Improving Adherence to Clinical Practice Guidelines for the Treatment of Acute Otitis Media in Pediatric Patients

Jessica M. Crandall, MSN, ARNP-FNP-BC

Misty Schwartz, PhD, RN

Creighton University, Omaha

Abstract

Background: The management of acute otitis media (AOM) in pediatric patients has been a growing issue throughout healthcare. AOM is the second most common pediatric diagnosis seen in outpatient clinics. It is noted that approximately 80% of children will have a diagnosis of AOM at least once in their lifetime. AOM leads to an increase in healthcare cost in the United States. The American Academy of Pediatrics (AAP), American Academy of Family Physicians (AAFP), and the American Academy of Otolaryngology (AAO) all note that the management of AOM is a significant problem throughout the United States. The AAP notes that children under the age of 2 years should be treated with antibiotics for AOM, while children 2 years of age and older should refrain from antibiotic use for 48 to 72 hours pending assessment and symptoms. The main clinical problem addressed throughout this project is clinic providers not following clinical practice guidelines as they were unaware of them which is leading to inappropriate management of AOM.

Objectives: The main objective of this quality improvement project was to provide clinicians with an up-to-date evidenced-based algorithm and education on diagnosis, treatment, and management for AOM for children between the age of two and eighteen years. The population was all providers in an urgent care and emergency department in rural Iowa.

Methods: The previous algorithm was updated and modified according to the recommendations of the American Academy of Pediatrics. Providers were educated via an emailed PowerPoint on the significant of the clinical problem AOM and the newly updated algorithm and modifications, significance of the clinical problem of AOM and the newly updated algorithm which included the specific modifications that were made, the watch and wait component, and current recommendations. Caregivers/Parents were also educated on the recommendations with flyers in

the exam rooms along with handouts at discharge. Electronic medical records (EMR) were used to collect the percentage of providers utilizing the current clinical practice algorithm pre and post-intervention. Other data collected included number and type of antibiotic prescriptions.

Results: Upon completion of the project, there was a 35% increase in adherence to the clinical practice guideline algorithm. There was also an 18% decrease in antibiotics prescriptions overall and a 12% increase in the use of first-line antibiotic therapy with Amoxicillin.

Conclusion: The importance of proper management of AOM by following evidenced-based clinical practice guidelines is recommended in clinical settings but even more imperative when considering the impact of antibiotic use and stewardship. There was a 35% increase in adherence to the clinical practice guideline algorithm from pre-intervention to post-intervention. Education in multiple forms and multiple occasions played a key role in the success of this project. Sustainability will be achieved through continuous education and proposal to other clinics throughout Greater Regional Health and other clinical practice algorithms will be evaluated and updated as needed.

Background

Acute otitis media (AOM) is defined by Danishyar and Ashurst (2021) as an infection of the middle ear. Danishyar and Ashurst (2021) also identify that acute otitis media is the second most common pediatric diagnosis seen in family practice, urgent care, and emergency departments. This infection is most commonly seen between the ages of 6 to 24 months but can occur at any age. Advanced practice nurses play a major role in detecting, treating, and preventing acute otitis media in patients. Spoiala et al. (2020) note that approximately 23% of children one year of age and under will experience at least one episode of AOM and 60% of children will experience one or more episodes of AOM by age three years.

Acute otitis media is slightly more common in males than females (Wright & Nelson, 2019). It has been found that approximately 80% of children will have a diagnosis of AOM at least once in their lifetime (Danishyar & Ashurst, 2021). Although acute otitis media carries a very low rate of mortality, the morbidity can be significant (Danishyar & Ashurst, 2021). AOM can lead to conductive hearing loss, speech and language delays, and side effects from increased antibiotic use (Meek, 2020). AOM remains an important subject in healthcare for several reasons. Improper diagnosis and treatment can lead to complications such as tympanic membrane perforation, hearing loss, mastoiditis, and antibiotic resistance (Meek, 2020).

AOM can be a viral or bacterial infection, or a combination of the two (Danishyar & Ashurst, 2021). The most common viral pathogens that lead to acute otitis media include influenza viruses, adenoviruses, respiratory syncytial virus, coronaviruses, picornaviruses, and human metapneumovirus (Danishyar & Ashurst, 2021). The most common bacterial organisms seen in acute otitis media are streptococcus pneumoniae, non-typeable haemophilus influenzae, and Moraxella catarrhalis (Danishyar and Ashurst, 2021). Risk factors that can lead to AOM

include recent viral infection, family history, pacifier use, and passive cigarette smoke (Wright & Nelson, 2019). It has been shown that breastfeeding an infant for at least three months can have a protective effect against AOM (Wright & Nelson, 2019).

Common complaints leading to AOM are unilateral or bilateral ear pain/tugging, fever, and fussiness (Venekamp et al., 2017). AOM is diagnosed clinically by the use of an otoscope and assessment findings of a patient includes, yellow, red, or cloudy tympanic membrane often including bulging of the tympanic membrane. In some cases, the tympanic membrane can rupture causing a perforation in the tympanic membrane leading to discharge throughout the ear canal (Venekamp et al., 2017). Overall, the prognosis for patients diagnosed with AOM is excellent, however, proper diagnosis and treatment is essential in the prevention of complications such as tympanic membrane perforation, labyrinthitis, mastoiditis, meningitis, brain abscess, petrositis, hearing loss, and lateral and cavernous sinus thrombosis (Danishyar and Ashurst, 2021).

AOM leads to an increase in healthcare cost in the United States. The outpatient cost for patients with acute otitis media In the United States is approximately $314 per child per year, which averages about $2-3.5 billion in added healthcare costs (Shawabka et al., 2017).

Ear pain is one of the most common complaints seen in the Urgent Care at Greater Regional Health in a rural midwestern town. Approximately 50% of patients seen in the Urgent Care a week present with ear complaints, and 25-30% of those patients receive a diagnosis of AOM. Following diagnosis, these patients are often treated with antibiotics not based on current clinic policy and guideline recommendations.

Significance

The American Academy of Pediatrics (AAP), American Academy of Family Physicians (AAFP), and the American Academy of Otolaryngology (AAO) all affirm that the management of AOM is a significant problem throughout the United States (Spoiala et al., 2020). AOM does not have a specific core objective for Healthy People 2030 but could fall under the category of Maternal, Infant, and Child Health Workgroup (Maternal, Infant, and Child Health Workgroup, n.d.). Proper diagnosis and treatment are essential in decreasing complications however, treatment of AOM can be controversial. The AAP notes that children under the age of 2 years should be treated with antibiotics upon diagnosis of AOM. It is acceptable and recommended that children 2 years of age and older refrain from antibiotic use for 48 to 72 hours pending assessment and symptoms. Initial treatment for AOM is high dose amoxicillin for 5-10 days (Meissner, 2018). It is recognized that approximately 60% of symptoms related to AOM will completely resolve without the use of antibiotics within about 24 hours, while approximately 80% will resolve on their own without treatment within three days (Venekamp, Damoiseaux, & Schilder, 2017).

A first-choice antibiotic such as amoxicillin is more effective than macrolides and cephalosporins (Schilder et al., 2017). Children that were treated with amoxicillin/clavulanate for 10 days reached a “clinical cure” earlier than those treated with cefdinir for five days. The use of systemic steroids did not show any benefit in the recovery of symptoms and when homeopathic and conventional treatments were compared, both were clinically cured at 21 days. Surgical procedures such as tympanostomy tubes and/or adenoidectomy remain controversial and are age dependent; watchful waiting is appropriate in mild to moderate AOM.

The Association for Professionals in Infection Control and Epidemiology (n.d.) note that antibiotic stewardship programs have been developed throughout healthcare in hopes of

decreasing inappropriate antibiotic usage and antibiotic resistance. Antibiotic stewardship programs are coordinated programs that help promote the use of antimicrobial medications. These programs help reduce antimicrobial resistance, decrease the spread of infections caused by multidrug-resistant organisms, and help improve patient outcomes.

Clinical guidelines are created to help combat AOM complications consistently while achieving the best patient outcomes and decreasing the economic burden on healthcare costs (Spoiala, et al., 2020). A summary of the best practice guidelines includes proper diagnosis of AOM based on the presentation of moderate to severe bulging of the tympanic membrane (TM), new onset of otorrhea without the presence of acute otitis externa, ear holding, tugging, rubbing in non-verbal children, extreme erythema of the TM (Spoiala et al., 2020).

Initial treatment with analgesics along with antibiotics should be reserved for patients with bilateral or unilateral severe AOM, in children 6 months of age and older. Bilateral AOM in children 6 months of age to twenty-three months of age with non-severe AOM should be prescribed antibiotics. In some cases, observation with close follow-up can be offered in this age group. Children 24 months and older without severe signs or symptoms such as mild otalgia for less than 48 hours and temperature less than 102.2 degrees Fahrenheit, should be initially offered observation with close follow-up rather than antibiotics (Spoiala et al., 2020).

When antibiotics are initiated, Amoxicillin should be the first line as long as the child does not have an allergy or has not received amoxicillin in the past 30 days. If the child has had amoxicillin in the past 30 days, an antibiotic with Beta-lactamase coverage should be utilized. Patients should be reassessed if the caregiver reports a lack of improvement or worsening of symptoms within 48 to 72 hours of implementation of the antibiotics as a change in medication may be necessary. Prophylactic antibiotics should not be prescribed to patients with frequent

episodes of AOM to reduce the frequency of AOM. Tympanostomy tubes may be offered to patients that have recurrent AOM defined as three episodes in six months, or four episodes in one year with one episode in the preceding six months (Spoiala et al., 2020).

The AAFP states that approximately 87% of patients seeking care for AOM get an antibiotic. Clinical guidelines have helped decrease unnecessary prescriptions by up to 12% and increase the accuracy of antibiotic choice by up to 58%. Clinical practice guidelines were created by the AAP and AAFP to provide clinicians with evidence-based recommendations for the management of acute otitis media (Lieberthal, et al., 2013).

The AAP discusses the appropriate diagnosis and management of AOM in pediatric patients based on clinical practice guidelines (Lieberthal et al., 2013). Pediatric patients, in regard to these guidelines, are defined as patients from 0-12 years of age without complicated AOM. This 2013 evidence-based clinical practice guideline was updated from its 2004 version. Evidence has shown that clinicians are hesitant to follow treatment guidelines and recommendations (Lieberthal et al., 2013). A proper diagnosis such as children who present with moderate to severe bulging of the tympanic membrane or new onset of otorrhea not due to acute otitis externa are discussed as well as symptoms that rule out AOM such as non-complicated middle ear effusions. Treatment to reduce pain such as acetaminophen and ibuprofen should be discussed with parents regardless of AOM diagnosis.

High dose (80-90 mg per kg) of first-line antibiotics should be initiated upon diagnosis of acute otitis media if the patient does not have a penicillin allergy. The watch and wait method should also be utilized with patients greater than two years of age who present with mild symptoms and reliable follow-up. It was noted that 66% of patients that completed the watch and wait method recovered without the use of antibiotics (Danishyar and Ashurst, 2021).

Preventative measures such as exclusive breastfeeding until 6 months, receiving the pneumococcal vaccine, and non-exposure to cigarette smoke are also recommended.

Problem Statement

The management of AOM is a common problem throughout healthcare settings in the United States. It leads to increased healthcare costs, more frequent antibiotic use, and increased morbidity. Many national provider organizations have emphasized the significance of proper diagnosis and treatment is essential for a full, uncomplicated recovery. The AAO, AAFP, and AAP all state that AOM is one of the most common, recurring medical problems in childhood which leads to the most frequent office visits when compared to other complaints such as cough and sore throat.

Literature Review

The literature review is composed of multiple studies and systematic literature reviews involving AOM. These studies revolve around the most current diagnosis, treatment, and clinical practice guidelines for AOM for individuals between the ages of two and twelve. Along with the diagnosis, treatment, and clinical practice guidelines, *antibiotic stewardship* is a major topic throughout this review. The search engines that were utilized for the literature review include, CINHAL complete, Cochrane, Google Scholar, Medline Complete, PubMed, and ScienceDirect. A total of 52 articles were retrieved from the databases, 11 were included throughout this literature review. This section discusses the literature that impacts diagnosis, treatment, and guidance for clinicians working with possible AOM diagnosis. Many interventions and activities for antibiotic stewardship related to AOM are also discussed. Inclusion criteria for the literature are studies and reviews performed in the United States within the last fifteen years for AOM and

antibiotic stewardship. Outdated guidelines and studies performed outside of the United States were excluded from this review.

Diagnosis

A study utilizing a focus group done by Zetts et al. (2020) examined providers' attitudes towards antibiotic resistance, the feasibility of outpatient antibiotic stewardship efforts, and inappropriate antibiotic prescribing. The study consisted of 26 family medicine/internal medicine providers and 26 pediatric providers that were divided into two groups in each location. The study was conducted using an independent moderator guide in which the participant interactions were recorded, transcribed, and coded. The results were coded for major themes using deductive and inductive content analysis methods (Zetts, et al., 2020). The study identified four main themes, antibiotics as a public health issue, the acceptability of antibiotic stewardship interventions (patient and physician education), drivers of antibiotic prescribing, and acceptability of performance reporting. This study took place in the United States cities of Birmingham, Chicago, Los Angeles, and Philadelphia. In general, most providers felt that they were good antibiotic stewards but stated they often felt pressured by patients to prescribe them to keep good satisfaction scores. In-patient providers generally blame outpatient providers for over and inappropriate prescribing despite supporting evidence. Providers were overall supportive of most education training and education-focused stewardship activities. The study concluded that providers mutually agreed that antibiotic resistance is an important public health issue, but do not feel it is as important as other issues such as opioids and obesity (Zetts, et al., 2020). Many of the participants agreed that inappropriate antibiotic prescribing was also a major concern but noted that they felt the majority of it was done in the outpatient settings such as retail clinics and urgent care clinics. One activity that did not have great support was the approach of tracking and

reporting antibiotic use, which is effective in reducing inappropriate prescribing in previous studies. Participants believed that antibiotic stewardship programs were appropriate and should be considered by stakeholders.

The systematic review by Schilder et al., (2017) was completed between the years 2011 and 2015 and the purpose was to summarize key articles published during that time on recurrent AOM, treatment of AOM, otitis media with effusion, tympanostomy tube otorrhea, and chronic suppurative otitis media. The databases utilized included Ovid Medline, the Cochrane Library, PubMed, and Clinical Evidence (BMJ publishing). A total of 1122 articles related to the topic were reviewed by the panel, and 118 articles were included in this review. It was concluded that although early antibiotic treatment for AOM led to an earlier reduction in symptoms, the benefit of treatment needed to be weighed against the risk of antibiotic side effects such as rash, diarrhea, and vomiting.

Based on these two articles, it is found that accurate diagnosis is essential in the management of AOM. Providers must have expert knowledge on the diagnosis of AOM to better manage the patient. Providing antibiotics when deemed necessary can greatly benefit the patient, however, the benefit needs to outweigh the risk based on assessment and diagnosis.

Interventions

Interventions to aid in antibiotic stewardship were explored by Tedijanto, Grad, and Lipsitch (2020). A systematic review of surveys was completed on 16 frequently used antibiotics in the outpatient setting and their effects on antibiotic resistance in certain populations. The review included the 2015 National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey (NAMCS/NHAMCS), the Human Microbiome Project Consortium, along with assorted carriage and etiology studies. It was determined that elimination

of all unnecessary outpatient antibiotic use could avert 6% to 48% of exposures across the most common sixteen antibiotics and nine bacterial pathogens. These pathogens included S.pyogenes, E. Coli, P. aeruginosa, S. pneumonia, S. aureus, S. agalactiae, K. pneumonia, H. influenzae, and M. catarrhalis, It was also found that antibiotic stewardship interventions resulted in behavior changes in providers when diagnosing and prescribing medications for patients. These interventions included rapid and accurate diagnosis, determination between bacterial and non-bacterial causes, patient education, increased vaccine education to help decrease infection rates, and improved decision-making tools.

A quality improvement project was completed by Uhl et al. (2021) to implement initiatives and interventions to improve AOM guideline adherence. The project's specific aim was to increase the percentage of individuals 2 years of age and older with AOM who received a short duration of antibiotics versus the recommended long duration of antibiotics from 7% to a target goal of at least 50% in 12 months. The project took place at a large tertiary freestanding pediatric hospital in Columbus, Ohio along with seven National Children's Hospital Urgent Care centers (NCH) and seven NCH UC network clinics from August 2018 to November 2020. The patient demographics were largely diverse and 21% - 67% were covered by Medicaid. These patients were prescribed enteral antibiotics for AOM. Exclusion criteria included ages greater than 18 years, an additional diagnosis such as sinusitis, streptococcal pharyngitis, pneumonia, pyelonephritis, or skin/soft tissue infection.

Interventions were implemented by a multidisciplinary task force which included urgent care and infectious disease physicians, a lead nurse in urgent care, a pediatric resident, an epic systems physician builder, and quality improvement and data professionals. The team found that drivers revolved around education and clinical decision support systems which lead the team to

utilize the Institute of Healthcare Improvement (IHI) Plan-Do-Study-Act cycles to implement the interventions. These interventions included in-room posters on AOM guidelines, blog, and podcasts for guidelines reviews, discharge planning, sending situation, background, assessment, and recommendation (SBAR) to nursing and pharmacy teams, distributing updated education in the RN newsletter, providing AAP's guideline summary via SBAR email, ongoing guideline summary reminders in clinician meetings, add guideline to the handbook, and implementing a new discharge template. Initially, a pre-intervention report for baseline data was completed from the dates of August 2018 through July 2019, for patients that met inclusion criteria was performed. The outcome measure was the percentage of patients 2 years of age and older with AOM who received antibiotics for seven or fewer days. Statistical analysis with the use of Shewhart p-charts to plot the monthly percentage of patients receiving a recommended course of treatment, return visits, and AOM discharge template usage was completed. Results confirmed that from August 2018 through November 2020, a total of 17,998 patients met inclusion criteria. The baseline period included 10,931 patients, and an additional 7,067 were enrolled after initiating interventions. The percentage of patients diagnosed with AOM receiving a short course of antibiotics increased from a baseline of 7% to 67%. This showed the interventions to be effective.

Staub et al. (2020) performed a pre-intervention analysis to identify prescriber characteristics that predict high prescribing of antibiotic behavior and then educate on antibiotic stewardship programs. This study took place throughout retail pharmacies in Tennessee. The study looked specifically at the filling of outpatient antibiotics. The study found that there were 7,949,816 outpatient oral antibiotic prescriptions written and filled in Tennessee in 2016. It was noted that 50% of Tennessee's outpatient oral antibiotic prescriptions were written by 9.3% of

the prescribers. Specialty areas such as urology were associated with higher prescribing. Prescribers that were born in the 1960s and those in rural areas were also more likely to be high prescribers. Broad-spectrum antibiotics were more likely to be prescribed by high prescribers. It was noted that targeting education on high prescribers based on specialty, practice locations, age, gender, and specialty may play an essential role in the implementation of accurate and effective antibiotic stewardship interventions. More studies focusing on those that are frequent prescribers are needed to address other barriers such as evidence-based education and proper diagnosis by examination.

A systematic review was done by King et al. (2020) to describe the antibiotic prescribing trends within the outpatient clinic settings in the United States. The prescription rates were estimated using national prescription dispensing count data from IQVIA Xponent software divided by census estimates for 2011-2016. Both broad-spectrum and narrow-spectrum antibiotics were examined in this study. The ratio of broad to narrow-spectrum antibiotics was calculated by dividing broad-spectrum prescription rates by narrow-spectrum prescription rates. Poisson models were used to estimate prevalence rate ratios, comparing 2011 to 2016 prescription rates and linear models to evaluate temporal trends throughout the study period. Results showed that antibiotic prescription rates decreased by approximately 5% from 2011 to 2016. Rates of dispensing to pediatrics decreased by 13%, however, rates for adult prescriptions increased by 2%. The main decrease was noted with macrolide and fluoroquinolone prescriptions. The researchers recommended that antibiotic stewardship programs should include prescribing antibiotics recommendations for both pediatric and adults clients.

Gaddey, Write and Nelson (2019) performed a systematic review of the best, most recent evidence to guide the diagnosis and treatment of AOM. Five recent clinical practice guidelines

and recommendations from the AAP were reviewed. These clinical recommendations included: 1) AOM should be diagnosed in symptomatic children with moderate to severe bulging of the tympanic membrane or new-onset otorrhea not caused by otitis externa, and in children with mild bulging and either recent-onset ear pain (less than 48 hours) or intense erythema of the tympanic membrane; 2) Pneumatic otoscopy with or without tympanometry should be used to assess the tympanic membrane for effusion in patients with suspected AOM; 3) If antibiotics are used for AOM, high-dose amoxicillin (80-90 mg/kg/day in two divided doses) is first-line therapy; 4) Consider observation for 48 to 72 hours with the deferment of antibiotic therapy in lower-risk children with AOM, and 5) Pain should be treated as needed in children with AOM. A consistent recommendation of delaying a prescription for antibiotics for AOM in children two to twelve years of age with non-severe symptoms was found throughout this review.

A meta-analysis of randomized controlled trials was completed by Evridiki et al. (2009), the authors sought to compare antibiotic treatment with placebo or watchful waiting for patients diagnosed with AOM. The studies were retrieved from PubMed and Cochrane databases for this meta-analysis. A total of 7418 articles from PubMed and 736 articles from Cochrane Library were initially retrieved, after extensive examination, a total of 11 articles were utilized in this meta-analysis. It was noted that current recommendations on withholding antibiotics in children with acute otitis media were inadequately implemented throughout clinical practice. Clinical success, defined by the authors as AOM improvement, or the complete or substantial resolution of all symptoms and signs of AOM was more likely achieved with the initiation of antibiotics, however, diarrhea was also more likely. The study found no statistically significant differences between the two treatments regarding rapid resolution of AOM or safety outcomes such as the occurrence of diarrhea, rash, and study withdrawals. Providers waiting to treat patients with an

antibiotic does not impact the speed of resolution and can help decrease the occurrence of side effects and adverse reactions from antibiotics.

A quality improvement project was completed by Sun, Rivas-Lopez, and Liberman (2019) to improve watchful waiting in the management of AOM. Data from 250 patients, 18 years of age and younger with a diagnosis was AOM, was utilized as baseline data to characterize AOM management before interventions. The intervention took place in a tertiary care children's emergency department from September 2016 through December 2019. The interventions included a 1-hour long presentation to providers explaining the AAP AOM guidelines, reviewing the institution's current antibiotic prescription rates, developing of a visual algorithm, posting a commitment poster signed by providers, and an easy-to-read parent handout explaining the reasoning for the watch and wait method. A summary of the presentation was also provided to the clinicians via email. After initiation of the interventions, 65 patients were randomly selected to assess the impact of the interventions. A 20% increase in adherence to the AAP guidelines for the management of AOM was found. It was noted that this multipronged quality improvement project significantly improved adherence to the AAP guidelines by increasing the watch and wait method and decreasing immediate antibiotic prescriptions.

A systematic review was completed by Deniz et al. (2018) to determine the effects of following clinical practice guidelines on the prescription of antibiotics and analgesics for children with AOM. Search engines PubMed, Embase, and Cochrane library were utilized to gather the evidence used in the review. The initial search contained 411 potentially relevant records, and after examination, seven were utilized. Characteristics of the studies (year, country, design, setting, and data source), study populations (number and age of children with AOM), clinical guideline details (date of introduction, method of dissemination, and management

recommendation), and data on predefined outcomes were summarized. (Deniz et al., 2018). Data were compared prior to implementation of clinical practice guidelines and after. Management of AOM in various settings, antibiotic prescription rates, type of antibiotic, and analgesic prescriptions rate were reviewed pre- and post-implementation of clinical practice guidelines in all the studies examined. The results revealed when providers followed the clinical practice guidelines there was a decrease in antibiotic prescription rates and an increase in analgesic prescriptions.

This literature review has explored multiple scholarly studies and projects related to AOM and antibiotic stewardship. A common theme throughout this review of the available knowledge is the importance of accurate diagnosis of AOM along with appropriate and effective treatment options by following current clinical guidelines. With the goal to aid in the reduction of antibiotic prescriptions on patients two years of age and older with mild symptoms, many studies suggest interventions such as education for providers on clinical guidelines and caregiver education on the "watch and wait" method with effective pain management. First-line antibiotic therapy of amoxicillin is consistent throughout the articles when antibiotics are deemed necessary. Educational interventions such as antibiotic stewardship programs along with following recommended clinical guidelines along with expert clinical knowledge are essential in the proper management of AOM.

Based on the evidence reviewed for this project it was found that multiple interventions, adherence to clinical guidelines along antibiotic stewardship programs play a key role in the reduction of unnecessary antibiotic prescriptions for the management of AOM. Education in multiple forms and easy-to-follow algorithms aided in the adherence to clinical guidelines.

Ideally, education should be presented more than a single event with updates or follow-ups, when necessary, to ensure continuation and adherence to interventions.

Theoretical Framework

Applying/utilizing a theoretical framework is important in quality improvement projects as it can help guide individuals through the process and implementation of change. Frameworks can also aid in patient satisfaction along with providing accurate, effective, and safe healthcare. Lewin's Three-Step Model of Planned Change (2014) can be applied to this quality improvement study. This model is composed of three main steps, unfreeze, change, freeze (Morrison, 2014). The purpose of this three-step model is to provide an exceptional approach to quality improvement by assisting in the overall change of individuals. Change must be accepted and embraced by others for it to be effective (Morrison, 2014).

History of Model

The first step in Lewin's Model is the "Unfreeze – ready to change" step (Morrison, 2014). This step represents the routines and habits that have been naturally established over time. Some of these routines may be unnecessary and out of date but still being done either due to lack of knowledge, education, or company policies. Some individuals may have veered off course in this step evolving to their processes and routines which may also not be up to date or effective (Morrison, 2014). To "unfreeze" these routines and habits, the current routines and habits need to be analyzed and assessed. Individuals will need to be introduced to new and innovative perspectives on the changing issue to fully understand the change and embrace it (Morrison, 2014).

The second step in Lewin's Model is the "Change – Implementation" step (Morrison, 2014). During this stage, it is important that individuals are opening their minds to process

change for the change to begin. This stage involves some transition time to ensure effectiveness (Morrison, 2014). For change to be effective, individuals will need to take on new responsibilities and tasks in which they may require additional education and knowledge. It is important to remember that during the "Change – Implementation" step, it may appear to be chaotic, unorganized, and confusing, but time, increased support and education can help resolve the chaos and ensure an effective change (Morrison, 2014).

The third and final step in Lewin's Model is the "Freeze (Re-freeze) – Making it stick" step (Morrison, 2014). The implementation of the change can only reach its full effectiveness if it is made a permeant part of the process. It is essential to ensure that the new change becomes standard throughout the organization (Morrison, 2014). Changes can be made later as more up-to-date and effective recommendations are made. Further changes should follow the same three-step process (Morrison, 2014).

Application of Theory to DNP Project

The goal of this quality improvement project is to reduce unnecessary outpatient antibiotic prescriptions for treatment of AOM in a rural Iowa Urgent Care setting. Implementation of an evidence-based algorithm to guide providers in accurate and effective management of AOM is the focus of this project. The population includes patients between the ages of two and twelve years of age.

Lewin's Three-Step Model for Change will be applied to this quality improvement project. Constant change is essential in any practice setting to ensure that the most up-to-date, effective and efficient care is provided throughout the healthcare system. In Lewin's first step of "unfreeze – ready to change," the healthcare professionals in this clinic will be educated on the effects of unnecessary antibiotic prescriptions and usage along with the negative consequences of

antibiotic resistance. Education will also include current clinical practice guidelines and the approved algorithm. Providing the staff with evidence-based information can help them "unfreeze" and be open to change.

Throughout the second step of Lewin's Model, "change – implementation," the presented changes, the use of an evidenced-based algorithm, provider education, and caregiver education in the form of posters and handouts is implemented. Staff is supported throughout the implementation to ensure the change is permanent and effective.

The third step of Lewin's Model, "freeze (re-freeze) – making it stick," is essential in the long-term sustainability of the algorithm usage. Continued quarterly chart audits will be implemented to ensure proper and continued usage. Further education supported with the most up-to-date evidence-based information will be provided as needed so effective and efficient care is provided.

The Plan-Do-Study-Act (PDSA) Methodology will also be incorporated with Lewin's Model of Change for this quality improvement project. The PDSA is one of the most commonly used tools throughout quality improvement projects that aids in the documentation of change and recognizing necessary modifications (Christoff, 2018). The PDSA is a tool widely utilized by the Institute for Healthcare Improvement (IHI) for quality improvement projects (Tools, 2022). The Agency for Healthcare Research and Quality (2020) states that the PDSA is composed of four steps that guide individuals thinking to improve and evaluate the outcome of the quality improvement project. The IHI has created an essential worksheet that assists individuals in carrying out the step of the PSDA (Tools, 2022).

The four steps in the PDSA are Plan, Do, Study and Act. The first step, Plan, consists of the development of a plan by identifying tasks and identifying individuals who will complete the

tasks. How and where the plan is implemented is also considered in this step (Christoff, 2018). During this step, the development of a plan to implement interventions for decreasing antibiotic prescriptions in AOM will be formed. Clinical guidelines along with proposed algorithms will be evaluated. Before implementation of the interventions, a pre-intervention chart review will be completed to assess the current management of AOM in relation to antibiotics. Audits of charts will include, age of patient, length of symptoms in days, fever, otalgia, pulling/rubbing of ears, presence of fluid behind tympanic membrane, if an antibiotic was prescribed, what antibiotic prescribed, duration of antibiotic prescribed, if an analgesic was prescribed or recommended, other, and if the watch and wait along with clinical practice guideline algorithm was followed. A decision of when and how to implement the interventions will be finalized.

The second step of the PDSA is the Do step. In this step, the plan is carried out and relevant data is documented. This data should identify the barriers, successes, and outcomes of the project (Christoff, 2018). This step will begin with the pre-intervention review of charts to identify problems and successes of the current management of AOM in the Urgent Care setting. After identification and pre-intervention chart review, interventions will be implemented. Providers will receive education via email and a pre-recorded presentation. Caregiver education in the form of both flyers and brochures will be posted throughout the exam rooms and discussed with caregivers during the clinic visit. Again, barriers, successes, and outcomes will be assessed and evaluated.

The third step of the PDSA is the Study step. This step is considered the “most crucial step” throughout this process (Christoff, 2018). Throughout this step, the data will be evaluated to determine if the implemented plan is working. Chart audits with a review of subjective data along with assessment and plan will take place with the use of EPIC EMR, to determine the

percentage of providers that correctly use the clinical guideline algorithm. This review will take place prior to the proposed educational interventions and then again 2 weeks after. The results of the data evaluation will then be compared to the predicted outcomes and documented appropriately (Christoff, 2018). The data from the pre-intervention review along with the intervention review will be evaluated in this step to help determine if the interventions are effective. Predicted outcomes, of increasing the percentage of providers that currently utilize the algorithm, will be compared with actual outcomes based on the data evaluation.

The fourth and final step of the PDSA is Acting. Throughout the Act phase, the intervention implemented is "adopted, adapted or abandoned" (Christoff, 2018). If there is an improvement in the percentage of the use of the clinical practice algorithm the change in practice will be adopted. If the intervention needs to be adapted, additional problem-solving ideas are explored based on the evaluation of the results from the Study step. It is important that a decision is made whether the interventions are effective or not; if they are, the changes will be adopted as the standard of care throughout the clinic and if not, additional changes will be discussed and implemented so the interventions are effective and sustainable.

Purpose Statement

The purpose of the quality improvement (QI) project was to provide clinicians at a rural Iowa Urgent Care/Emergency department with a revised up-to-date, evidence-based clinical practice algorithm and education on the diagnosis, treatment, and management for AOM for pediatric patients between the ages of two and eighteen years. The anticipated outcome was an increase in the adherence of providers that correctly used the newly proposed clinical practice algorithm for the management of AOM by 50%. The interventions to achieve this outcome included modifying and developing the algorithm, educating providers on the proposed

algorithm based on clinical guidelines, along with educating patients and caregivers using flyers and brochures.

The objectives of this DNP project included:

1. The DNP student provided clinicians with an up-to-date evidenced-based algorithm and education on diagnosis, treatment, and management for AOM for pediatric patients.
2. Implementation of the evidenced-based algorithm for the management of AOM for children between the age of two and eighteen years. The percentage of providers that correctly use the algorithm for the initial management of non-severe AOM in pediatric patients ages two through eighteen was determined pre- and post-intervention.
3. Application of the implemented algorithm for the management of AOM in pediatric patients ages two through eighteen years of age was evaluated based on the pre and post implementation data and a plan to adapt or adopt the algorithm in clinical practice was made.

Methods

Project Design

The QI design was utilized throughout this study to implement and enforce an algorithm for the management of AOM based on current clinical practice guidelines. QI projects play an essential role in the improvement of patient safety, efficiency, and clinical outcomes throughout healthcare (Basics of quality improvement, n.d). The overarching goal is to increase adherence to clinical practice guidelines for the management of AOM. Kurt Lewin's Change Theory along with the PDSA method was utilized throughout this study to ensure the sustainability of implemented interventions. The primary focus of this project focused on standardizing the use of the clinical practice guideline algorithm for the management of AOM in patients two years to

twelve years of age. The design included PowerPoint education, exam room flyers, and patient/caregiver handouts. Pre- and post-chart audits were utilized throughout this design. All providers in the Urgent Care clinic and Emergency Department were included in this design. The proposed outcome of this study was to increase the percentage of providers that correctly utilize the proposed clinical practice algorithm for the management of AOM by 50%.

Population

The population throughout this project was all providers in the urgent care and emergency department. There was a total of nine providers; one medical doctor, one doctor of osteopathic medicine, and seven advanced registered nurse practitioners.

Stakeholders

The key stakeholders for this project included the DNP supervisors, the Urgent Care Clinic and Emergency Department Medical director, the members of the antibiotic stewardship program, the project leader, and the providers. The need for better adherence and increased education for the management of AOM was recognized during chart audits completed by the members of the antibiotic stewardship program. The current AOM algorithm used in the Urgent Care Clinical was not adequately utilized based on clinical guidelines.

Setting

The setting is a single rural Urgent Care Clinic with an attached Emergency Department in Creston, Iowa. Greater Regional Urgent Care and Emergency Department are staffed with both Physicians and Nurse Practitioners. The Urgent Care clinic is open seven days a week 361 days a year. The hours of operation for the clinic are 7:30-7:30 p.m. Monday through Friday and 8-2 p.m. on Saturday and Sunday. The clinic is closed on New Year’s Day, Easter,

Thanksgiving, and Christmas day. The Emergency Department is open 24 hours a day, seven days a week, 365 days a year.

Greater Regional Health has one Urgent Care Clinic and one Emergency Department location. There is a total of six full-time providers and three per diem providers that include both Nurse Practitioners and Physicians that rotate throughout the two departments. Providers work varied shifts throughout the week between 12 to 72 hours depending on the department they are covering. The Urgent Care clinic sees around 40 to 80 patients a day, while the Emergency Department treats approximately 20 patients a day. Urgent Care is staffed with two providers, either nurse practitioners and/or physicians and the Emergency Department is staffed with a single nurse practitioner or physician a day. There are two registered nurses staffed in both the Urgent Care and Emergency department that assist with the management of patients every day.

Tools

The algorithm developed and utilized is based on clinical practice guidelines from the AAP and UpToDate (see Appendix A and B). The education will be provided in the form of a PowerPoint presentation to providers and educational posters will be posted in each exam room. Patient education handouts will also be provided at the discharge of each visit. The posters and handouts explain management of AOM in plain language. (see Appendix C).

Educational Intervention

An email of the PowerPoint presentation was distributed to all the providers in the Urgent Care and Emergency Department explaining the purpose of the project and containing the updated clinical practice guideline algorithm along with a description of the recommended management of AOM. When providers acknowledged the email via follow-up email, the team lead was notified. All nine providers participated in this study.

Chart Audits

This study utilized both a pre-intervention chart audit and post-implementation chart audit. Sixty charts were audited from the months of August through October 2021 to assess the percentage of patients between the ages of 2 and 18 with a diagnosis of AOM that were treated per current clinical guidelines. The charts were compiled with the use of the EPIC electronic medical records (EMR) query system. Data gathered throughout the charts that meet inclusion criteria included age, documentation of diagnosis of bilateral or unilateral AOM with the following ICD codes: H66.001, .002, .003, H65.111, 112, 113, H60.502, length of time with symptoms, type of symptoms such as fever, otalgia, pulling/rubbing ears, presence of fluid behind TM, plan for patient such as antibiotic prescribed, analgesic prescribed, what antibiotic and for how long, and clinical judgement noted in the chart such as medication allergies or recent treatment. Charts that meet exclusion criteria were eliminated. The exclusion criteria included patients with pressure equalizer (PE) tubes, patients under the age of 24 months and over the age of 18, and patients that had additional diagnosis during the visit such as acute sinusitis, streptococcal pharyngitis, urinary tract infection, soft tissue or skin infection, and acute conjunctivitis.

Following initial pre-intervention chart audit, the PowerPoint presentation, exam room signs, and patient/caregiver education were implemented. Follow up emails and/or personal interviews were sent to providers for feedback and question responses as needed. The chart audit post-implementation occurred over 8 weeks following the educational interventions. This audit included 92 charts from the months of August through October 2022. Queries were run using the EPIC EMR similarly as they were in the pre-intervention chart audit. The same criteria were

applied for the chart audit in the post-implementation phase. All charts were coded with an assigned number to ensure no patient identifiers revealed and maintain privacy.

Data Collection

Initial data collection was completed with the use of EPIC EMR. Data was collected for 8 weeks between the months of August and October 2021, pre-intervention, August and October 2022, post intervention. Patient data were coded and entered into an Excel spreadsheet. The charts were coded based on the number reviewed and did not include any patient identifying information. This data included information gathered throughout the charts that met inclusion criteria. The spreadsheet was coded using "Y" for yes, and "N" for, no to signify if the clinical practice guideline algorithm was utilized with each patient.

The pre-intervention chart audit resulted in 177 charts when initial query was run, with 60 audited. The additional 117 charts were eliminated due to exclusion criteria such as age or additional diagnosis such as otitis externa, respiratory infections, or sinusitis. The post-implementation chart audit resulted in 153 charts with 91 of those being audited. The pre-intervention percentage of patients that had a diagnosis of AOM and were managed based on clinical practice guidelines was compared to the post-intervention percentage patients managed by the implemented algorithm.

The developed algorithm, based on current clinical practice guidelines, was the focus for the PowerPoint education. Flyers for exam rooms, and discharge handouts were also provided and based on AAP along with Centers for Disease Control and Prevention recommendations (see Appendix C). The algorithm is in an easy-to-follow flow sheet form. It begins by ensuring the child is greater or equal to 24 months of age. From there, the severity of symptoms is outlined. If symptoms are deemed to be non-severe, i.e., no TM perforation, fever greater than102 degrees F,

severe pain or bulging of TM, the algorithm guides the provider to offer watch and wait with close follow-up. If severe symptoms, the algorithm guides the provider to refer to the treatment management algorithm that is already present at Greater Regional Health.

Ethical Considerations

Ethical considerations were applied and non-identified patient information was used throughout this project. Collaboration Institutional Training Initiative (CITI) Social & Behavioral Research training was completed in October 2021. This project posed no risk to human subjects as it is a quality improvement initiative and the project was reviewed and deemed QI by the Institutional Review Board at Creighton University. The project was also approved by the Healthcare Management and Information System at Greater Regional Health. All participants followed the Health Insurance Portability and Accountability Act (HIPPA).

No financial stipends were given to providers that completed the education. There was also no loss of compensation for not completing the education or following the clinical practice guidelines, however all providers did complete the education.

Results

Overall, the data revealed a 35% increase from the pre-intervention review to the post-intervention review in providers that utilized the up-to-date clinical practice algorithm. The pre-intervention data review revealed that only 38% (n=60) of the time patients were managed based on clinical practice guidelines, while 62% (n=60) of the time they were not. The post-intervention data review showed that 73% (n=91) of the time patients were managed based on clinical practice guidelines, while only 27% (n=91) of the time they were not (see Figures 1 and 2).

Figure 1

Number of Charts that Providers Managed Based on Clinical Practice Guidelines

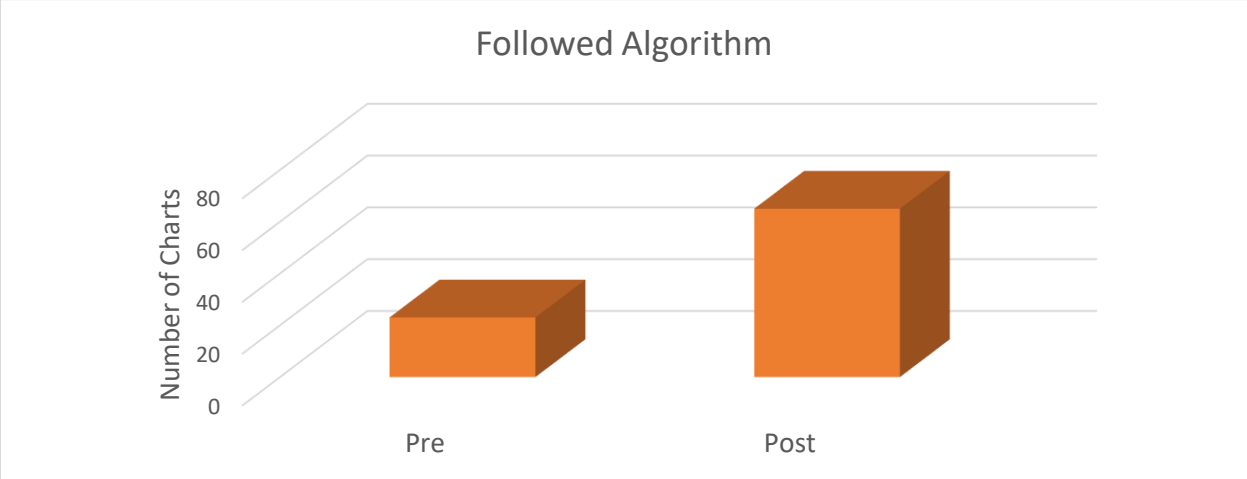
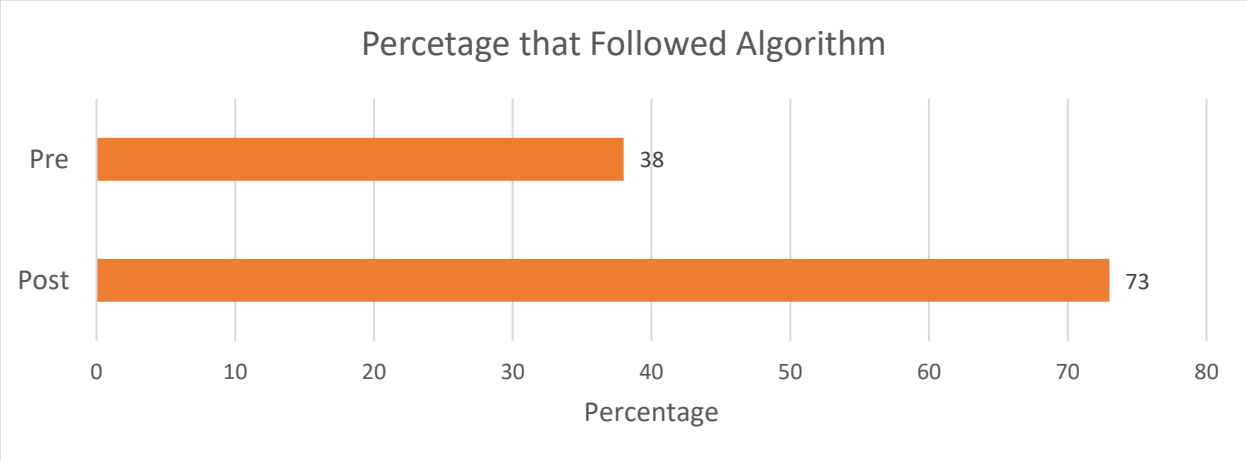


Figure 2

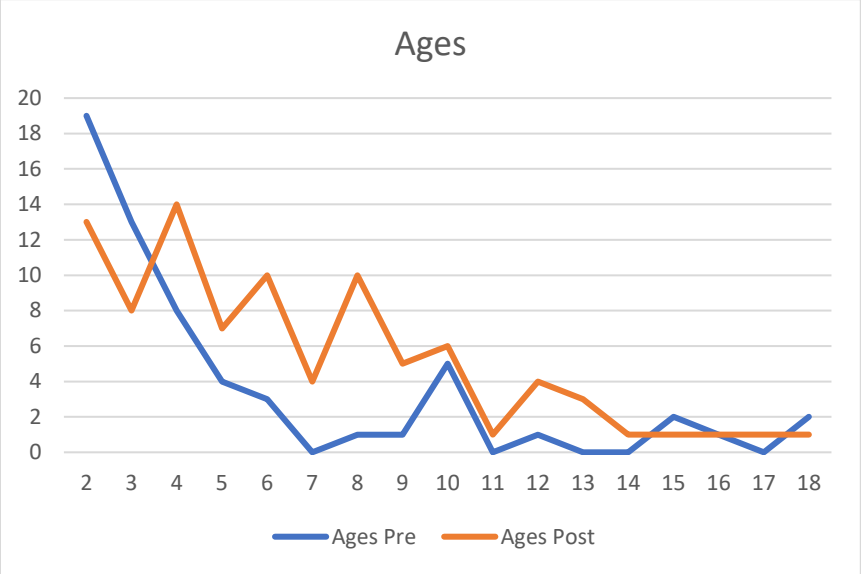
Percentage of Charts Accurately Followed Clinical Guideline Algorithm



The average age of patients in the pre-intervention study was 5 years, with most frequent age being 2 years, and the most frequent age for antibiotic prescription was 2 years. The post-intervention data revealed an average age was 6 years, most frequent age of 4 years, and most frequent age for antibiotic prescription was both 2 and 4 years old (see Figure 3).

Figure 3

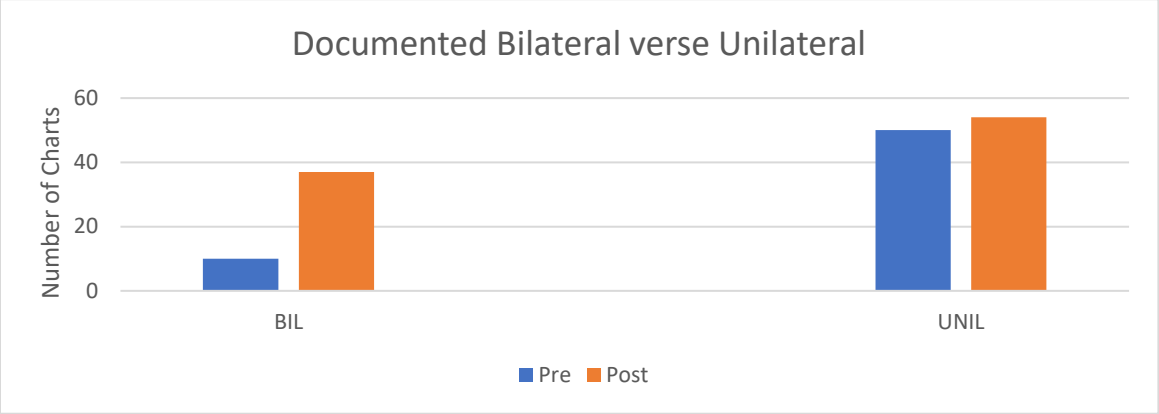
Ages of Patients in the Pre-and Post-Intervention Groups



The pre-intervention data showed 83% of patients being diagnosed with AOM were unilateral, while 17% were bilateral. Of those with unilateral diagnosis, 100% of the patients received antibiotics, while 90% of patients diagnosed with bilateral AOM received antibiotics, and 10% did not. The post-intervention data revealed a total of 60% unilateral AOM diagnoses and 40% were bilateral. Of those unilateral diagnoses, 89% were given antibiotics, indicating a decrease of 11% in antibiotic prescriptions. Of those bilateral, 65% were given antibiotics also showing a 25% decrease in prescriptions (see Figure 4).

Figure 4

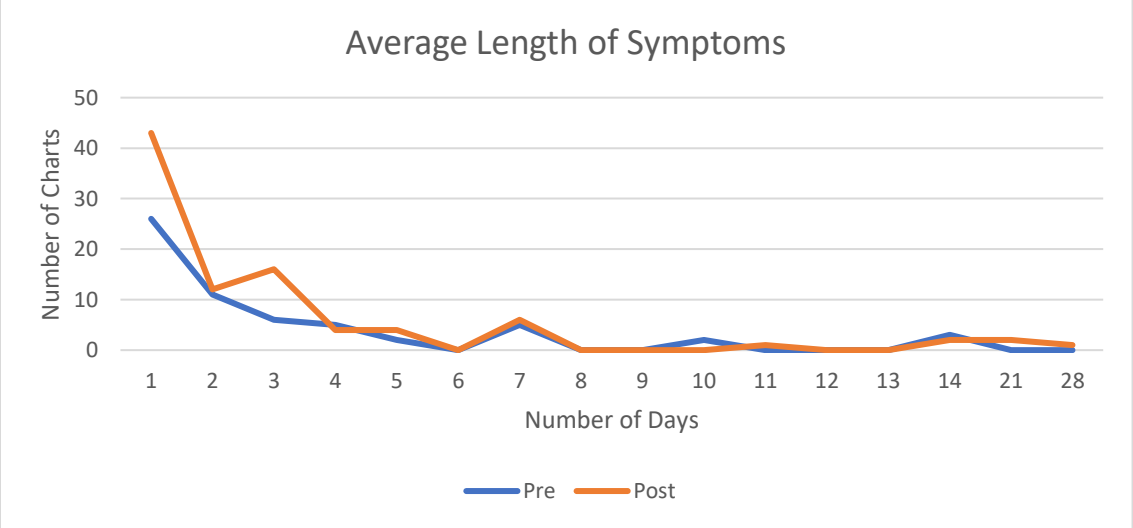
Bilateral and Unilateral Diagnosis



The average length of symptoms for the pre-intervention and post-intervention data were both three days. Fevers were present 57% (n=60) of the time in patients throughout the pre-intervention data, while only present 27% (n=91) of the time throughout the post-intervention data. Otalgia was present 90% of the time in the pre-intervention data and 98% of the time in the post-intervention data. Fluid behind the tympanic membrane was present 98% of the time in the pre-intervention data, and 89% of the time in the post-intervention data (see Figure 5).

Figure 5

Average Length of Symptoms



Overall, regardless of the patient presentation, antibiotics were prescribed 98% of the time in the pre-intervention data, and this decreased to 80% of the time in the post-intervention data. The most common antibiotics utilized in the pre-intervention data were Amoxil at 57%, Augmentin at 20%, Cefdinir at 19%, Doxycycline at 2% and Ciprodex at 2%. The most common antibiotics in the post-intervention data were Amoxil at 69%, Augmentin at 8%, Cefdinir at 14%, and Azithromycin at 6%. Analgesics were recommended 98% (n=60) of the time in the pre-intervention data, and 93% (n=91) of the time in the post-intervention data (see Figures 6 and 7).

Figure 6

Percentage of Antibiotics Prescribed

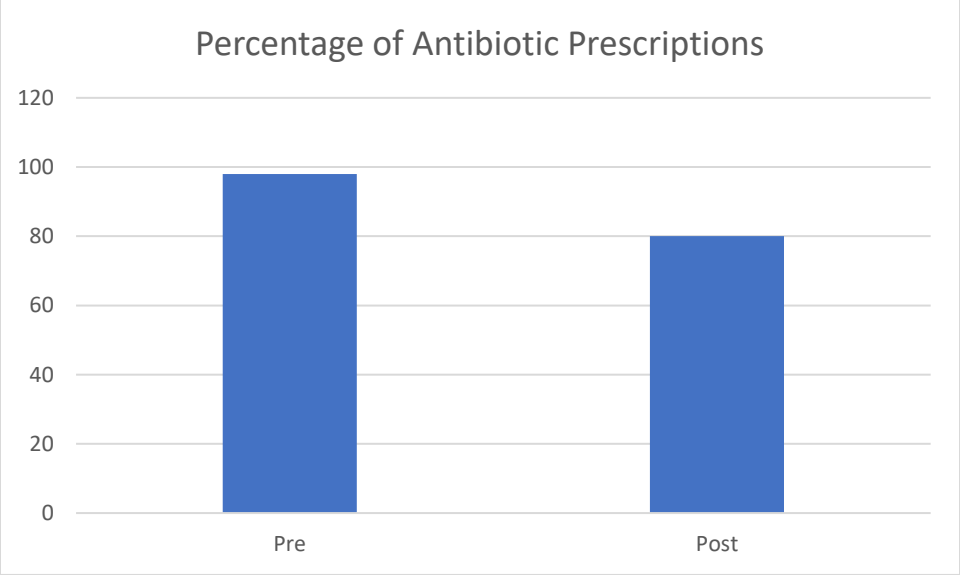
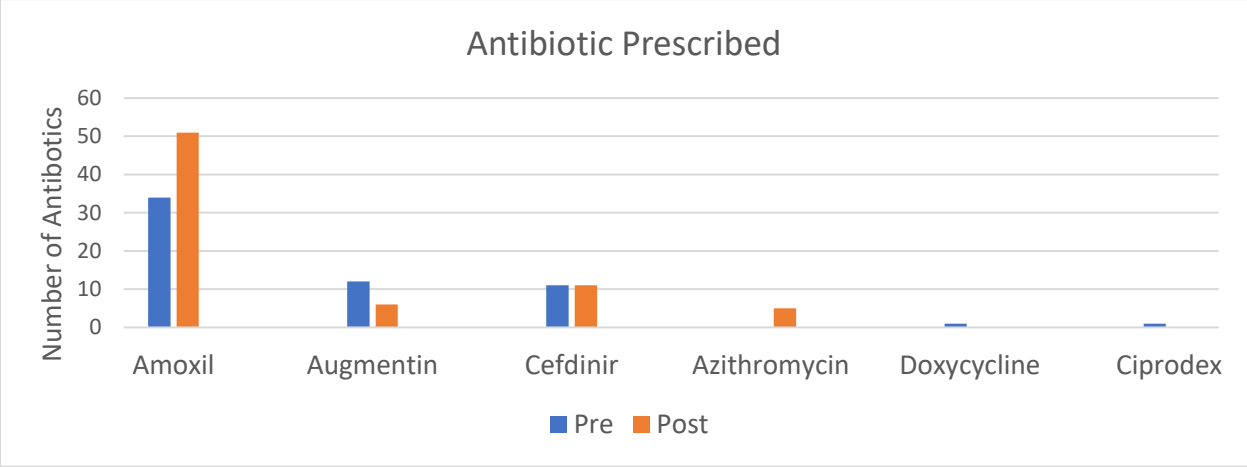


Figure 7

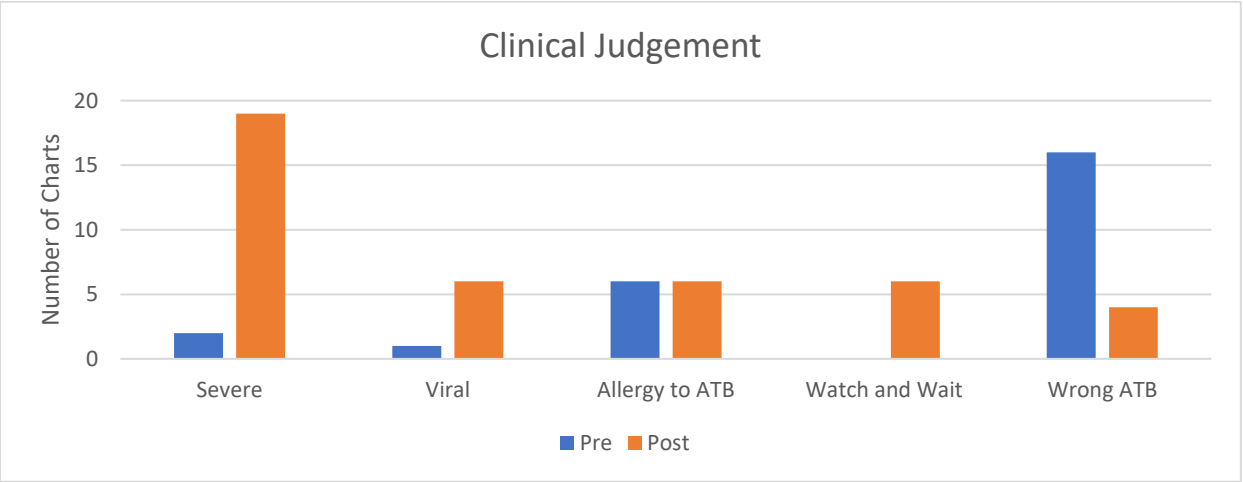
Name of Antibiotic Prescribed



When it came to the application of clinical judgment, throughout the pre-intervention data 3% of patient symptoms were documented as severe, 2% of the diagnosis were documented as viral, 10% of patients had allergies to first-line medications, and 27% utilized the wrong antibiotic based on the clinical practice algorithm. The post-intervention data revealed that 20% were documented as severe, 6% viral, 6% had allergies to first-line medications, and only 4% utilized the wrong antibiotic based on the clinical practice algorithm (see Figure 8).

Figure 8

Clinical Judgement



Discussion

The purpose of this quality improvement project was to improve provider adherence to the newly modified evidence-based clinical practice algorithm for the management of AOM in children ages 2 to 18 years of age. AOM is one of the most common complaints seen in outpatient clinics and approximately 60% of children will experience one or more episodes of AOM by the age of 3 and 80% in their lifetime (Danishyar & Ashurst, 2021; Spoiala et al., 2020). If not treated properly, AOM can lead to conductive hearing loss, speech and language delays, and side effects from medications. Clinical practice guidelines were present at Greater Regional Health; however, it was discovered they were not being utilized. The "watch and wait" component of the algorithm was created and presented to the providers to allow for standardization and quick, easy access to the algorithm for the management of AOM.

There were three primary objectives for this project. The first was providing clinicians with an up-to-date evidenced-based algorithm and education on diagnosis, treatment, and management of AOM for pediatric patients. This objective was achieved by reviewing the available knowledge and recommendations from multiple professional organizations. Upon review, it was found that the clinical practice guidelines at Greater Regional were up-to-date with first-line antibiotic choices however, did not include the "watch and wait" recommendations.

The literature supports the use of up-to-date clinical practice guidelines to aid in recommended diagnosis and management of AOM and the reduction of antibiotic usage. Gaddey, Write, and Nelson (2019) note the clinical practice guidelines created by the AAP should be followed when treating patients with ear complaints with special attention to delaying antibiotic prescriptions by utilizing the "watch and wait" recommendation. Watching and waiting

helps eliminate the side effects of possible unnecessary antibiotic use and results in similar outcomes when compared to a placebo (Eyridiki et al., 2009). The watch and wait algorithm that was created in this project was presented to allow for quick, easy access and management. This algorithm aided in the overall increased adherence to the clinical practice guidelines. The pre-intervention audit of 60 charts revealed only 38% of providers were utilizing the clinical practice algorithm, and 62% did not. There was a 35% increase when comparing pre-intervention and post-intervention data. The literature outlines the importance of following recommendations and data analysis from this project revealed an 18% decrease in antibiotic prescriptions which supports the use of the algorithm.

The second objective was the implementation of the watch and wait for evidenced-based algorithm for the management of AOM for children between the age of 2 and 18 years. This objective was achieved through the creation and implementation of the watch and wait section of the algorithm along with chart audits. Chart audits were completed to determine if the revised evidenced-based clinical practice algorithm and educational module improved adherence rates for the management of AOM in patients 2 through 18 years of age in an eight-week timeframe. Zetts et al. (2020) stated that antibiotic resistance along with inappropriate antibiotic prescribing is an important health issue in which the majority of providers view as more of an outpatient provider issue. A trend of prescribing outside of current clinical recommendations was recognized by outpatient providers in the urgent care and emergency department at Greater Regional Health. The pre-intervention data collected throughout this study revealed that providers were diagnosing AOM in their patients properly, but not utilizing the current clinical practice guideline algorithm correctly or consistently for the management of AOM in their

patients. Post-intervention data revealed a 35% increase in adherence to the clinical practice guideline algorithm which led to better management of pediatric patients with ear complaints.

Provider and patient education were essential to the success of this project. As noted in the study by Tedijanto, Grad and Lipsitch (2020), inappropriate antibiotic usage could be overall decreased by more than 45% if providers accurately diagnosed patients by recognizing differences between viral and bacterial infections, providing patient education, and improving access to decision-making tools. Education presented to all providers in the urgent care and emergency throughout this project allowed for increased knowledge on examination, diagnosis, and treatment for patients with ear complaints. Providers noted that the easy-to-follow algorithm along with additional education helped them better manage patients along with increasing their confidence in educating caregivers. They did not feel as pressured to prescribe antibiotics when not appropriate and felt most parents and caregivers were satisfied with the management at the time of the visit.

The “watch and wait” algorithm was added to the current AOM management algorithm at Greater Regional Health. The “watch and wait” method should be utilized in any patient over the age of 24 months with non-severe symptoms. This method is supported by the AAP and allows for a watchful waiting period of 48 to 72 hours prior to initiating antibiotics for AOM (Venekamp, Damoiseaux, & Schilder, 2017). It is found that close to 60% of symptoms caused by AOM will completely resolve without the use of antibiotics within 24 hours, while close to 80% of symptoms will completely resolve in approximately 3 days (Venekamp, Damoiseaux, & Schilder, 2017). The pre-intervention data showed that 0 charts out of 60 were managed with the “watch and wait” method. The post-intervention data showed that 6 charts out of 91 were

managed with the “watch and wait” method. The literature supports the initiation of the “watch and wait” method as it can help decrease unnecessary antibiotic use.

The current algorithm for the management of AOM at Greater Regional Health was reviewed for current recommendations, and was found to be up to date on antibiotic recommendations. The first-line antibiotic recommendation for the treatment of AOM is high dose amoxicillin for 5-10 days (Meissner, 218). High-dose is calculated by using 80-90mg/kg/dose but not exceeding 1000mg per dose for patients. In order to help combat antibiotic resistance and promote antibiotic stewardship, it is imperative to follow all clinical practice guideline recommendations which includes first-line antibiotic choice (Spoiala, et al., 2020). The pre-intervention data revealed that only 27% of the charts were managed with the first-line antibiotic choice, while the post-intervention revealed that 96% of the charts were managed with the first-line antibiotic.

The third and final objective was the application of the implemented algorithm for the management of AOM in pediatric patients ages 2 through 18 years of age was evaluated based on the data and a plan to adapt or adopt the algorithm in clinical practice will be made. This objective was achieved by analyzing the collected data and determining that there was increased utilization of the algorithm and overall improved outcomes such as increased use of the watch and wait recommendation, decreased antibiotic use and the correct antibiotic prescribed 96% of the time.

The education in this project included appropriate first line antibiotic choice along with duration when an antibiotic was deemed necessary. Current clinical practice guidelines recommend a 10-day course of antibiotics for the treatment of AOM. Some recent studies like one by Uhl et al. (2021) note that shorter duration of antibiotics can be just as effective for the

management of AOM. Pending further studies, this medication duration could change the current clinical practice guidelines along with aiding in antibiotic stewardship.

Lastly, based on informal, anecdotal feedback from providers, they stated they were satisfied with the data and how the project was carried out. Due to the education and easy access to the algorithm, they changed the way they managed patients with ear complaints.

Limitations of Study

This study was limited to urgent care and emergency providers. The primary care and ear, nose and throat clinic were not included at this time. Including additional clinics could be considered in the future. Reports were run through EPIC for specific ICD codes for AOM and charts that did not have AOM as a specific diagnosis may have been missed in the query. The timing of data collection was also a limitation; the project was conducted between the months of August and October which historically has lower numbers of illnesses including AOM. If the study could have been done between the months of November through February, the number of charts retrieved would most likely have been larger. Lastly, knowing whether the educational posters that were in the exam room were beneficial to the caregivers/patients was not measured therefore, the only way of knowing if the intervention was effective or not was from informal feedback from the providers.

Sustainability

The management of AOM continues to pose a major problem throughout healthcare. It is essential for providers to remain up-to-date on current clinical practice guidelines for the management of AOM to provide the patient with the best possible care. This project showed a 35% increase in adherence to clinical practice guidelines. Continued monthly and bi-monthly

education to both providers and nurses will take place in the clinical setting. The current algorithm along with the watch and wait algorithm will be presented to the primary care, pediatric, and ear, nose, and throat clinic at Greater Regional Health. This will allow all providers to continue to provide excellent evidence-based care. Education via advertisements and social media pages will continue to be presented to the public to inform them on the current guidelines and management of AOM.

Conclusion

Proper management of AOM along with the importance of following clinical practice guidelines was noted throughout this project. Clinic providers at Greater Regional were not following current clinical practice guidelines for the management of AOM as they were unaware of the most recent updates, this led to inappropriate management of AOM. The evidence-based clinical practice guidelines were modified along with an easy-to-follow “watch and wait” algorithm that was created and presented to providers in the Urgent Care and Emergency Department. Education in multiple forms and multiple occasions played an essential role in the success of this project. There was a 35% increase in adherence to clinical practice guidelines along with an 18% decrease in antibiotic prescriptions following the interventions. Sustainability will be achieved through continuous education and proposal to other clinics throughout Greater Regional Health.

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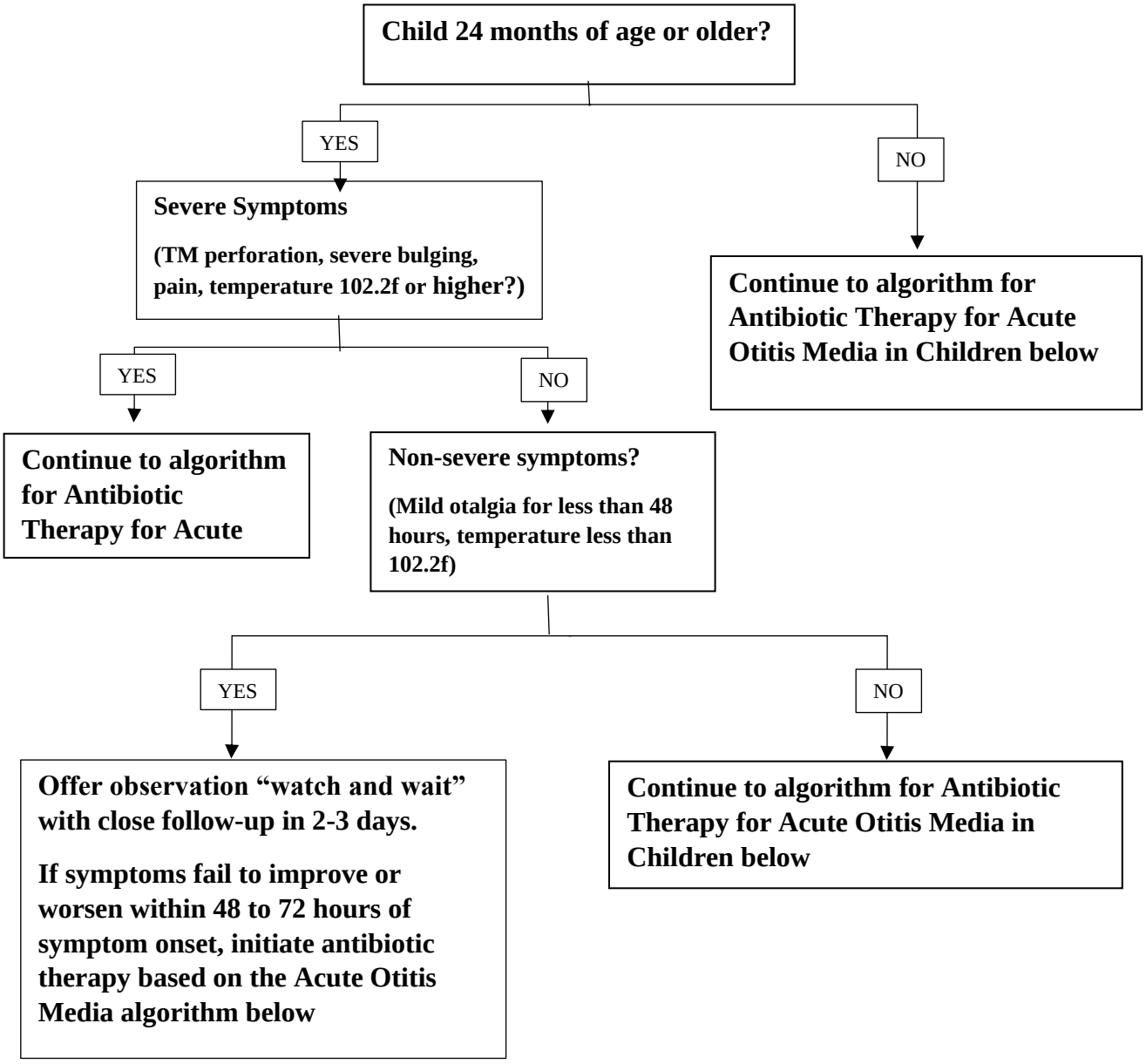
Appendix A

Criteria for Watch and Wait Method in Children with Acute Otitis Media

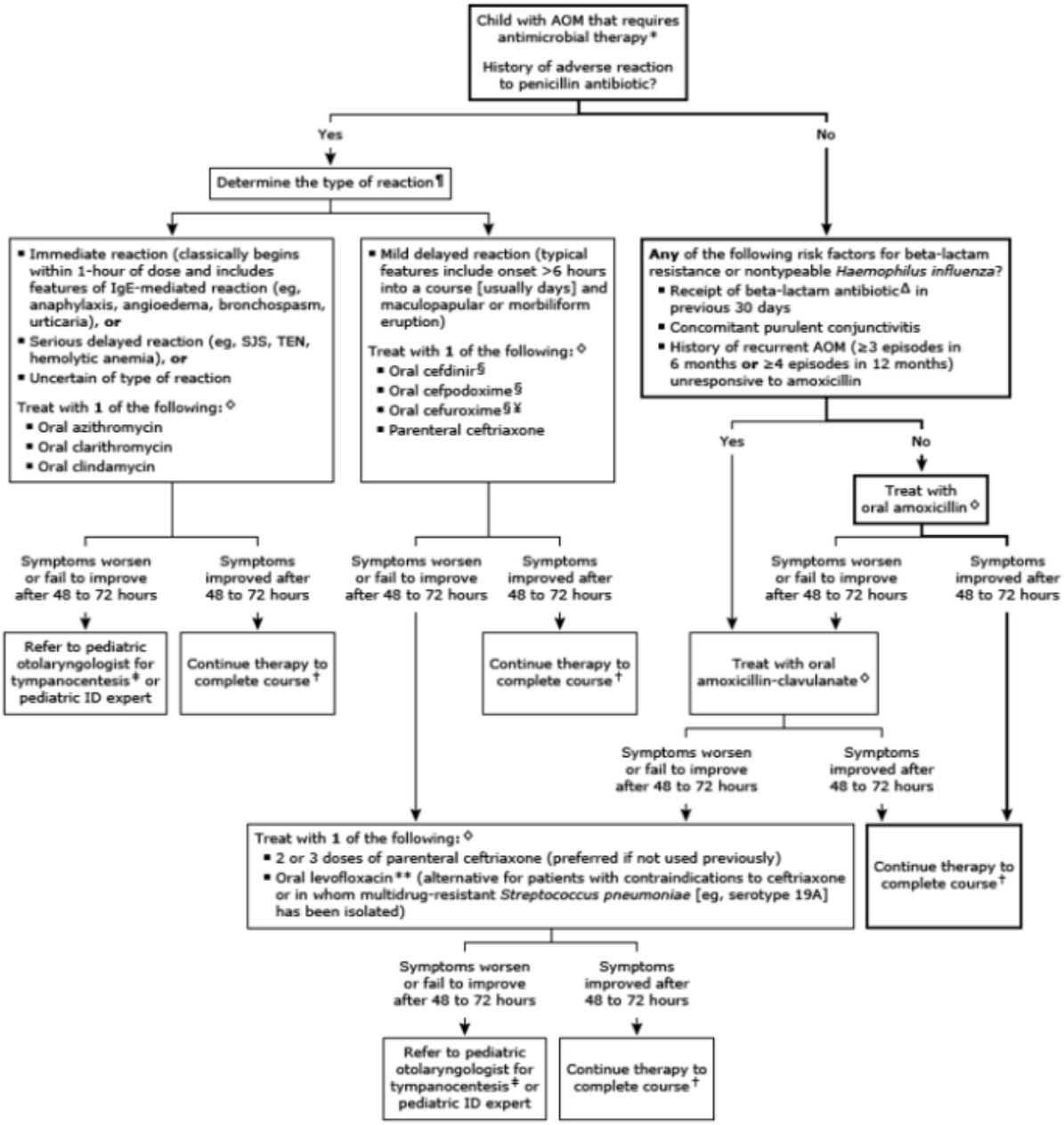
For use in children 24 months and above, if <24 months continue to the algorithm for Antibiotic Therapy for Acute Otitis Media in Children below



Appendix B

Greater Regional HEALTH

Antibiotic Therapy for Acute Otitis Media in Children



Appendix C

Accessible version: https://www.cdc.gov/antibiotic-use/ear-infection.html

Preventing and Treating Ear Infections

Is your child's ear hurting? It could be an ear infection. Children are more likely than adults to get ear infections. Talk to your child's doctor about the best treatment.

Some ear infections, such as middle ear infections, need antibiotic treatment, but many can get better on their own without antibiotics.

What is an ear infection?

There are different types of ear infections. **Middle ear infection** (acute otitis media) is an infection in the middle ear.

Another condition that affects the middle ear is called **otitis media with effusion.** It occurs when fluid builds up in the middle ear without being infected and without causing fever, ear pain, or pus buildup in the middle ear.

When the outer ear canal is infected, the condition is called "swimmer's ear," which is different from a middle ear infection.

Causes

Middle ear infections can be caused by:

- Bacteria, like *Streptococcus pneumoniae* and *Haemophilus influenzae* (nontypeable) —the two most common bacterial causes
- Viruses, like those that cause colds or flu

Symptoms

Common symptoms of middle ear infection in children can include:

- Ear pain
- Fever
- Fussiness or irritability
- Rubbing or tugging at an ear
- Difficulty sleeping

When to Seek Medical Care

See a doctor if your child has:

- A fever of 102.2°F (39°C) or higher
- Pus, discharge, or fluid coming from the ear
- Worsening symptoms
- Symptoms of a middle ear infection that last for more than 2–3 days
- Hearing loss

See a doctor right away if your child is younger than 3 months old and has a fever greater than 100.4 °F (38 °C).

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

CDC

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Accessible version: https://www.cdc.gov/antibiotic-use/ear-infection.html

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Preventing and Treating Ear Infections

Treatment

A doctor will determine what type of illness your child has by asking about symptoms and doing a physical examination. Your doctor can make the diagnosis of a middle ear infection by looking inside your child's ear to examine the eardrum and see if there is pus in the middle ear.

Antibiotics are often not needed for middle ear infections because the body's immune system can fight off the infection on its own. But sometimes antibiotics, such as amoxicillin, are needed to treat infants, severe cases, or cases that last longer than 2–3 days.

For mild cases of middle ear infection, your doctor might recommend **watchful waiting** or **delayed antibiotic prescribing**.

- **Watchful waiting:** Your child's doctor may suggest watching and waiting to see if your child needs antibiotics. This gives the immune system time to fight off the infection. If your child doesn't feel better after 2–3 days of rest, extra fluids, and pain relievers, the doctor will write a prescription for an antibiotic.
- **Delayed prescribing:** Your child's doctor may give an antibiotic prescription but will suggest that you wait 2–3 days to see if your child is still sick before filling it.

How to Feel Better

Some ways to feel better—whether or not antibiotics are needed for an ear infection:

- Rest.
- Drink extra water or other fluids.
- Take acetaminophen or ibuprofen to relieve pain or fever. Ask your doctor or pharmacist what medications are safe for your child to take and what dose to give your child.

Over-the-Counter Medicine and Children

Be careful about giving over-the-counter medicines to children. **Not all over-the-counter medicines are recommended for children of certain ages.**

- Pain relievers:
  - Children younger than 6 months: only give acetaminophen.
  - Children 6 months or older: it is OK to give acetaminophen or ibuprofen.
  - Never give aspirin to children because it can cause Reye's syndrome, a rare but very serious illness that harms the liver and brain.

Be sure to ask your doctor or pharmacist about the right dosage of over-the-counter medicines for your child's age and size. Also, tell your child's doctor and pharmacist about all the prescription and over-the-counter medicines they are taking.

Prevention

You can help prevent ear infections by doing your best to stay healthy and keep others healthy.

- Make sure your child is up to date on vaccinations and gets a flu vaccine every year. The pneumococcal vaccine protects against *Streptococcus pneumoniae,* a common cause of middle ear infections.
- Clean your hands.
- Breastfeed exclusively until your baby is 6 months old and continue to breastfeed for at least 12 months.
- Don't smoke and avoid exposure to secondhand smoke.

To learn more about antibiotic prescribing and use, visit www.cdc.gov/antibiotic-use.

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