Jul)	Cycle 2 ^b	After Cycle 2 (Aug-Sep)	Cycle 3 ^b	After Cycle 3 (Oct-Nov)		
1A	60.0	67.5	Communication training	20.0	Parent engagement	20.0	66.7	
2A	75.0	76.8	Provider education	30.2	Communication training	17.9	76.1	
3A	40.0	51.9	Provider education	34.8	Provider education	29.4	26.5	
4A	63.8	55.2	Provider education	30.6	Parent engagement	26.7	58.2	
5A	61.5	47.1	Provider education	15.2	Communication training	32.9	46.5	
6A	50.0	47.6	Social media	19.2	Delayed prescribing	13.6	72.8	
7A	47.1	48.3	Delayed prescribing	20.0	Provider education	38.1	19.1	
10A	53.8	53.1	Provider education	16.5	Patient engagement	12.2	77.3	
12A	65.4	61.5	Provider education	43.3	Communication training	44.2	32.4	
13A	60.7	54.9	Parent engagement	17.1	Patient engagement	24.0	60.5	
14A	42.9	49.2	Delayed prescribing	16.1	Provider education	8.3	80.7	
15A	55.4	53.6	Delayed prescribing	26.8	Provider education	31.3	43.5	
16A	65.5	58.0	Parent engagement	36.7	Communication training	40.0	38.9	
17A	62.3	58.3	Provider education	25.5	Communication training	28.4	54.4	
18A	70.0	54.8	Parent engagement	36.5	Delayed prescribing	26.9	61.6	
19A	91.7	86.7	Social media	83.3	Communication training	16.7	81.8	
24A	79.5	78.4	Parent engagement	46.2	Social media	53.4	32.8	
25A	50.0	44.1	Parent engagement	31.3	Social media	25.0	50.0	
27A	93.3	88.0	Parent engagement	70.0	Social media	72.7	22.1	
29A	72.2	60.4	Parent engagement	8.3 ^c	Social media	— ^d	88.5	

Specific interventions grouped into categories are listed in Supplemental Table 3.

^a A commitment letter was required for PDSA cycle 1.

^b Individual sites chose from a menu of intervention options adapted from the CDC toolkit for PDSA cycles 2 and 3.

^c Data for August only.

^d No data for October and November.

TABLE 2

Patient Demographics for the 3 Target Diagnoses

Patient Characteristic (N = 3833)	AOM (n = 1994, 52.0%)	OME (n = 272, 7.1%)	Pharyngitis (n = 1567, 40.9%)	P
Age, y, median (IQR)	2 (1–5)	2 (1–6)	7 (4–10)	< .01
Race				.06
White	1390 (69.7)	206 (75.7)	1068 (68.2)	
Black	170 (8.5)	14 (5.2)	154 (9.8)	
Unsure	434 (21.8)	52 (19.1)	345 (22.0)	
Language				.01
English	1744 (87.5)	255 (93.8)	1408 (89.9)	
Other	138 (6.9)	12 (4.4)	111 (7.1)	
Unsure	111 (5.6)	5 (1.8)	48 (3.1)	
Insurance				.44
Commercial	1084 (54.4)	162 (59.6)	845 (54.0)	
Public	712 (35.7)	81 (29.8)	579 (36.9)	
Military	62 (3.1)	6 (2.2)	39 (2.5)	
None	52 (2.6)	8 (2.9)	43 (2.7)	
Unsure	84 (4.2)	15 (5.5)	61 (3.9)	
Codiagnosis				
Tier 1 or tier 2	276 (13.8)	18 (6.6)	95 (6.1)	< .01

Data are presented as No. (%) unless otherwise indicated. IQR, interquartile range.