

Pediatric Prescribing Trends of Acute Otitis Media in children; a
comparison between the practices of pediatricians in Salem, Oregon with physicians
in a public hospital in Buenos Aires, Argentina.

by
Kali M Burkhardt

A THESIS

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degree of

Honors Baccalaureate of Science in General Science
(Honors Scholar)

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AN ABSTRACT OF THE THESIS OF

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Abstract approved:

Robert Boyce

This study compared and analyzed the practice of pediatricians in Salem Pediatric Clinic, Salem, OR, USA with physicians in Hospital de Niños Dr. Ricardo Gutierrez, Buenos Aires, Buenos Aires, Argentina in the treatment of acute otitis media in children. It was found that Argentine and USA practices for treatment of AOM use similar antibiotics including amoxicillin as first line choice, followed by amoxicillin clavulanate as second line choice, with varying third line choices. Argentine physicians were more likely to wait to prescribe antibiotics than the USA pediatricians, though no primary data collection was done in Argentina to mirror the data collected in the USA. In the Argentine hospital used, there was not a standard system of data collection for patient clinical histories which made it difficult to follow patient's cases. Future research is needed to determine if such high use of antibiotics in the treatment of AOM is causing resistance rates in both countries, or if the guidelines used should be followed by Argentine hospitals while there is still a lack of a standardized data collection system in the public system.

Key Words: Antibiotic Resistance, Acute Otitis Media, Treatment Guidelines, Buenos Aires, Salem, Oregon, Argentina,

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I understand that my project will become part of the permanent collection of Oregon State University, Honors College. My signature below authorizes release of my project to any reader upon request.

Kali M Burkhardt, Author

I would like to thank and dedicate my thesis to the following individuals, without whom this would have never happened.....

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Introduction

In the World Health Organization's (WHO) 2014 global report on the surveillance of antimicrobial resistance (AMR), they warned the globe that a "post-antibiotic era," where common infections and minor injuries can kill, is completely possible for the 21st century if something is not done about the growth of AMR.¹ Alarming as this warning may be, it brings home the true impact of what AMR can cause and bring about if not properly managed and maintained. This report, released in April of 2014, was the first report conducted on AMR by the WHO with the goals of determining the scope of the problem of AMR on a global level.

The WHO conducted this report to fill in the gaps of knowledge about the true magnitude of this problem and to try and develop a means of combating AMR, with a special focus on antibacterial resistance (ABR) in common bacterial pathogens.¹ The results were frightening, revealing that the surveillance of ABR is neither coordinated, recorded, or standardized, making the problem near impossible to monitor and therefore contain in most situations.¹ However, even with the lack of information, the report makes a clear case that ABR to common bacterial pathogens has reached alarming proportions in many parts of the world (Table 1), indicating that many early treatments for common infections are no longer useful.¹

Shortly after the release of the 2014 WHO report, Doctors Without Borders (DWB) announced that about three-fourths of their Iraqi patients in Amman, Jordan, arrive with infections due to resistant bacteria.² In a short video clip from their surgical program in Amman, Jean-Baptiste Ronat, a medical advisor with DWB, claimed that the overuse of antibiotics for fevers not caused by bacteria, use of counterfeit antibiotics, and administering antibiotics to animal farms all have contributed to the problem of ABR to antibiotics.²

Later in 2014, Tom Frieden—Centers for Disease Control and Prevention Director, (CDC) stated that antibiotic resistance could turn what are considered to be ordinary illnesses into the "next pandemic."³ Frieden also stated in an interview with Medscape in 2014, that more than 20,000 Americans a year die from drug-resistant infections, and that there are "far too many" antibiotics given for conditions that are not truly indicated. Frieden gives two examples of common conditions for which this occurs, listing otitis media (OM) and bronchitis.⁴ Frieden goes on to discuss how doctors need to have a discussion with their patients about why antibiotics are not necessary 100% of the time, and how using the excuse of "what's good for the community is not necessarily good for my specific patient" is no longer a valid argument as the tendency rates of antibiotic resistant strains are becoming a concern for every patient.⁴

Table 1¹ Overview of data sets obtained on request to national official sources that included information on at least 1 of the 9 selected bacteria–antibacterial drug resistance combinations based on testing of at least 30 isolates

	For each bacteria–antibacterial drug-resistance combination ^a : no. of returned data sets ^b based on at least 30 tested isolates/total no. of data sets for each requested combination ^c						Total no. of reports with data sets based on ≥30 tested isolates
	AFR	AMR/PAHO	EMR	EUR	SEAR	WPR	
<i>E. coli</i> / 3 rd generation cephalosporins ^d	13/19	14/15	5/7	35/36	5/5	14/19	86/101 (85%)
<i>E. coli</i> / fluoroquinolones ^e	14/19	16/16	5/7	35/35	5/5	17/20	92/102 (90%)
<i>K. pneumoniae</i> / 3 rd generation cephalosporins	13/16	17/17	5/7	33/37	4/5	15/17	87/99 (88%)
<i>K. pneumoniae</i> / carbapenems ^f	4/7	17/17	5/7	31/35	4/5	10/12	71/83 (86%)
Methicillin-resistant <i>S. aureus</i> (MRSA)	9/15	15/17	5/7	36/37	3/4	17/19	85/99 (86%)
<i>S. pneumoniae</i> non-susceptible or resistant to penicillin	5/14	15/21	3/5	31/35	2/5	11/18	67/97 (69%)
Nontyphoidal <i>Salmonella</i> / fluoroquinolones	9/19	13/20	4/5	29/30	2/4	11/13	68/91 (75%)
<i>Shigella</i> species/ fluoroquinolones	4/12	14/19	2/3	10/12	0/2	5/9	35/57 (61%)
<i>N. gonorrhoeae</i> / 3 rd generation cephalosporins	2/10	4/12	2/3	17/22	5/7	12/21	42/75 (56%)
Total no. of reports with data sets based on ≥30 tested isolates	73/131 (56%)	125/154 (81%)	36/51 (71%)	257/279 (92%)	30/42 (71%)	112/147 (76%)	Total 636/805 (79%)

AFR, African Region; AMR/PAHO, Region of the Americas/Pan American Health Organization; ECDC, European Centre for Disease Prevention and Control; EMR, Eastern Mediterranean Region; EUR, European Region; SEAR, South-East Asia Region; WPR, Western Pacific Region.

a. Not all countries returned information for all combinations.

b. To avoid duplicate data collection, ECDC and AMRO/PAHO forwarded data already collected in their existing surveillance networks.

c. From countries providing several data sets, one per country and data with highest denominator is included in this table.

d. 3rd generation cephalosporins mentioned in obtained national data are ciprofloxacin; gatifloxacin; levofloxacin; moxifloxacin; norfloxacin; ofloxacin; pefloxacin; reflexacin and sparifloxacin.

e. Fluoroquinolones mentioned in obtained national data are ciprofloxacin, norfloxacin or ofloxacin.

f. Carbapenems mentioned in obtained national data are imipenem, meropenem, doripenem or ertapenem.

It is clear that antibiotic resistance in common bacterial pathogens is a prominent and threatening issue in today's society as it has drawn the global attention of the WHO, CDC, and DWB. A common cause noted by Frieden in his interview and by the clip provided by DWB, is the overuse of antibiotics and its detrimental effect of the ABR crisis.^{2,4} One way that the WHO suggested to combat this inappropriate use of antibiotics is to gather information in order to create informed treatment guidelines.¹ This suggestion is concurrent with a study stating that antibiotic resistance can be reduced by using antibiotics prudently when based on guidelines of antimicrobial stewardship programs (ASP).⁵ An antimicrobial stewardship program is an activity that includes the appropriate selection, dosing, route, and duration of antibiotic

therapy, and involves goals to optimize clinical outcomes and minimizing unintended consequences of antimicrobial use, including resistance.⁶

As mentioned by Frieden in his interview, otitis media (OM) is a condition that has been recognized as a condition where inappropriate antibiotic usage can occur.⁴ In fact, OM is the most common condition for which antibacterial agents (antibiotics) are prescribed for children in the United States.⁷ Approximately 80% of children will have at least one episode of acute otitis media, defined as a history of acute onset of signs and symptoms, the presence of middle-ear effusion, and signs and symptoms of middle-ear inflammation associated with an infection behind the tympanic membrane.^{8,9,10} Meanwhile, 80-90% of children will have at least one episode of OM with effusion (OME), which is defined as fluid in the middle ear without signs or symptoms of acute ear infection,⁸ before school age.^{9,10} Acute otitis media (AOM), can be difficult to correctly diagnose and determine causality without performing a procedure that pierces the ear drum to culture the fluid that is in the inner ear (tympanocentesis).¹¹ With such a large amount of antibiotics prescribed to children for AOM, and the difficult nature of confirming the specific cause of the condition, it is reasonable to target AOM as a condition where appropriate antibiotic usage should be tightly defined and possibly reduced.^{12,13}

That being said, the treatment guidelines on the management of AOM vary, even when specified to the treatment of strictly AOM. In Europe, there is a recommendation of only analgesics, and rarely antibiotics to treat AOM.¹³ A study conducted in northern Europe, states that with 25 years of treatment only by analgesics, without antibiotics, no true increase of complications presented themselves.¹³ This therapeutic option is actually of a greater consensus and could contribute to the decrease of antibiotic resistance.¹³ Another study states that antibiotics do not really have an effect on the tympanic membrane in relation to pain, and that in high income countries, most cases of AOM will cure themselves without complications.¹⁴ Additionally, treatment guidelines in western European countries such as Spain, the Netherlands, and Germany have been created to reduce the use of antibiotics in AOM, with the goal of containing the problem of antibiotic resistance.¹³

In contrast to Europe, not as restrictive recommendations to antibiotic use exists in the Americas. For example in Canada, the official guidelines suggests that parents should receive a prescription for an antibiotic to use with discretion depending on how their child's condition of AOM progresses.¹³ The new guidelines from the American Academy of Pediatrics (AAP) suggests an increased use of antibiotics in comparison to those treatment guidelines used in the other European countries previously mentioned.^{7,13} However the recommendation on increased used has certain conditions; antibiotics should only be used in cases where the patient history is well known and easily followed, and that it only should be utilized when the physician has a high certainty that the child has AOM, not OME or any other condition presenting similar symptoms.⁷ Meanwhile in other countries in the Americas, such as Argentina, there is no official guideline identified for the treatment of AOM, but there is a national consensus about the treatment for AOM in

ambulatory pediatrics published by the National Committee of Infections and the Committee of Ambulatory Pediatrics.¹⁵ However, in the literature from their Society of Pediatrics, they reference the treatment guidelines used in the USA.¹⁶ Using the guidelines for the USA in Argentina maybe problematic for the following two reason.

First, In the article publishing the new guidelines for treatment of AOM by the AAP, the AAP stated that their guidelines should only be followed when the history of the patient could be closely followed.⁷ However the methodology and availability of resources to create a patient history that would be similar to a patient history kept in the USA are different in each province and medical setting in Argentina.¹⁷ While some clinics in Argentina have digital record keeping systems, most public systems do not have any electronic medical record (EMR) systems, or have a standardized way of recording data from every visit.¹⁷ The record keeping systems vary within the city of Buenos Aires, Argentina and in one of their largest pediatric hospitals, there is no case history management as meticulous to that seen in the USA.¹⁷ This makes following a patient medical history difficult and nearly impossible in some cases. For most pediatric visits, the doctor must rely on the parents or caregiver to provide not only the most recent symptoms, but the patient's medical history as well.¹⁷

Second, in the consensus found through the Argentine Society of Pediatrics, the antibiotics reported differ from those suggested by the AAP guidelines.^{7,15} The definition of acute otitis media also differs in the consensus versus how the AAP defines AOM.^{7,15} There is also no publication date on the Argentine consensus, making it difficult to discern how up to date the consensus is.¹⁵

The United States and Argentina collect surveillance information on the five bacterial strains requested by the WHO in its AMR surveillance report.¹ A side by side comparison of reported antibiotic resistance in the two countries is shown below in Table 2 and Figure 1, demonstrating alternating resistance trends with the USA having higher resistance rates in some strains, while Argentina having higher rates in the others.

In Figure 1 we can identify *Streptococcus pneumoniae*, which was shown to be a principle cause of 249 cases of AOM in Argentina where tympanocentesis was used to determine causality.¹¹ The resistance of *S. pneumoniae* is not only important due to its specific link to AOM, but studies reveal that this bacterium colonizes in the majority of children during the first few years of life.¹⁸ That same study found that the use of antibiotics was associated with a greater presence of resistant bacteria in their specific population of children.¹⁸ Resistance of this strain of bacteria is found in both the USA (4.2%)¹ and Argentina (27.5%)¹, with higher rates found in Argentina.

Table 2¹

Pathogen	Percentage of resistance in cases of Argentina	Percentage of resistance or non-susceptible in Argentina	Percentage of resistance in cases of USA	Percentage of resistance or non-susceptible in USA
<i>Escherichia coli</i> : Resistance to third generation cephalosporins	5.1	---	14.6	---
<i>Escherichia coli</i> : Resistance to fluoroquinolones	7.8	---	33.3	---
<i>Klebsiella pneumoniae</i> : Resistance to third-generation cephalosporins	65	---	23	---
<i>Staphylococcus aureus</i> : Resistance to methicillin (MRS)	54	---	51.3	---
<i>Streptococcus pneumoniae</i> : Resistance, or non-susceptibility, to penicillin	---	27.5	---	4.2
Nontyphoidal <i>Salmonella</i> (NTS): Resistance to fluoroquinolones	3	---	0	---
<i>Shigella</i> : Resistance to fluoroquinolones	0.1	---	2	---
<i>Neisseria gonorrhoeae</i> : Decreased susceptibility to third-generation cephalosporins	0	---	1.4 (cefixime) 0.4 (ceftriaxone)	---

Figure 1¹



The current management and diagnosis of AOM, suggested by the AAP is as follows:

The diagnosis of AOM used a 3-part definition of AOM in the 2004 Clinical Practical Practice Guideline: Diagnosis and Management of AOM, which includes the three following symptoms; 1) acute onset of symptoms, 2) presence of a middle ear effusion (MEE), and 3) signs of acute middle ear inflammation.¹⁹ However, this definition lacked precision to exclude cases of OME⁷, and could have been accounted for many diagnosis of AOM with an “uncertainty” of diagnosis (cases that were not true cases of AOM were diagnosed as AOM).⁷ Therefore in the 2014 review of the clinical practical guideline, a systematic review was conducted to evaluate symptom accuracy.⁷ No new “3-part” definition was released but investigators did correlated tympanic membraneTM color, mobility, and position with the presence of middle ear fluid collected by tympanocentesis in an attempt to identify true symptoms of AOM.⁷

It was discovered that the combination of a “cloudy,” bulging TM with impaired mobility was the best predictor of AOM.⁷ Impaired mobility, and a cloudy TM alone were good indicators of AOM as well.⁷ The presence of a bulging TM has positive bacterial cultures 75% of the time, and increased to 80% of the time when the TM was displaying a yellow color in addition to bulging.⁷

The conclusion of the review stated that the above symptoms should all be used in the diagnosis of AOM and that each physician should learn to distinguish OME from AOM, as OME is not a disorder that would benefit from antibiotic treatment as AOM does.⁷ The final statement about the diagnosis of AOM in the 2014 review is that there may never be a “gold standard” for the diagnosis of AOM because of the continuum from OME to AOM.⁷

The following treatment guidelines were provided in the article.

Table 3⁷ **Recommendations for Initial Management for Uncomplicated AOM^a**

Age	Otorrhea with AOM ^a	Unilateral or Bilateral AOM ^a With Severe Symptoms ^b	Bilateral AOM ^a Without Otorrhea	Unilateral AOM ^a With Otorrhea
6 mo to 2 y	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy or additional observation
≥ 2 y	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy or additional observation	Antibiotic therapy or additional observation ^c

^a Applies only to children with well documented AOM with high certainty of diagnosis
^b A toxic-appearing child, persistent otalgia more than 48h, temperature ≥ 39°C (102.2°F) in the past 48hours, or if there is uncertain access to follow up after the visit
^c This plan of initial management provides an opportunity for shared decision-making with the child’s family for those categories appropriate for additional observation. If observation is offered, a mechanism must be in place to ensure follow-up and begin antibiotics. If the child worsens or fails to improve within 48 to 72 hours of AOM onset.

Table 4⁷

Recommended Antibiotics for (Initial or Delayed) Treatment and for Patients Who Have Failed Initial Antibiotic Treatment			
Initial Immediate or Delayed Antibiotic Treatment		Antibiotic Treatment After 48-72h of Failure of Initial Antibiotic Treatment	
Recommended First-Line Treatment	Alternative Treatment (if Penicillin Allergy)	Recommended First-Line Treatment	Alternative Treatment
Amoxicillin (80-90mg/kg per day in 2 divided doses)	Cefdinir (14mg/kg per day in 1 or 2 doses)	Amoxicillin-clavulanate ^a (90mg/kg per day of amoxicillin, with 6.4 mg/kg per day of clavulanate in 2 divided doses)	Ceftriaxone, 3d Clindamycin (30-40 mg/kg per day in 3 divided doses), with or without third-generation cephalosporin
or	Cefuroxime (30 mg/kg per day in 2 divided doses)	Or	Failure of second antibiotic
Amoxicillin-clavulanate ^a (90mg/kg per day of amoxicillin, with 6.4 mg/kg per day of clavulanate [amoxicillin to clavulanate ratio, 14:1] in 2 divided doses)	Cefpodoxime (10mg/kg per day in 2 divided doses)	Ceftriaxone (50mg IM or IV for 3days)	Clindamycin (30-40mg/kg per day in 3 divided doses) plus third-generation cephalosporin
	Ceftriaxone (50mg IM or IV for 1 or 3 days)		Tympanocentesis ^b
			Consult specialist ^b

IM, intramuscular; IV, intravenous
^a May be considered in patients who have received amoxicillin in the previous 30days or who have the otitis-conjunctivitis syndrome
^b Perform tympanocentesis/drainage if skilled in the procedure, or seek a consultation from an otolaryngologist for tympanocentesis/drainage. If the tympanocentesis reveals multidrug-resistant bacteria, seek an infectious disease specialist consultation.

The current management and diagnosis of AOM, suggested by the Argentine consensus is as follows:

The definition of AOM is an inflammation or infection of the mucous in the middle ear with an acute occurrence and that lasts less than 3 weeks.¹⁵ For treatment, the consensus states that amoxicillin and TMP-SMX have traditionally been first line choice treatment options for AOM, but amoxicillin is preferred.¹⁵ It is stated that there is no little to no use of penicillin with increased rates of penicillin resistance (also observed in Figure 1).^{1,15} The consensus continues to say that due to an increase in the resistance of the frequent pathogens observed in AOM, it is necessary at times to use new antibiotics as an alternative treatment.¹⁵ The consensus then lists second generation cephalosporins, amoxicillin clavulanate, ampicillin, rifampin, clarithromycin, azithromycin and other antibiotics of the same classes as choices for alternative treatments.¹⁵

A side by side comparison of actual standards of practice between Argentina and the USA has not yet occurred and could provide insights into why there are different rates

of ABR between them. What is the realistic practice of Argentina and the USA in cases of AOM? Are the treatment guidelines used by the USA truly followed by Argentina? Are the treatment guidelines used by the USA adequate for Argentina to use? These are all questions that arise when a country lacks their own guidelines and follows the guidelines of another. Per the AAP 2014 review, we can expect that more antibiotics will be written in the United States of America than in Argentina as it is more difficult to follow a patient's history in Argentina than the USA. In the USA, we will expect the suggested antibiotics found in Table 4 to be used, while in Argentina we would expect the same antibiotics used if they truly follow the AAP guidelines.

Methods

The methodology for this paper consists of two parts; primary research through data collection and secondary research through the search of academic papers and sources available. All activities of this study were approved by the Oregon State University IRB previous to the start of any data collection. No HIPPA or confidentiality violations occurred as no identifiable information was collected.

On July 1st, 2015 a meeting was held between a practicing pediatrician from Salem Pediatric Clinic in Salem, OR and an investigator to collect data from their respective clinic. The meeting was conducted in an interview format where questions were asked in order to gain the data collected in the data collection sheet found in Appendix 1. The questions were answered by the doctor accessing his clinic's database for corresponding data, which he would then verbally communicate to the researcher. Previous to this meeting, consent letters had been sent out to all of the parents whose children's data fit the search criteria. Only the patients whose parents had signed and returned the consent form were used in the data collection process.

The primary research conducted included obtaining data from a population of patients aged 6 months to 6 years who had been treated in the past 10 years for otitis media with acute symptoms (indication AOM) at the Salem Pediatric Clinic. A total of 35 cases were recorded including the information found in the data collection sheet of Appendix 1, and all follow up information was recorded, even if there was more than a single follow up for a patient (for space purposes the inclusion of space for numerous follow up information gathering was not included in the blank data sheet as no new information fields were used with additional follow ups).

The information was then visually analyzed and viewed for trends in antibiotic usage, whether patients received antibiotics on the first visit, and any other possible trends or patterns that were detected within the sample size.

An attempt was made between the months of August 2015-December 2015 to gather primary data in a hospital or medical clinic in Argentina, however due to lack of a record system for data collection or lack of willingness from local hospitals, no direct

data collection was able to occur. Therefore secondary research was conducted using Argentine databases and US databases in the time range of August 2015-April 2016 to gather articles and resources to help define the true standard of practice with Argentina of the management of acute otitis media, including common antibiotics used to manage AOM.

Results

The results show that the sample used from Salem, Oregon, all doctors prescribed antibiotics upon diagnosis of acute otitis media (Table 5). Rarely would doctors choose to wait to prescribe antibiotics once a patient arrived at the clinic.

Table 5

Salem Pediatric Clinic	
Percentage of Cases that Received antibiotics on first visit	100%
Percentage of Cases that Required at least one Follow Up	46%
Percentage of Cases that Received new antibiotics on the first follow up	63%
Percentage of Cases that Required more than one Follow Up	44%
Percentage of Cases that Received new antibiotics on second Follow up	78%

Table 5: Data attained from the information collected in the data collection sheet found in appendix 1.

Figure 2

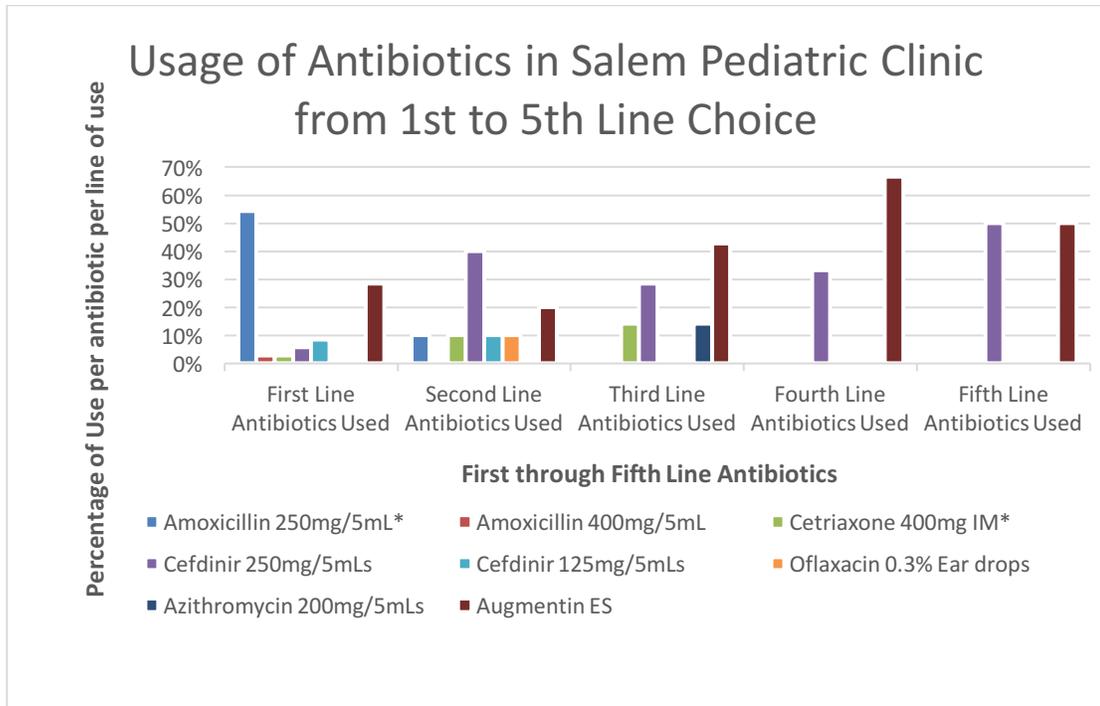


Figure 2: Data attained from the information collected in the data collection sheet found in appendix I.

Figure 3

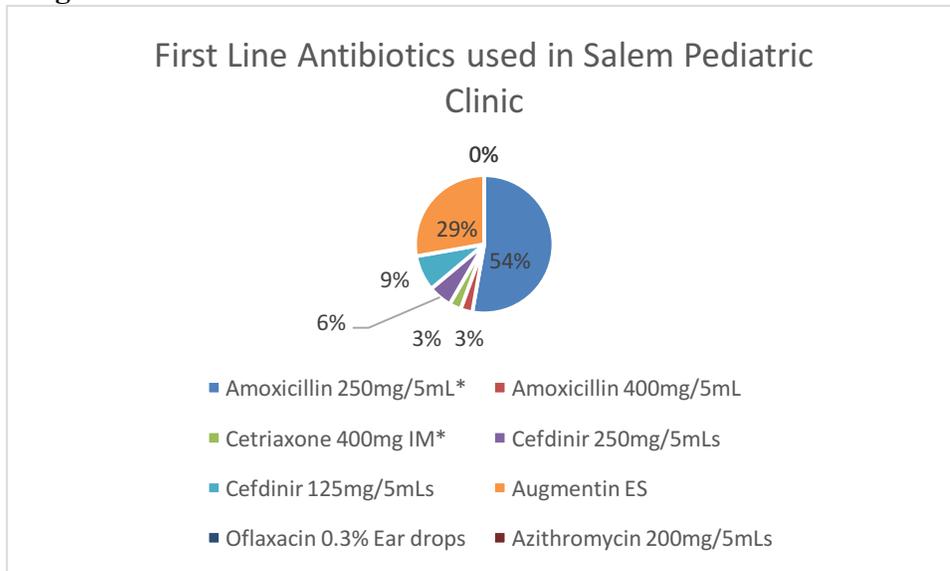


Figure 3: Data attained from the information collected in the data collection sheet found in appendix I.

Figure 4

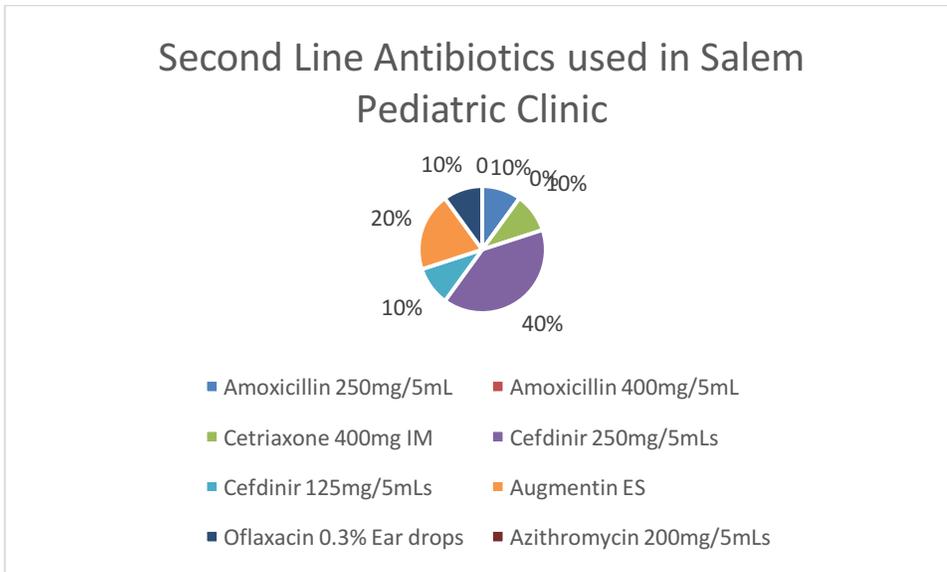


Figure 4: Data attained from the information collected in the data collection sheet found in appendix I.

We can observe that the most common antibiotics used by Salem Pediatric Clinic are Amoxicillin 250mg/5mL, Augmentin ES, and Cefdinir 250mg/5mL. Amoxicillin 250mg/5mL (54% first line, 10% second line) is the primary first line choice, while Augmentin ES (29% first line, 20% second line) and Cefdinir (6% first line, 40% second line) are popular second through fifth line choices. All three of these antibiotics are recommended in as either a first or second line use by the AAP as found in Table 4.

In previous work, the practices of a variety of physicians were investigated in a public hospital in Buenos Aires, with most doctors claiming that a patient diagnosed with AOM would receive antibiotics. However, the treatment of the patient with AOM varied depending on the physician. The two major variables affecting what treatment course was taken included department of physician and age of physician (Table 6).

Table 6¹⁵

Estimation by physician of their own use of antibiotics in the treatment of Acute Otitis Media.		
Physician	Estimated Use (of total cases treated for Acute Otitis Media)	Age of Physician
4 th Year Pediatric Student 1	15%	29
4 th Year Pediatric Student 2	50%	29
4 th Year Pediatric Student 3	20%	30
Pediatrician 1	60%	39
Pediatrician 2	100%	65
Otolaryngologist	100%	30
Urgent Care Physician	Could not provide an estimation	55

In this specific case, the younger the physician, the less likely they are to write for antibiotics in the treatment of AOM. While in the interviews conducted, most physicians who have been working claimed that while the guidelines suggested less use of antibiotics, they would rather prescribe an antibiotic to be safe, or because there will small chances of being able to follow up with the patient.¹⁷

The primary antibiotics used were amoxicillin (50mg/kg/d until 100 mg/kg/d) as first line choice, followed by amoxicillin clavulanate, and then ceftriaxone.¹⁷ The only physicians to mention analgesics as a first choice were the pediatric residents.¹⁷ All of these antibiotics are suggested in their respected use by the AAP as seen in Table 4.⁷

Errors and limitations

There are definite limitations to this study as only a sample of 35 cases were gathered from Salem Pediatric Clinic, spanning no more than 5 doctor's practices. In addition, only data from patients whose parents had signed and returned consent forms were used, therefore reducing the population pool that could be used.

The research done in Argentina was conducted by interviewing physicians and fourth year pediatric students in the public hospital, Hospital de Niños Dr. Ricardo Gutierrez and was limited to less than 10 interviews. There also were some doctors who refused to be part a study run by a United States citizen, and there could be a double bias between the study's interpretation of results, and the answers given by the physician in response to a study ran by an USA citizen.

Due to the small sample sizes of this study, data was only collected from one pediatric practice, room for error, and possible bias potential, no definitive conclusions should be drawn by this study. Only the observations were recorded and implications discussed.

Discussion

The main antibiotics used by both the physicians in Argentina and the pediatricians in Salem follow the treatment guidelines provided by AAP.⁷ Although we observe larger resistance rates in Argentina in *S. pneumoniae*, we cannot say that they are attributed to an increase use of antibiotics as the physicians interviewed seemed more likely to cautiously prescribe antibiotics for AOM, while the pediatricians in the USA never waited to prescribe antibiotics on the first visit. However, it was confirmed in the interviews with the physicians in Argentina that there is not a standardized system for collection or format of patient history.¹⁷ In addition, many argentine physicians were hesitant to claim that they strictly follow a guideline, raising the point that they are treating the patient who is a person, and not a number on some report.¹⁷

It is crucial to note the difference of perspective between a report done by the WHO and a doctor treating their individual patient. While the WHO sees numbers of resistance rates rising, a doctor sees the patient in their office and deals with the emotion of an illness associated with that number. In that sense, it could be difficult to refuse providing some sort of antibiotics to a crying child when the physician observes the suffering of the patient first hand. This can provide a barrier to the adherence of treatment guidelines that promote prolonging the patient's symptoms for a cause of "the greater good."

In the theme of antibiotic resistance, it is clear that the surveillance methods in each country must improve. In order to increase surveillance and reduce inappropriate use of antibiotics, guidelines should be introduced to standardize and control the use of antibiotics worldwide to help keep up with the growth in antibiotic resistance.

Future research to help develop treatment guidelines that fit each region of the WHO could greatly attribute and help the fight against antibiotic resistance, as each society functions under its own medical system. The "borrowing" of treatment guidelines may not work from country to country as each treatment guideline system is based on research done to serve each respective country, and patient populations differ between countries due to varying factors. Future research to analyze both the US and Argentine practice in the treatment of AOM in reference to actual percentages of antibiotics use, and the certainty of diagnosis of AOM being used could help determine whether countries can follow each other's guidelines so strictly. In addition, a standardized patient information collection system would greatly benefit the ability of doctors to follow a patient's history and symptom development, thereby improving the capability of a doctor to better treat their patient.

In the current day and age, any guideline of use in certain countries with extremely high levels of antibiotic resistance could help reduce the spread of ABR in helping to reduce the use of broad spectrum antibiotics or reducing inappropriate antibiotic usage. However, with the lack of information collection systems in many countries, the reported percentages of resistance could be greatly skewed, if even represented at all.

Conclusion

In conclusion, Argentine and USA practices for treatment of AOM use similar antibiotics including amoxicillin as first line choice, followed by amoxicillin clavulanate as second line choice, with varying third line choices. Argentine physicians were more likely to wait to prescribe antibiotics than the USA pediatricians, though no primary data collection was done in Argentina to mirror the data collected in the USA. In the Argentine hospital, there was not a standard system of data collection for patient clinical histories which made it difficult to follow

patient's cases. Future research is needed to determine if such high use of antibiotics in the treatment of AOM is causing resistance rates in both countries, or if the guidelines used should be followed by Argentine hospitals while there is still a lack of a standardized data collection system in the public system. Additional research is needed to create better surveillance methods to report and follow the antibiotic resistance, and to create guidelines to help physicians standardize their treatment and antibiotic use in WHO regions.

Appendix 1

	<u>Weight (kg)</u>	<u>Date Seen</u>	<u>Antibiotic Prescribed? Y/N</u>	<u>Name of drug</u>	<u>Course of Treatment</u>	<u>Allergies of Pt if applicable:</u>	<u>F/U date:</u>	<u>F/U results</u>	<u>F/U Drug</u>	<u>Conclusion/was the treatment successful? Y/N</u>
Case 1										
Case 2										
Case 3										
Case 4										
Case 5										
Case 6										
Case 7										
Case 8										
Case 9										
Case 10										

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