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Reducing Antibiotic Use in Pediatric Upper Respiratory Infection: A Multifaceted Parent-Clinician Approach

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Abstract
The goal of this QI initiative was to decrease inappropriate antibiotic for the treatment of pediatric upper respiratory infection (URI) in the retail clinic setting. The approach included the use of a protocol to treat viral upper respiratory illness, a visual aid decision-making tool for guideline adherence, prescription pad for nonprescription remedies, and shared decision-making techniques for providers to involve patients and parents in management plans regarding nonprescription remedies, supportive treatment, and signs and symptoms that would warrant a return visit. An improvement trend during the first 3 months of the initiative showed a shift in antibiotic avoidance from a baseline avoidance rate of 66% to a post intervention rate of 82%. The antibiotic avoidance initiative proved to be an effective approach in reducing the rate of inappropriate antibiotic treatment for pediatric viral upper respiratory conditions.

Keywords
inappropriate antibiotic use; shared decision making; retaiul clinic; antibiotic prescribing;

Cover Page Footnote
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Introduction

Clinicians in retail clinics face a challenge in prescribing antibiotics for viral illnesses as patient or parent satisfaction with treatment decisions need to be balanced with appropriate use of the drug. A difficulty is that parents often believe that antibiotics should be prescribed for their child's upper respiratory symptoms. Nurse practitioners and physician assistants are faced with balancing time needed to explain inappropriateness of antibiotic use with time to maintain a profitable business. In addition, issues such as parental expectations, provider uncertainty of diagnosis, and provider overestimation of complications and negative sequelae following pediatric upper respiratory infection (URI) are added complications (Bauchner, 1999; Crocker et al., 2013).

On a national level, rates of antibiotic prescribing are highly variable. Prescribers in Gulf Coast states prescribe antibiotics at a rate nearly twice per capita than those living in Western based states (Centers for Disease Control and Prevention [CDC], 2011). The national average of prescriptions written per 1,000 people in 2010 was 801 per 1,000. Overall, the wide variability and rise in broad-spectrum antibiotic prescribing has caused widespread antibiotic resistance, which enhances the severity of the problem and need for intervention and quality improvement.

Available Knowledge

Inappropriate provider prescribing of antibiotics for viral illness occurs most frequently in outpatient family practices (Hicks et al., 2015), of which 25% of antibiotics prescribed overall are counter- indicated (Shapiro, Hicks, Pavia, & Hersh, 2014). Although guidelines for common childhood illnesses, such as acute sinusitis, acute pharyngitis, and acute otitis media, clearly state appropriate antibiotic prescribing practices, clinicians do not necessarily follow these guidelines (Lieberthal et al, 2012; Shulman et al, 2012; Wald et al, 2013). Although retail clinics report a high level of adherence to URI clinical practice guidelines and provide the same quality of care as compared to primary care and emergency room settings (Jacoby, Crawford, Chaudhari, & Goldfarb, 2011; Mehrotra et al., 2009; Mehrotra, Wang, Lave, Adams, & McGlynn, 2008; Shrank et al., 2014), retail clinics struggle to meet the national benchmarks for antibiotic avoidance.

The Centers for Disease Control and Prevention (CDC) reported antibiotic prescribing was on the decline for children less than 14 years of age. However, prescribing rates remained high (58%) for URIs in children aged less than 14 years (CDC, 2011). Despite this decline, recent data shows, on the average, children in the United States receive between 10-20 courses of antibiotics before 18 years of age (DuPont, 2014).

In systematic reviews of literature, authors suggest that quality improvement strategies are key in antimicrobial stewardship efforts (Arnold & Straus, 2005; Ranji, Steinman, Shojania, & Gonzales, 2008; Ranji et al., 2006). The consensus is no single quality improvement strategy, such as audit and feedback, interactive educational sessions, reminders, clinical decision support, is considered the most effective for curbing inappropriate antibiotic use. Additionally, researchers agree that a multifaceted approach that combines quality improvement methods works best for antimicrobial stewardship in the outpatient setting.

Local Problem

According to the CDC (2011), the state of Texas averaged 867 prescriptions per 1,000 people annually. Across the 3 retail clinics constituting the setting of the study, antibiotics were avoided at a variable rate of 18% to 71%, depending upon the particular clinic. The average antibiotic avoidance rate for pediatric upper respiratory viral illnesses of the three retail clinics was 68%. The current national benchmark for retail clinics for the quality measure of avoidance of antibiotics in pediatric URIs is 86% (National Committee for Quality Assurance, 2015).

Aims of the Project

The aim was to implement a shared decision making and clinical decision support system for treating URIs in children, ages 18 months to 18 years. The goal was to decrease antibiotic use in this population. The benchmark was to reach 86% avoidance of antibiotic use.

Ethical Considerations

The Internal Review Board of the healthcare institution deemed the initiative exempt from oversight. All patient and staff data were de-identified and stored in password protected computers. The project managers complied with Health Insurance Portability and Accountability Act (HIPAA) requirements.

Method

The project initiative team developed an approach to guide parents on the diagnosis, treatment options and discussions about URIs. In the educational sessions, clinicians used a protocol to explain URI treatment protocol for children who present with symptoms of an upper respiratory illness and pharyngitis.

Context

The retail clinic organization has clinics located within local groceries that are open 12 hours a day, seven days a week. The initiative was implemented in three retail clinics in a suburban area that share an oversight physician and clinical coordinator. Each clinic is staffed by a team of two nurse practitioners or physician assistants. The majority of the clinicians have less than five years of nursing experience and are new to retail clinics. The clinical coordinator oversees the clinicians and is in charge of clinic operations and performance. The clinicians have access to the oversight physician by phone. The on-call oversight physician walks a clinician through patient cases. Prearranged monthly physician oversight meetings engage clinicians in discussion regarding difficult cases, concerns, and new ideas for quality improvement. This permits collaboration in an open environment among the oversight physician, clinical coordinator, and clinicians.

Intervention

The project initiative team, in conjunction with key members within the organization, developed a clinician education module, tools to use during the patient visit, and a clinical protocol for children with upper respiratory symptoms. The *Help Me Feel Better* decision tool for parents

(Appendix A) used an algorithm approach to help parents diagnose ear pain, runny nose/congestion or sore throat. A second form gave parents a "prescription" for treating the same symptoms of viral URI (Appendix B). The clinician training module addressed shared decision making techniques, patient treatment preferences, and how to create an individualized a care plan. Measure of knowledge was by means of a pre and post test.

Plan, Do, Study, Act cycles were introduced to assess initiative processes. Also, the initiative team conducted monthly program evaluation meetings with staff, provided clinician protocol reinforcement, and brought about project modification through feedback. Clinicians self-reported their satisfaction with the process and tools.

Data Analysis

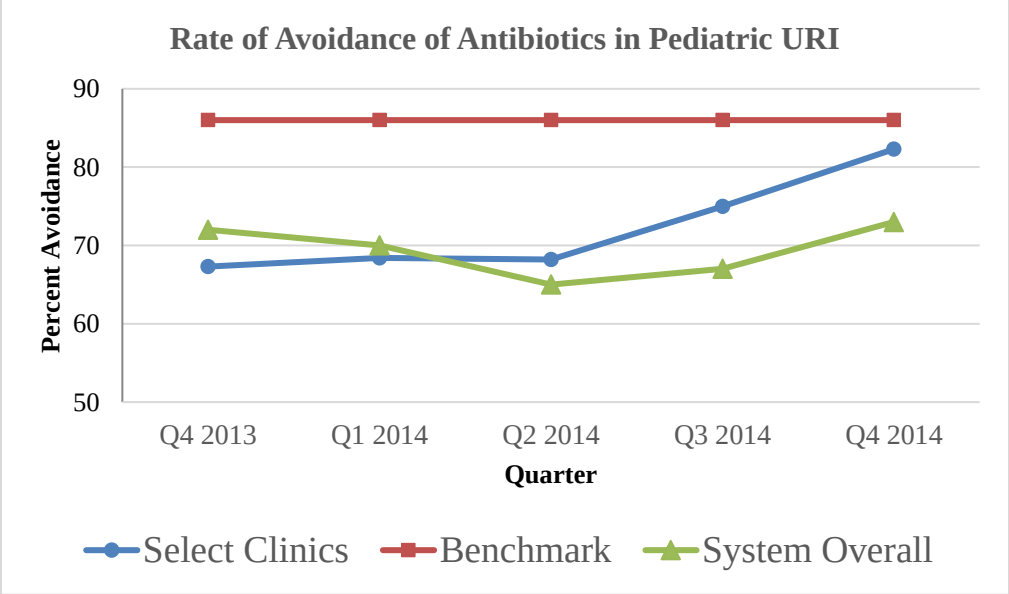
Data on the number of times antibiotics were prescribed for the diagnosis of viral URI and viral pharyngitis were collected on a quarterly basis. Chi square tests on the frequency of use and descriptive statistics (frequencies and percentages) were determined to compare baseline to outcome antibiotic avoidance. The one-sample chi-square test compared fourth quarter avoidance percentage with the national standard percentage of 86%, as well as the percentage of antibiotic avoidance across the five quarters of project implementation.

Results

Antibiotic Avoidance Rate

The baseline avoidance rate of antibiotic use in the quarters preceding the intervention ranged from 65% to 68%. Outcome avoidance rates reached 82%, which is significantly different from past quarters ($p < .0001$), as shown in Figure 1.

Figure 1. **Results of Avoidance of Antibiotics in Pediatric URI**



As shown in Table 1, the percentage increase showed that antibiotic avoidance was on a consistent increase from baseline through the final quarter, with the greatest difference being for the fourth quarter. Although the goal of 86% antibiotic avoidance was not attained within the given time frame, the shift in antibiotic avoidance was clinically significant and is indicative of improvement in antibiotic avoidance rate after the implementation of the shared decision making protocol for pediatric URI.

Table 1. Results of quality measure: Avoidance of Antibiotics in Pediatric URI

Antibiotic Avoidance	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5
1 (N) **Percent**	317 67.30	277 68.40	341 68.20	339 75.00	591 82.31
2 (N) **Percent**	154 32.70	128 31.60	159 31.80	113 25.00	127 17.69
Total	471	405	500	452	718

Staff Education

A total of 7 clinicians completed a pre and post test of knowledge gained through the clinician education module. The pre and post test scores on appropriate antibiotic use showed an increase in providers' knowledge (See Table 2). Because of staff turnover and use of rotating staff throughout the organization's clinics, the number of pre-post test completions was less than expected.

Table 2: Descriptive Statistics for Knowledge Assessment

Statistic	Pre Test	Post Test
N	7	7
M (SD)	68.57 (13.452)	82.86 (7.559)
Median	70	80
Minimum	50	70
Maximum	90	90

Discussion

The project staff used current evidence regarding quality initiative strategies for antibiotic stewardship in outpatient settings and synthesized that evidence to develop teaching tools to help parents make decision about best treatment options for viral illnesses. From a financial perspective, the cost of implementing the intervention was at relatively low cost to the institution. Strengths of the initiative included alignment of the treatment approach with current evidence based practice, inclusion of both parents and clinicians in the intervention, the ease of data collection, and the low cost of the intervention.

The nature of the retail clinic setting makes it difficult to implement a sustainable initiative. This is due to a high turnover rate of staff, including float clinicians that rotate through at any given time and introduction of clinicians new to the process. Also, the overhead organization had recently been acquired and, therefore, was undergoing changes that occur with transfer of ownership.

Relation to Other Evidence

The project aligns with evidence that illustrates multifaceted interventions are successful in antibiotic stewardship (Arnold & Straus, 2005; Ranji et al., 2008; Ranji et al., 2006). Arnold et al. (2005) supported multifaceted approaches with educational interventions occurring at varying ideas and levels to promote change. Ranji et al. (2008) found that active strategies aimed at provider education and management of URIs is more effective than individualizing illnesses. A randomized trial found that patients engaged in shared decision making with providers trained in antibiotic use prescribed antibiotics 27.2% of the time versus 52.2% for the patient group that did not participate in shared decision making (Legare et al., 2012). The present initiative was the first attempt to address antibiotic stewardship in this retail health care setting.

Interpretation

The initiative to decrease the inappropriate use of prescribing antibiotics to treat viral illness in a pediatric population was effective in the three retail clinic sites, as evidenced by an improvement in the outcome measures. We achieved significant progress towards the targeted goal of 86% avoidance rate to achieve a 17-point improvement from 65% to 82%. The protocol included a shared decision-making approach of clinicians and patents. A focus on educating clinicians on appropriate ways to treat viral illnesses with non-antibiotic measures added to the initiative's success.

Ways to improve the antibiotic avoidance initiative may include an alert pop up based on symptoms, physical examination findings, and diagnoses. Trigger questions to ensure shared-decision making can also be embedded within an electronic medical record to increase patient satisfaction and understanding of both the diagnoses and management plans. Aligning a program with the electronic medical record is one way that may allow new staff to recognize needs and adopt policy and practice change. Heightened awareness of antibiotic avoidance can engage providers in meaningful dialogue with parents that permit them to address concerns, expectations, and attitudes towards antibiotic use.

Tools that address misconceptions about antibiotic use in pediatric URIs can guide clinicians in their discussion with parents and offer clinical support to providers. It is important to implement policies targeting antibiotic overuse while campaigns by the American Academy of Pediatrics, the CDC, the Institute of Medicine, the Food and Drug Administration, the American Public Health Association, and the World Health Organization further promote support for this agenda (Kemper & Oberg, 2010).

Primary Outcome

The antibiotic avoidance quality improvement initiative increased the rate of avoidance of antibiotics in the treatment of pediatric URIs. The clinics where the protocol was implemented

outperformed the aggregate 30 clinics overall. The trend, if continued, will increase performance of the organization as a whole. It is unclear if the improvement is part of a long-term, secular trend within the organization and therefore mirrors the system as a whole. More in depth data analysis across performance of the organization is needed to make this determination.

The implementation of the project showed the importance of careful planning for all aspects of the intervention. The sustainability of the initiative is dependent on the commitment of the clinics to track antibiotic avoidance and continue the training of new hire clinicians on shared decision making and antibiotic use.

Conclusion

As the threat of antibiotic resistance increases, provider action to prescribe antibiotics only when necessary must improve on the national level. The antibiotic avoidance initiative was successful in increasing antibiotic avoidance in pediatric URI in three retail clinics, where performance increased from a 62% avoidance rate to 82% avoidance rate within a 3-month period. The implementation of a process to achieve a desired outcome illustrated that a group of dedicated clinicians can make a significant difference in how care is provided to improve outcomes.

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Appendix A: *Help Me Feel Better* decision tool for parents

HELP ME FEEL BETTER!

FOR PARENTS OF SICK KIDS - HOW TO DECIDE

EAR PAIN

(or ear pulling in kids too young to talk)

What to look for:
□ swelling of one or more ear drum
□ ear drainage (not from swimmer's ear)
□ very red ear drum

↓

What's wrong: Ear infection

↓

Treatment:
If temperature more than 102.2 degrees Fahrenheit and severe pain more than 48 hours OR less than 2 years old with infection to both ears, then:
☑ antibiotics (amoxicillin or cefdinir if allergic)
□ symptom control
□ follow up if worsening

All others:
□ antibiotics (amoxicillin)
□ symptom control
□ follow up if worsening
OR
□ watch and wait
□ symptom control
□ follow up if worsening

What to look for:
□ fluid behind ear drum
□ mild redness of ear drum
□ no ear drainage

↓

What's wrong: Ear pain or fluid behind the ear drum

↓

Treatment:
□ symptom control
□ follow up if worsening

RUNNY NOSE/CONGESTION

What to look for:
□ daytime cough
□ illness for more than 10 days
□ fever more than 102.2 degrees Fahrenheit and more than 3 days

↓

What's wrong: Sinus infection due to bacteria

↓

Treatment:
□ antibiotics (amoxicillin or cefdinir if allergic)
□ symptom control
□ follow up if worsening

What to look for:
□ daytime cough
□ no fever
□ fever less than 3 days or low fever (less than 102.2 degrees Fahrenheit)

↓

What's wrong: Common cold or sinus infection due a virus or allergies

↓

Treatment:
□ symptom control
□ follow up if worsening

SORE THROAT

What to look for:
□ pus on tonsils
□ fever (more than 102.2 degrees Fahrenheit)
□ small red dots in the back of the throat (petechiae)
□ contact with a person with strep throat
□ swollen lymph nodes on neck
□ 3 years old or older
□ positive rapid strep test

↓

What's wrong: Strep throat

↓

Treatment:
☑ penicillin or amoxicillin (cephalexin if allergic)
□ symptom control
□ follow up if worsening

What to look for:
□ cough
□ red or white open sores (ulcers) on throat
□ change in voice (hoarseness)
□ runny nose
□ less than 3 years old
□ negative rapid strep test

↓

What's wrong: Sore throat from a virus or allergies

↓

Treatment:
□ symptom control
□ send off throat swab for culture
□ follow up if worsening

Appendix B: Alternative Measures Prescription Pad

Sore Throat (Pharyngitis)

Patient Name: _____

- □ Give lots of clear liquids. Don't drink sodas, orange juice or lemonade.
- □ Give honey mixed with warm water or by itself.
- □ Swish or gargle with salt water, recipe: 1 tsp table salt mixed with 8 oz warm water. Don't swallow.
- □ Cool mist humidifier (keep it cleaned), put in child's room at night.
- □ Give ibuprofen (Motrin) or acetaminophen (Tylenol) for fever (>100.4 F) or pain. (Doses on back)
- □ (Provider Signature) _____

Runny Nose (Rhinitis)

Patient Name: _____

- □ Give lots of clear liquids.
- □ Suction the nose with saline drops (3 in each nostril) and bulb suction.
- □ Try nasal irrigation by using a Neti Pot or Neil Med Sinus Rinse twice a day.
- □ Cool mist humidifier (keep it cleaned), put in patient's room at night.
- □ Use nasal steroid spray, spray one puff in each nostril every morning.
- □ Give diphenhydramine (Benadryl) at bedtime, 1 tsp (5 ml) if child weighs more than 20 lbs., or _____ ml.

OR

- □ Give Bromfed DM (a prescription), for children 2 years and up, can cause sleepiness.

(Provider Signature) _____

Ear Pain (Otalgia)

Patient Name: _____

- □ Give ibuprofen (Motrin) or acetaminophen (Tylenol) for fever (>100.4 F) or pain. (Doses on back)
- □ Give Bromfed DM (a prescription), for children 2 years and up, can cause sleepiness.
- □ Drop 2-4 drops of prescription ear drop into the ear for pain every hour until the pain stops. Do NOT use if your child has a hole in their eardrum (ruptured eardrum).
- □ (Provider Signature) _____

Ibuprofen (Advil) and Acetaminophen (Tylenol) Dosing, Children's Liquid, 160 mg/5ml strength:

Weight in pounds	Dose
6-11 lbs	1/4 tsp (1.25 ml)
12-17 lbs	1/2 tsp (2.5 ml)
18-23 lbs	3/4 tsp (3.75 ml)
24-35 lbs	1 tsp (5 ml)
36-47 lbs	1.5 tsp (7.5 ml)
48-59 lbs	2 tsp (10 ml)
60-71 lbs	2.5 tsp (12.5 ml)
72-95 lbs	3 tsp (15 ml)

Bromfed DM Dosing:

Age	Dose	Interval
2 to 5 years	1/2 tsp (2.5 ml)	Every 6 hours
6 to 11 years	1 tsp (5 ml)	Every 6 hours
12 years and over	2 tsp (10 ml)	Every 6 hours