

**USE OF ANALGESIC/ANTIPYRETIC MEDICATIONS AND OBSERVATION FOR
ACUTE OTITIS MEDIA**

By

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CERTIFICATE OF APPROVAL

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What's Known:

Current clinical guidelines for acute otitis media (AOM) strongly recommends treating otalgia with analgesics and an optional trial of observation for mild to moderate AOM. It is uncertain what factors may be associated with provider recommendations to patients for their use.

What's New:

Recommendations for post-visit analgesics/antipyretics (A/A) for AOM are more likely associated with the use of observation compared to immediate use of antibiotics. We found higher rates of recommendations for post-visit A/A and use of observation than previously reported.

Abstract:

Background: Acute otitis media (AOM) is one of the most common presenting pediatric complaints accounting for a large proportion of antibiotic prescriptions. Current guidelines for AOM strongly recommend the use of analgesics and observation without antibiotics for mild to moderate cases of AOM, yet few studies have described their use. This study is the first to identify predictor variables for use of analgesics and observation.

Methods: A retrospective chart review of 600 charts was conducted from ambulatory clinic and pediatric emergency department (PED) records in an academic, tertiary care center for children ages 6 months to 12 years diagnosed with AOM between June 2008 and June 2010. Charts were assessed for recommendations for analgesics/antipyretics (A/A), use of observation (prior to antibiotic use) and hypothesized predictor variables.

Results: The mean age of the study cohort was 40.6 months. Recommendations for use of A/A use following the visit were significantly higher in the PED compared to the ambulatory clinic (86.7% vs. 60.7%, $p < 0.001$). Observation was recommended in 37.8% of all visits. Patients with recommended use of observation received post-visit A/A recommendations more often than those prescribed antibiotics immediately (OR 2.11: 95% CI 1.36-3.28). The absence of fussiness ($p=0.03$), fever ($p < 0.001$), and tympanic membrane bulging ($p < 0.001$) were all independently associated with the use of observation.

Conclusion: A/A were more often given in conjunction with observation compared to immediate antibiotic use. Overall the frequencies of use of observation and A/A were found to be higher than previously reported. Further prospective analyses are necessary to confirm these findings.

Introduction:

The non-judicious use of antibiotics have been associated with the rise of antimicrobial resistance, antibiotic side effects, increased medical costs, and increased incidence of recurrent acute otitis media (AOM).^{1,2,3} However, treatment options have long been controversial. In 2004 clinical guidelines developed by the American Academy of Pediatrics included recommendations for the treatment of pain associated with AOM and selective use of observation or delayed antibiotic use.⁴ The use of an observation option concurrently with analgesics has been reported to reduce the use of antibiotics.^{2,3,5,6} However, recent studies have questioned the use of observation and called for the use of immediate antibiotics to reduce symptom duration with potential for increased medication induced side effects.^{7,8} Prior studies have evaluated the observational approach and have reported no significant difference in patient satisfaction or complication rates compared to immediate prescriptions of antibiotics.^{2,3,4,5,6,9}

Currently there is limited information on the treatment of otalgia and the use of observation for AOM in contemporary practice. Recently the National Ambulatory Medical Care Survey evaluated provider compliance with the 2004 guidelines for treating AOM and found an increase in the use of analgesics for the treatment of AOM but no significant change in rates of antibiotic prescriptions.¹⁰ Oral analgesics such as ibuprofen and topical analgesics have been shown to be effective in treating otalgia.^{2,3,5,6,11,12,13,14} However, many medications such as acetaminophen and ibuprofen have dual indications as both analgesics and antipyretics (A/A). Otolgia is the most frequent presenting complaint and primary concern of the parent. Lack of providing effective analgesia is not clinically appropriate for good patient care.

Therefore, we evaluated the use of A/A and an observation option for the treatment for AOM in the PED and ambulatory clinic settings among children (6 months to 12 years)

presenting at an academic medical center. We assessed hypothesized clinical predictors for both the use of A/A and observation, including symptoms on history, physical exam findings and demographic information. This is the first study to assess the clinical use of A/A medications for the treatment of AOM and the use of observation in accordance to clinical guidelines for the treatment of AOM in two distinct clinical settings.

Methods:

Study Design

This is a retrospective, cross-sectional observational study analyzing data abstracted from primary electronic medical records taken from both PED and ambulatory pediatric clinic encounters. The study was approved by the Oregon Health and Science University Institutional Review Board.

Patient Population:

Cases of AOM were identified using discharge ICD9 diagnostic codes from the OHSU PED and ambulatory pediatric clinic medical records. All patient visits for children 6 months to 12 years of age with a documented ICD-9 diagnosis of AOM were eligible for the study.

Patient visits were excluded if children were: immunocompromised, currently taking antibiotics or documented to have taken antibiotics within two weeks, diagnosed with an additional infection or condition requiring antibiotics, had a history of tympanostomy placement, documented eustachian tube dysfunction, craniofacial abnormalities or nasopharyngeal abnormalities. In addition, patient visits were excluded if children were diagnosed with recurrent AOM defined as more than three episodes of AOM in the past six months or a history of recurrent or chronic AOM or chronic serous otitis media. Patient visits were excluded if the patient was diagnosed with AOM within two weeks prior to date of the encounter diagnosis.

Data Collection:

Data were abstracted from the resident and attending record. When discordance of data was found between resident and attending records, the attending record was used.

Recommendations for A/A use were assessed from prescriptions or written recommendations recorded during the visit in the assessment portion of the record. Indications for prescriptions were recorded if present in the prescription or physician record. Standard automated discharge instructions were not included in chart review for the use of A/A or an observation option. Charts were reviewed by one study investigator with 10% of charts were re-abstracted by a second investigator to assess inter-rater variability and data quality.

Variables:

Hypothesized predictor variables included age (in months), gender, location (pediatric ED or clinic), ethnicity, provider specialty training, the involvement of residents in care, insurance status, and A/As given by history prior to visit. Predictors taken from the patient history included a history of fever, upper respiratory symptoms, fussiness, emesis, otalgia, and ear drainage. Similarly, predictors were identified from physical exam findings including perforation of the tympanic membrane, erythema, bulging, mobility, light reflex, pus, drainage, unilateral disease, fever, tachycardia, and tachypnea. Demographic information including documented ethnicity, age in months, insurance status, location of care, provider training level, resident involvement and time of visit were recorded and assessed for interaction and used to stratify patient visits into groups for analysis.

Outcomes:

The use of A/A and an observation option were the two primary outcomes. The use of A/A was defined as any recommendation or prescription for medications with analgesic properties (acetaminophen, ibuprofen and other anti-inflammatory medications, topical analgesics, and opiate medications) included in the assessment portion of the physician record or any prescription for medications with analgesic indications following the patient encounter. Recommendations for A/A use that were part of pre-written post-visit patient instructions or summary were not included in the analysis. Terms used to define use of an observation option include: 1) any documentation of an observation option prescription, 2) delayed antibiotic use, 3) use of a rescue or safety-net script, 4) wait-and-see prescription or 5) documentation by the physician of intention of delayed use of antibiotics.

Sample Size/Power Calculation

A pilot study was performed with 60 charts to determine feasibility and evaluate the baseline prevalence for the use of an observation option. We then used this information to inform a power calculation to guide the number of patient records to be abstracted. We estimated a baseline prevalence of 30% for the use of an observation option based on our pilot study, and assuming a standard p-value of 0.05, power of .80, and R^2 of 0.05 between a predictor and other predictors. From this, approximately 600 subjects are needed to detect a 10% clinical meaningful change in AOM guideline compliance using a multiple logistic regression model.

Statistical Analyses:

Descriptive statistics were performed with Pearson's χ^2 test or Fisher's exact test to assess differences between groups. Univariate analysis with odds ratios and corresponding 95% confidence intervals (CI) were constructed for predictor variables with each outcome. Predictors with a p-value of greater than or equal to 0.20 in univariate testing were considered for the multivariable model. Model building for a multivariable logistic regression model was undertaken using forward step-wise selection following univariate testing. Interaction terms were added to the main effects model after the final model had been constructed, with a p-value ≤ 0.05 to denote the presence of an interaction. Only location of clinical care (PED vs. ambulatory clinic) was shown to be an important statistical confounder. As age is known to be an important confounder, it was kept in the final model disregarding its significance level. All models were assessed for potential confounders such as provider training level, ethnicity, gender and insurance level, however, they were not significant and were removed from the final model. The generalized estimating equation (GEE) approach was used in all models to adjust for clustering at the provider level. A final p-value of 0.05 was used for variables to be included in the final model. Final models were tested by fit using a multiple logistic regression model using Pearson goodness-of-fit testing. Stata/IC 11.2 (StataCorp LP, College Station, TX) was used for all analysis.

Results:

A total of 600 patients were included in the final analysis divided equally between PED and ambulatory clinic visits. In order to obtain our calculated sample size, 401 charts in the PED and 530 charts from the pediatric clinic were reviewed to obtain 300 charts for each site. Inter-rater agreement yielded a kappa score of 0.70 for recommendations for A/A and 0.63 for the use of an observation option showing good agreement between reviewers. The most common reason for exclusion was recurrent or chronic otitis media, eustachian tube dysfunction or tubes or prematurity as shown in figure 1. Demographic and variable comparisons are shown below in Table 1.

Measured fever was more likely in the PED compared to the ambulatory clinic, while fever by history was not significantly different ($p=0.48$). Topical A/As were more likely to be recommended in the PED compared to the ambulatory clinic (41% vs 22%; $p<0.001$). Additionally, residents were also much more likely to be involved in clinical care in visits to the PED compared to the ambulatory clinic (60% vs 23%; $p<0.001$).

Use of Analgesics/Antipyretics:

The overall use of A/A recommended at discharge was 73.7%. Recommendations for use of A/A following the visit were higher in the PED compared to the ambulatory clinic (86.7% vs. 60.7%, $p<0.001$). In comparison, there was a higher use of A/A given during the visit in the PED compared to the ambulatory clinic (58.3% vs 0.3%, $p<0.001$). This difference remained significant ($p<.001$) when adjusted for severity indicators such as fever, vomiting, and tympanic membrane pus, bulging and erythema. Following each visit, acetaminophen alone was recommended 49% of the time, NSAIDs alone 46.5% of the time, and both together were

recommended 31.2% of the time. Topical agents were used less frequently than oral agents (31.5%). Topical agents were also more often used in the PED compared to the ambulatory clinic (41.3% vs. 21.7% $p<0.001$). Overall, there was no significant difference between return visits for those that received recommendations for A/A use ($p=0.45$) or observation ($p=0.59$) compared to those who did not return to care.

The presence of fever, history of otalgia, use of an observation option, and prior use of A/A were all associated at the univariate level with recommendations to use of A/A following the visit. Conversely, resident involvement, a history of vomiting, absence of TM mobility, or Medicaid/unknown insurance were independently associated with a decrease in A/A discharge recommendations. Additionally, A/A use remained higher in the PED when adjusted for fever (OR 3.65: 95% CI: 2.41-5.51, $p<0.001$).

In the final multivariate model, patients with recommended use of observation were more likely to receive post-visit A/A recommendations (OR 2.11: 95% CI 1.36-3.28, $p=0.001$) compared to those prescribed antibiotics immediately. A/A use was more common in those that received A/A prior to visit compared to those with no history of A/A use prior to the clinical visit (OR 2.18: 95% CI 1.46-3.26, $p<0.001$). Other significant predictors of A/A recommendations included children with a fever on presentation (OR 3.13: 95% CI 1.57-6.29, $p=0.001$) and children receiving care in the PED (OR 3.77 CI 2.45-5.81, $p<0.001$). The complete model is presented in Table 2.

Use of Observation:

Overall, an observation option was recommended for 37.8% of all AOM visits which did not differ significantly between the PED and ambulatory clinic sites ($p=0.93$) or between provider training levels ($p=0.68$). Observation was more likely with the use of A/A (CI: 1.65-

4.14; $p < 0.001$) compared to those not given A/A. In addition, a recorded history of ear drainage ($p < 0.001$) and fussiness ($p = 0.003$) were significantly associated with a decrease in the use of an observation option, as well as the presence of fever ($p < 0.001$), tympanic membrane bulging ($p < 0.001$), erythema ($p = 0.011$), or pus ($p = 0.007$). The multivariate model is shown in table 3.

Discussion

In addition to high rates of recommendations for observation and A/A use, this is the first report describing that A/A were more often given in conjunction with observation compared to use of immediate antibiotics. Observation was also found to be less likely in patients with markers of AOM disease acuity. Our study also found higher rates of recommendations for A/A use in the PED compared to the ambulatory clinic.

There are several possible potential reasons for the association between prescribing A/A and use of observation. It is likely that many clinicians still believe that antibiotics have intrinsic analgesic properties. Although use of immediate antibiotics has been shown to reduce total length of symptoms compared to placebo^{7,8}, antibiotics have no known intrinsic analgesic properties and therefore strong recommendations have been made to treat pain associated with AOM.⁴ In addition, lack of awareness, familiarity and agreement with clinical guidelines were the most commonly cited barriers to physician adherence to clinical guidelines.¹⁵ Physicians that are aware and familiar with the published guidelines for treating AOM may be more likely to use treatment guidelines in their entirety rather than A/A recommendations or observation alone

Overall, we found a higher frequency of recommendations for post-visit A/As and observation for the treatment of AOM compared to previous reports.^{10,16} This result is contrary to recent randomized trials supporting the initial use of immediate antibiotics as opposed to placebo without addressing otalgia directly.^{7,8} As the 2004 guidelines strongly recommend treatment of otalgia in all cases of AOM, our results still show inadequate or incomplete treatment of otalgia.^{7,8} If our results are confirmed by prospective analyses, this may signal a change in the management of AOM since recommendations were published eight years ago. However, as fever and pain are a common co-indication for ibuprofen and acetaminophen, it was difficult to

determine with retrospective chart review what aspect of these recommendations from clinicians directly addressed pain and/or fever. Interestingly, almost one-third of all visits were treated with topical A/As to address otalgia, higher than previously reported. Recommendations for A/A following the visit were also correlated with a history of A/A given by caretakers prior to the clinical visit. This may also suggest that physicians may address pain more often following parental suggestion or parental practices. Physicians may also ask more often about prior A/A when already considering addressing AOM pain.

Similarly, we found a higher utilization of observation than previously reported.⁶ Treatment in an academic setting may lead to higher physician familiarity and awareness to clinical treatment guidelines compared to community practice. This may describe the best-case clinical scenario as treatment should be optimal in a tertiary academic treatment center. In addition, markers of AOM acuity such as fussiness, tympanic membrane erythema and bulging were associated with decreased use of observation. This suggests that physicians may use degrees of AOM acuity to determine if immediate antibiotics should be administered. A concordant decrease in observation with the presence of markers of AOM acuity supports an increased physician familiarity with the use of observation in mild to moderate cases of AOM.

We also found that visit use and discharge recommendations for A/A was higher in the PED compared to the ambulatory clinic. Perhaps this was due to close to a three fold higher rate of fever noted in the PED compared to the ambulatory clinic, or possibly easier access to administration of medications in the PED. Similarly, higher percentages of medicaid patients that have over the counter A/A covered by insurance may have increased physician documentation and prescription of A/As in the PED. Finally, it is possible that more

standardized training using evidence based treatment principles for the treatment of AOM may help improve clinical adherence.¹⁷

Limitations:

As the study design is a retrospective chart review, outcomes are subject to recording bias, which lead to a underreporting of both A/A recommendations and observation. It is possible, but less likely, that providers may have documented recommendations for A/A use without effectively communicating this to parents. In addition, there may have been reviewer bias or inconsistency during the chart review. While this bias would likely be non-differential, this was addressed by dual review showing good inter-rater reliability. Since we could only assess the medical record retrospectively, it is impossible to determine if recommendations came solely from the provider or if they were influenced by parental treatment preference for antibiotics or A/As. Similarly, with the increasing use of pre-written discharge instructions in physician records, we choose not to include automated discharge instructions which would likely underestimate A/A recommendations. An additional limitation to this study include the use of a single academic center for chart review, and therefore generalizability is limited to one regional academic setting and our results cannot may not be applicable to community practice or other academic centers. The presence of fever, a potential indicator of AOM severity, was found to be significantly correlated with A/A use – and therefore these results should be interpreted with caution as it is impossible to determine if these agents were prescribed as an antipyretic, analgesic, or both. However, differences between sites and all models were adjusted for the presence of fever possibly limiting the effect of this confounder.

Conclusions:

A/A were more often given in conjunction with observation compared to immediate antibiotic use. The frequency of use of observation and A/A were found to be higher than previously reported. A/A recommendations were more likely to be given in a PED setting compared to the ambulatory clinic. Further prospective analyses in multiple academic and non-academic settings are warranted to confirm the results of this study

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Figure 1:
Flowchart of
patient inclusion/
exclusion

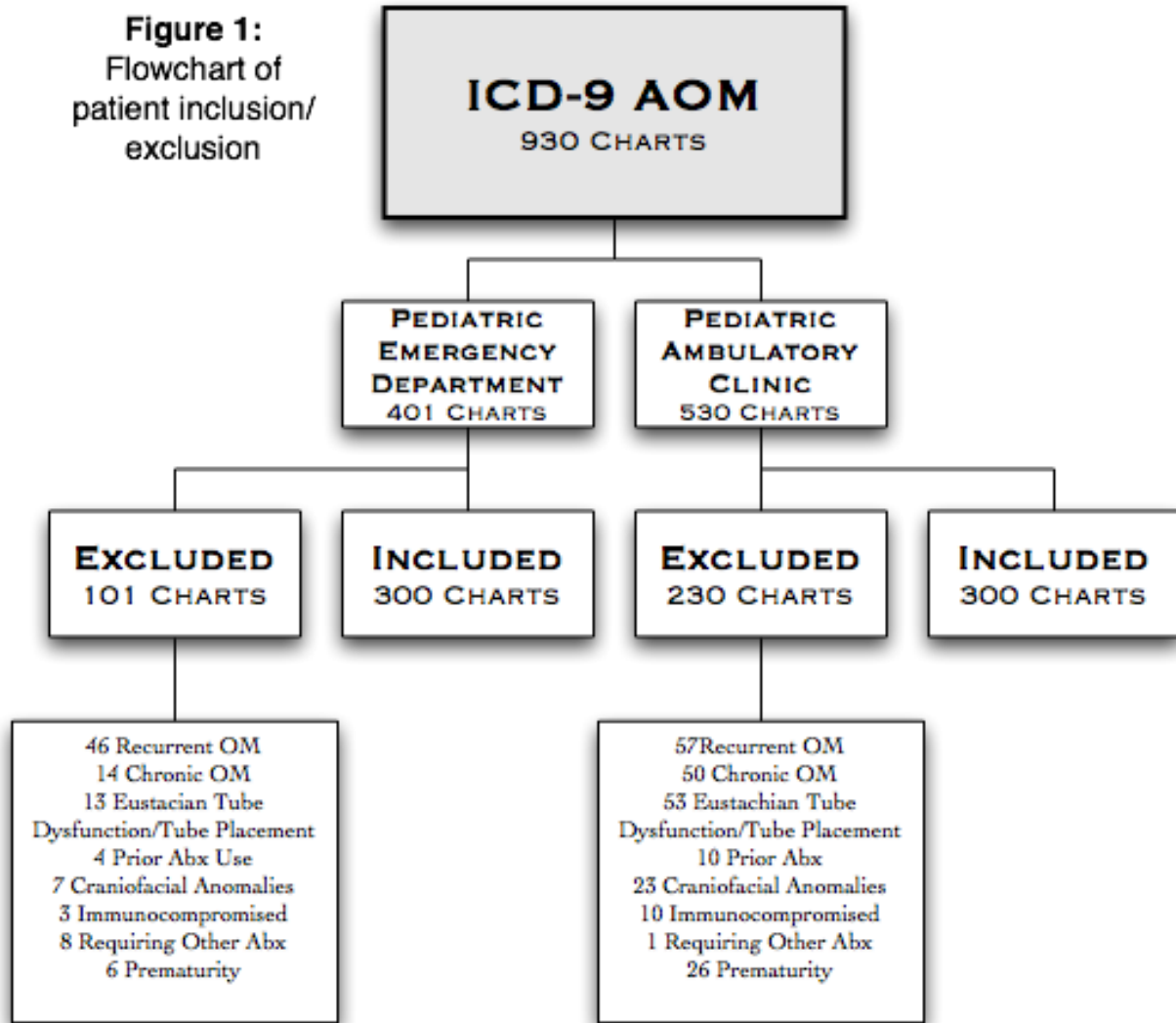


Table 1: Demographic and clinical information for children diagnosed with AOM

	Characteristics	PED (%)	Clinic (%)	p-value
Gender	Male	170 (43.3)	155 (51.7)	0.24
	Female	130 (56.7)	145 (48.3)	
Ethnicity	White	118 (39.5)	191 (63.7)	<0.001
	Black	16 (5.4)	1 (0.3)	
	Hispanic	131 (43.8)	83 (27.7)	
	Other	35 (11.7)	25 (8.3)	
Insurance	Private	70 (23.7)	185 (61.7)	<0.001
	Medicaid	197 (66.6)	101 (33.7)	
	Unknown	29 (9.8)	14 (4.7)	
Resident Involvement		179 (60)	69 (23)	<0.001
A/A Prior to Visit		178 (59)	150 (50)	0.02
Return Related to AOM		35 (12)	42 (14)	0.39
A/A Given at Visit		175 (58)	1 (0.3)	<0.001
Symptoms by History:				
	History of Fever	213 (71)	206 (67)	0.48
	History of URI Symptoms	196 (76)	270 (90)	<0.001
	History of Fussiness	212 (71)	203 (68)	0.43
	History of Vomiting	68 (23)	57 (19)	0.27
	History of Poor Sleep	150 (50)	173 (58)	0.06
	History of Otagia	194 (65)	185 (62)	0.48

Table 1: Demographic and clinical information for children diagnosed with AOM

Characteristics	PED (%)	Clinic (%)	p-value
History of Ear Drainage	23 (7.7)	11 (3.7)	0.03
Physical Exam Findings:			
TM Perforation	8 (2.7)	0 (0)	0.004
TM Erythema	232 (77)	241 (80)	0.37
TM Bulging	192 (64)	221 (74)	0.01
TM Mobility	1 (0.3)	29 (9.7)	<0.001
TM Pus	79 (26)	157 (52)	<0.001
TM Drainage	24 (8.0)	7 (2.3)	0.002
Bilateral Disease	81 (27)	98 (33)	0.13
Fever	87 (29)	28 (9.3)	<0.001

*Children of unknown ethnicity were placed in “Other”

Table 2: Multivariate Model for the Recommendations for Analgesic Use

Predictor	OR	95% CI	p-value
Observation	2.11	1.36-3.28	0.001
Pain Medications Prior to Visit	2.18	1.46-3.26	<0.001
History of Vomiting	0.56	0.35-0.90	0.017
Fever	3.13	1.57-6.29	0.001
Age <24 months	Reference	Reference	Reference
24-96 months	1.36	0.88-2.10	0.164
>96 months	0.78	0.38-1.63	0.513
PED	3.77	2.45-5.81	<0.001

Table 3: Multivariate Model for the use of an Observation Option

Predictor	OR	95% CI	p-value
Recommendations for A/A Use	2.61	1.65-4.14	<0.001
History of Fussiness	0.55	0.37-0.81	0.003
Fever	0.40	0.23-0.69	0.001
Tympanic Membrane Bulging	0.46	0.30-0.67	<0.001
Tympanic Membrane Erythema	0.55	0.34-0.90	0.011
Ear Drainage	0.09	0.02-0.32	<0.001
Pus in the Ear	0.56	0.38-0.86	0.007
PED	0.62	0.38-1.00	0.051

Appendix A: Public Health Significance

As AOM remains at the forefront of pediatric diagnosis, consensus on both the guidelines for the treatment of AOM and the clinical management are key. The high disease burden of AOM in the pediatric population and concurrent use of antibiotics, decisions that are made today will doubtless have substantial impacts on tomorrow's clinical environment. With the prevalence of antimicrobial resistance on the rise both in pediatric and adult populations it will become even more important to limit pediatric exposure to antibiotics. This is especially true as increased use of antibiotics for AOM have been associated with increased multi-drug resistant bacteria on repeat nasal swab (McCormick). Increasing the use of A/A may also improve patient satisfaction with observation and thereby decrease patient use of antibiotics. This also represents a more complete treatment of AOM as otalgia is commonly a presenting feature of AOM.

In front of this epidemiologic background is successful patient treatment of both AOM and the pain that surrounds it. In general this success encompasses both efficient, effective and targeted treatment in addition to patient satisfaction. Consensus guidelines, such as those put forth in 2004 by the A/AP and A/AFP, seek to provide direction as to how to properly address both concerns. This study is also pivotal in understanding current provider adherence to clinical guidelines for observation and the use of A/A for AOM. By better understanding what factors drive providers to adhere to guidelines, a more targeted approach to training and education can be evaluated prospectively. As this study provides a basis for establishing clinical baseline prevalence adherence proportions, the efficacy of each intervention can be effectively evaluated. However, in the absence of investigation, the efficacy of publishing treatment guidelines is limited.

Appendix B: Clinical Definitions

Acute Otitis Media: Otitis media diagnosed with no previous otitis media within 2 weeks

Chronic Otitis Media: recurrent otitis media requiring >3 treatments within 6 months, tympanic tube placement, otitis media within 2 weeks of diagnosis

Observation option: any option that includes a recommendation to wait to give antibiotics, treatment of acute otitis media that does not include antibiotics

Analgesics: medications with primary indications for analgesic use including antipyretics

Appendix C: Variable Table

Collected Variables:

Variable	Measurement (Categorical if specified)	Notes
Date of visit	Ordinal	
Visit Time	Ordinal	In 24hr increments
Age	Numerical	In Months
Sex	Male Female	
Location	Pediatric Clinic Pediatric ED	
Ethnicity	White Black Hispanic Asian Other	Self-reported - given in demographics tab
Training	Pediatric EM EM Pediatrics Nurse Practitioner	Determined by majority of care and decisions
Resident Involvement	Binary	Determined by chart coding or note
Insurance	OHP Private None Unknown	Determined by billing records, demographics tab

Variable	Measurement (Categorical if specified)	Notes
A/As prior to visit	Binary -If yes: Narcotic, acetaminophen, NSAID, topical, homeopathic	Self-report, in HPI, nursing notes or medication review
A/As given at visit	Binary: -If yes: Narcotic, Acetaminophen, NSAID, Topical -Indication: pain, fever, both, other -Timing: PRN or scheduled -OTC vs. RX	Recorded from medication administration records, physician record, nursing notes
Visit Information		
Return to care within 6wks	Binary -If yes: related to AOM (Yes/No) -Return Diagnosis: descriptive	Determined from OHSU EPIC records of visits alone
Antibiotics prescribed at visit	Binary -If Yes: Type (descriptive)	Medication administration records or physician notes
High Dose given	Binary -If No: Dose - ordinal	>80mg/kg, recorded in mg/kg
Observation Option	Binary	If WASP recommended, discussed observation, delayed use of abx, wait to treat for 24-48hrs, no immediate abx recommended etc

Variable	Measurement (Categorical if specified)	Notes
A/As prescribed following visit	Binary -If Yes: List (narcotic, acetaminophen, NSAID, Topical) -Indication: Pain, fever, both, unknown, other -Timing: PRN vs. Scheduled -OTC vs. RX	Physician records, prescription record, nursing notes **Excluded: Routine after visit summary instructions for AOM, unless modified by provider
History:		
Fever	Binary	From HPI/ROS, nursing/triage notes
URI Sx	Binary	HPI/ROS, nursing and triage notes: coughing, running nose, congestion, sore throat
Fussy	Binary	HPI/ROS and nursing/triage records Fussy or irritable
Vomiting	Binary	HPI, ROS - emesis, vomiting, throw-up, inability to keep food down etc
Otalgia	Binary	HPI/ROS, nursing and triage notes -ear pain, otalgia, pulling or fussy with ears
Ear Drainage	Binary	HPI/ROS, nursing and triage notes - Anything native noted to be coming out of ear

Variable	Measurement (Categorical if specified)	Notes
Physical Exam -Perforation -Erythema -Bulging -Mobility -Light Reflex -Pus -Drainage -Bilateral -Unilateral -Not Described	Binary	Taken from physical exam Attending record used if attending and resident do not agree
Vitals		
Temperature	Ordinal	recorded in Celsius, triage vitals if multiple recorded
Heart Rate	Ordinal	Recorded in BPM, taken from triage vitals if multiple present
Respiratory Rate	Ordinal	Recorded in respirations per minute, taken from triage vitals if multiple present
Weight	Ordinal	Recorded in kg, taken from triage vitals if multiple present

Appendix D: Additional Analysis

Bivariate Analysis:

Table 2: A/A Use							
Crude Univariate Analysis	Emergency Department		Pediatric Clinic		Overall		
	OR	95% CI	OR	95% CI	OR	95% CI	p-value
Any A/A Use							
Gender (male)	0.59	0.29-1.19	1.40	0.88-2.23	1.14	0.78-1.66	0.49
Ethnicity:							
White	Reference		Reference		Reference		
Hispanic	0.89	0.44-1.78	0.85	0.50-1.44	1.14	0.76-1.70	0.53
Black	2.52	0.31-20.37	***	***	2.94	0.65-13.34	0.16
Other	5.55	0.71-43.32	3.91	1.11-13.74	5.25	1.83-15.09	0.002
Resident Involvement	0.98	0.50-1.94	0.92	0.53-1.60	1.53	1.03-2.27	0.032
Insurance:							
Private	1	1	1	1	1	1	1
Oregon Health Plan	0.70	0.29-1.69	1.21	0.74-2.00	1.74	1.18-2.56	0.005
Unknown	0.48	0.15-1.57	5.71	0.70-46.57	2.27	0.95-5.40	0.065
A/As Prior	1.74	0.89-3.40	2.40	1.49-3.87	2.39	1.62-3.51	<0.001
Return Visits Related to AOM	0.46	0.19-1.11	1.28	0.64-2.56	0.85	0.50-1.47	0.57
High Dose Amoxicillin	1.50	0.73-3.08	1.000	0.999-1.001	1.000	0.999-1.000	0.96
Observation Option	1.34	0.66-2.74	2.86	1.71-4.80	2.05	1.36-3.08	0.001
Symptoms							
Hx Fever	2.61	1.32-5.14	0.68	0.41-1.14	1.10	0.73-1.64	0.65
Hx URI Symptoms	2.14	1.06-4.32	0.89	0.41-1.95	1.15	0.67-1.98	0.61
Hx Fussiness	1.04	0.50-2.15	0.77	0.47-1.28	0.88	0.59-1.33	0.54
Hx Vomiting	0.74	0.35-1.57	0.40	0.22-0.73	0.54	0.34-0.85	0.008
Hx Poor Sleep	1.00	0.51-1.95	0.86	0.53-1.37	0.81	0.56-1.19	0.28

Table 2: A/A Use

Crude Univariate Analysis	Emergency Department		Pediatric Clinic		Overall		
	OR	95% CI	OR	95% CI	OR	95% CI	p-value
Any A/A Use							
Hx Otagia	1.60	0.82-3.14	2.25	1.39-3.64	1.97	1.35-2.88	<0.001
Hx Ear Drainage	0.40	0.15-1.07	2.99	0.63-14.09	1.18	0.51-2.71	0.70
Physical Exam							
TM Perforation ***	0.24	0.055-1.05	***	***	0.52	0.12-2.29	0.39
TM Erythema	2.05	1.00-4.20	0.76	0.42-1.37	1.06	0.67-1.66	0.82
TM Bulging	2.20	1.12-4.30	0.94	0.55-1.59	1.14	0.76-1.70	0.53
TM Mobility ***	***	***	0.57	0.26-1.22	0.30	0.14-0.64	0.02
TM Light Reflex ***	0.46	0.046-4.49	2.35	0.76-7.33	1.32-5.14	0.47-3.74	0.60
TM Pus	0.54	0.27-1.10	1.80	1.13-2.89	0.90	0.61-1.32	0.58
TM Drainage	0.55	0.19-1.57	1.62	0.31-8.51	1.19	0.49-2.86	0.70
TM Bilateral	0.74	0.36-1.51	1.02	0.62-1.68	0.86	0.58-1.28	0.46
Fever	9.23	2.17-39.17	1.40	0.61-3.21	4.08	2.13-7.83	<0.001
Age: 6-24 months	1	1	1	1	1	1	1
25+ months	1.42	0.72-2.78	1.22	0.77-1.95	1.18	0.81-1.72	0.39
							*** sample size too small

Table 4: The use of an observation option

Crude Bivariate Analysis	Emergency Department		Pediatric Clinic		Overall		
	OR	95% CI	OR	95% CI	OR	95% CI	p-value
Males	1.383	0.855-2.236	1.695	1.049-2.740	1.542	1.098-2.164	0.012
Ethnicity:							
White	1	1	1	1	1	1	1
Hispanic	0.596	0.353-1.005	0.563	0.320-0.993	0.613	0.423-0.888	0.01
Black	0.894	0.292-2.743	***	***	1.138	0.402-3.218	0.808
Other	0.738	0.337-1.616	1.235	0.479-3.182	0.923	0.510-1.668	0.79
Resident Involvement	0.564	0.348-0.914	1.095	0.625-1.917	0.771	0.548-1.085	0.135
Insurance:							
Private	1	1	1	1	1	1	1
Oregon Health Plan	0.981	0.553-1.741	0.828	0.496-1.381	0.906	0.639-1.284	0.58
Unknown	0.972	0.405-2.332	1.135	0.295-4.370	0.967	0.489-1.912	0.922
Analgesics Prior	0.55	0.339-0.892	1.03	0.642-1.652	0.766	0.547-1.071	0.119
Return Visits Related to AOM	1.314	0.620-2.784	0.651	0.315-1.345	0.939	0.563-1.565	0.809
High Dose Amoxicillin	0.876	0.512-1.498	0.675	0.409-1.113	0.765	0.532-1.099	0.147
Analgesics Given After Visit	1.342	0.658-2.737	2.902	1.450-5.808	1.971	1.204-3.227	0.007
Analgesics Given At Visit	0.736	0.455-1.190	***	***	0.827	0.571-1.197	0.315
Symptoms							
Hx Fever	0.543	0.321-0.920	0.615	0.372-1.019	0.584	0.406-0.840	0.004
Hx URI Symptoms	0.824	0.467-1.454	0.568	0.263-1.228	0.734	0.469-1.150	0.177
Hx Fussiness	0.589	0.269-1.289	0.381	0.231-0.626	0.47	0.331-0.672	<0.001
Hx Vomiting	0.704	0.390-1.270	0.830	0.453-1.523	0.758	0.497-1.157	0.199
Hx Poor Sleep	0.731	0.458-1.168	0.639	0.399-1.025	0.686	0.493-0.956	0.026
Hx Otagia	1.756	0.755-4.084	1.000	1.000	1.000	1.000	0.959
Hx Ear Drainage	0.207	0.0594-0.721	0.381	0.0794-1.827	0.263	0.0996-0.695	0.007
Physical Exam							

Table 4: The use of an observation option

Crude Bivariate Analysis	Emergency Department		Pediatric Clinic		Overall		
	OR	95% CI	OR	95% CI	OR	95% CI	p-value
TM Perforation ***	0.508	0.101-2.560	***	***	0.510	0.102-2.547	0.412
TM Erythema	0.638	0.365-1.114	0.830	0.459-1.500	0.727	0.485-1.089	0.122
TM Bulging	0.514	0.314-0.841	0.734	0.431-1.248	0.613	0.429-0.877	0.007
TM Mobility ***	***	***	1.002	0.451-2.227	1.093	0.512-2.335	0.818
TM Light Reflex ***	4.745	0.487-46.197	1.590	0.579-4.366	1.930	0.787-4.733	0.151
TM Pus	0.674	0.386-1.177	0.744	0.463-1.195	0.726	0.513-1.027	0.071
TM Drainage***	0.211	0.0613-0.728	***	***	0.160	0.0480-0.535	0.003
TM Bilateral	0.824	0.481-1.411	0.531	0.313-0.903	0.669	0.460-0.974	0.036
Fever	0.478	0.275-0.831	0.902	0.398-2.048	0.593	0.379-0.927	0.022
Age: <24 months	1	1	1	1	1	1	1
25-96 months	1.534	0.943-2.495	3.899	2.298-6.616	2.374	1.669-3.376	<0.001
>96 months	1	0.380-2.634	2.802	1.112-7.062	1.631	0.842-3.157	0.147