Analysis of Prescription Guideline Adherence in Pediatric Outpatient Pneumonia Treatment

Carly Heck, BS; Marcia Kurs-Lasky, MA and Judith M. Martin, MD

UPMC Children's Hospital of Pittsburgh and the University of Pittsburgh School of Medicine

3414 Fifth Ave, CHOB 3rd Floor Room 305,
Pittsburgh, PA 15213
cah230@pitt.edu
Judy.martin@chp.edu
Phone: 570-690-4885,

Background

- Antibiotic resistance is a major public health concern accounting for an estimated 2.8 million infections and 35,000 deaths per year in the United States (1).
- Current guidelines for previously healthy, appropriately immunized children and adolescents with suspected bacterial-origin community acquired pneumonia (CAP) recommend amoxicillin as first-line therapy (2).
- This was a retrospective review of the electronic health records (EHR) of children diagnosed with CAP to compare patients who were prescribed non-guideline concordant therapy with those prescribed recommended therapy and searched for justification of antibiotic selection.
- The observations from this study can help to target appropriate areas for potential interventions for antibiotic stewardship programs in the pediatric outpatient setting.

Methods

- This was a retrospective chart review of 300 children (6 months to 6 years old) with an outpatient diagnosis and treatment of CAP between July 2017 and June 2019.
- 45 Children's Hospital of Pittsburgh (CHP) and UPMC Children's Community Pediatrics (CCP) practices were included.
- As per published guidelines, first-line recommended therapy was defined as amoxicillin, second-line therapy was defined as azithromycin or amoxicillin-clavulanate, and all other prescriptions were defined as other (2).
- Patients with first-line therapy were compared to patients with second-line therapy or other prescription.
- If first-line therapy was not prescribed, the EHR was manually reviewed for justification.
- If a drug allergy was listed, the medication allergy, date of diagnosis, and type of reaction were recorded.

Study Population

Table 1. Demographics

Age (months)	60.21 (± 12.23)
Male	145 (48.3%)
Race	
Asian	7 (2.3%)
Black	34 (11.3%)
White	255 (85.0%)
Declined	4 (1.3%)
Ethnicity	
Hispanic	3 (1.0%)
Non-Hispanic	293 (97.7%)
Declined	4 (1.3%)

Results

Table 2. Comparison Results

	All	1st line therapy	2nd line therapy/other	
Total	300	130 (43.3%)	170 (56.7%)	
Age (months)	60.21 (±12.23)	56.96 (± 15.24)	62.69 (± 8.54)	p < 0.001
Race				p < 0.001
White	255 (85.0%)	95 (37.3%)	160 (62.7%)	
Non-White	41 (13.6%)	33 (80.5%)	8 (19.5%)	
Ethnicity				p = 0.08
Hispanic	3 (1.0%)	3 (100%)	0	
Non-Hispanic	293 (97.7%)	126 (43.0%)	167 (57.0%)	
Location				p < 0.001
CHP	35 (11.7%)	29 (82.9%)	6 (17.1%)	
CCP	265 (88.3%)	101 (38.1%)	164 (61.9%)	
Provider				p = 0.35
MD/DO	226 (75.3%)	94 (41.6%)	132 (58.4%)	
PA/CRNP	74 (24.7%)	36 (48.6%)	38 (51.4%)	
Symptom Duration (days)	10.06 (±12.56)	6.81 (± 5.83)	12.85 (± 15.76)	p < 0.001
HR (bpm)	111.07(±21.46)	121.30 (± 23.26)	104.51 (± 17.42)	p < 0.001
RR(breaths/min)	23.30 (± 7.03)	27.29 (± 8.42)	20.37 (± 3.77)	p < 0.001
SpO2 (%)	96.80 (± 2.27)	96.79 (± 2.04)	96.81 (± 2.49)	p = 0.96
Fever				p < 0.001
Yes	171 (57.0%)	107 (62.6%)	64 (37.4%)	
No	129 (43.0%)	23 (17.8%)	106 (82.2%)	

Table 3. Justification and Drug Allergy Results

Justification for Non-Guideline Therapy		Drug Allergy		Type of Reaction	
Coverage of Atypical Organisms	52.4%	Amoxicillin	51.3%	Urticaria with unknown timing	42.3%
Details Not Available	20.0%	Penicillin	19.0%	Macular rash	15.4%
Drug Allergy	12.3%	Cefdinir	13.5%	Details Not Available	15.4%
Other	10.6%	Other	10.8%	Uniform papular rash	11.5%
First-Line Therapy Failed	2.3%	Amoxicillin-clavulanate	2.7%	Urticaria >6 hours after dose	7.7%
Immunizations Not Up to Date	0.6%	Ceftriaxone	2.7%	Joint pain or swelling	7.7%
Sick Contact at Home	0.6%				
Parental Preference	0.6%				
Concomitant Diagnosis	0.6%				

Discussion

- Multiple studies on guideline adherence for outpatient treatment of CAP have shown a large proportion of second-line or other therapy being prescribed. (3, 4, 5, 6).
  - Our study showed similar results, with 56.7% of patients receiving second-line or other therapy.
- Pathogens responsible for "atypical pneumonia" have only been identified in 3-23% of children, and the majority of atypical pathogens were identified in children aged 5 years and older (2).
  - Coverage of atypical pathogens was the most reported justification, despite that this study population was a younger age group of 6 months to 6 years old.
- Age, race, practice type, symptom duration, heart rate, and respiratory rate showed significant differences between the two groups.
- Patients with a documented amoxicillin allergy were prescribed treatment with a broader spectrum, less effective antibiotic. It is important to obtain details regarding a drug reaction including the timing of a rash in relation to treatment.

Limitations

- The patient population of 300 only captures a fraction of the cases of CAP between July 2017 to June 2019.
- This was a retrospective study and the providers were not aware their notes would be reviewed for justification of their antibiotic choices.
- We did not gather data on duration of treatment.
  - A recent study observed no differences between hospitalized patients with uncomplicated CAP who received short-course (5-7 days) versus prolonged-course (8-14 days) of antibiotic therapy (7).

Conclusions

This project observed a high proportion of children being prescribed non-guideline concordant therapy for a diagnosis of CAP. This study highlights the importance of education which reviews the current guidelines and the most likely pathogens for children with CAP.

References

1. Centers for Disease Control and Prevention. Antibiotic Resistance Threats in the United States 2019. U.S. Department of Health and Human Services, CDC. www.cdc.gov/DrugResistance/Biggest-Threats.html. Published November 2019. Updated December 2019. doi: http://dx.doi.org/10.15620/cdc:82532.
2. Bradley JS, Byington CL, Shah SS, et al. Executive summary: the management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clin Infect Dis. 2011 Oct;53(7):617-30. doi: 10.1093/cid/cir625
3. Saleh EA, Schroeder DR, Hanson AC, and Banerjee R. Guideline-concordant antibiotic prescribing for pediatric outpatients with otitis media, community-acquired pneumonia, and skin and soft tissue infections in a large multispecialty healthcare system. Clin Res Infect Dis. 2015 Jan 10;2(1).
4. Handy LK, Bryan M., Gerber JS, Zaoutis T, & Feemster KA. Variability in Antibiotic Prescribing for Community-Acquired Pneumonia. Pediatrics. 2017 Mar;139(4). doi:10.1542/peds.2016-2331
5. Islam S, Mannix MK, Breuer RK, & Hassinger AB. Guideline Adherence and Antibiotic Utilization by Community Pediatricians, Private Urgent Care Centers, and a Pediatric Emergency Department. Clin Pediatr (Phila). 2019 Oct;59(1): 21-30. doi:10.1177/0009922819879462
6. Poole NM, Shapiro DJ, Kronman MP, Hersh AL. Ambulatory Antibiotic Prescribing for Children with Pneumonia After Publication of National Guidelines: A Cross-Sectional Retrospective Study. Infect Dis Ther. 2020;9(1):69-76. doi: 10.1007/s40121-019-00276-3
7. Same RG, Amoah J, Hsu AJ, et al. The Association of Antibiotic Duration With Successful Treatment of Community-Acquired Pneumonia in Children [published online ahead of print June 11, 2020]. J Pediatric Infect Dis Soc. 2020. doi:10.1093/jpids/piaa055