Evaluating Appropriateness of Antibiotic Prescribing in Pediatric Inpatients

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INTRODUCTION

* Antibiotic appropriateness is key to informing antimicrobial stewardship efforts to optimize prescribing[1]
* An estimated 38-72% of pediatric inpatients receive at least one antibiotic prescription during their hospitalization
  * Nearly half of these prescriptions are unnecessary[2]
* Assessing appropriateness may be difficult
  * Indication not always documented in record
  * Appropriateness of some antibiotics for certain indications may be debatable
* Appropriateness of prescribing agents typically used for resistant Gram-positive organisms (e.g. MRSA) has not been evaluated in a pediatric inpatient setting

OBJECTIVES

* To evaluate appropriateness of antibiotics for resistant gram-positive infections among pediatric inpatients
* To Identify the factors associated with inappropriate prescribing

METHODS

* Study population
  * Oregon Health & Science University pediatric inpatients
  * Hospitalized between July 2017 and July 2018
* Inclusion criteria
  * < 18 years of age on admission
  * Received at least one antimicrobial agent typically used for resistant pediatric Gram-positive infections per the National Healthcare Safety Network (NHSN)
    * Agents include vancomycin, clindamycin, linezolid, daptomycin, ceftaroline, dalbavancin, oritavancin, telavancin, tedizolid, and quinupristin/dalforpristin[3]
* Data electronically extracted from electronic health record data repository
* Classification of antibiotic appropriateness
  * Laboratory and diagnosis code data used to categorize each antibiotic day of therapy as *appropriate* or *indeterminate* (Table 1)
  * Where **indeterminate**, conducted manual chart review to assess appropriateness based on clinical guidelines and/or consultation with infectious diseases experts
  * Reasons for inappropriate rulings include: longer than necessary duration, narrower spectrum available, redundant coverage, no evidence of infectious process, only Gram-negative organisms detected
* Calculated total, appropriate, and inappropriate days of therapy (DOT) overall and per patient-day
* Evaluated clinical characteristics and indications as potential predictors of inappropriate DOT using Chi-squared or Kruskal-Wallis tests

RESULTS

* We assessed 591 encounter records, which included 511 distinct patients and 708 antibiotic courses to evaluate
* Our study sample had a median age of 7 years, and was predominately male and non-Hispanic white (Table 2)
* Patients received a median of 3 days of gram-positive agent therapy per visit, or 5 per every 10 patient-days
* Of the 1,754 total days of therapy assessed, **94.8% were ruled appropriate**. Thirty-one (4.4%) courses were classified as at least partially inappropriate among 27 unique encounters (4.6%)
* There was a median of 2 inappropriate days among those with any inappropriate therapy, and the median length of stay was twice as long for those with inappropriate therapy compared to those with all appropriate (10 vs 5 days, p < 0.0001)
* There were no significant differences in inappropriate prescribing by age, sex, or race/ethnicity

Figure 1. Derivation of study sample – pediatric inpatients, July 2017-July 2018
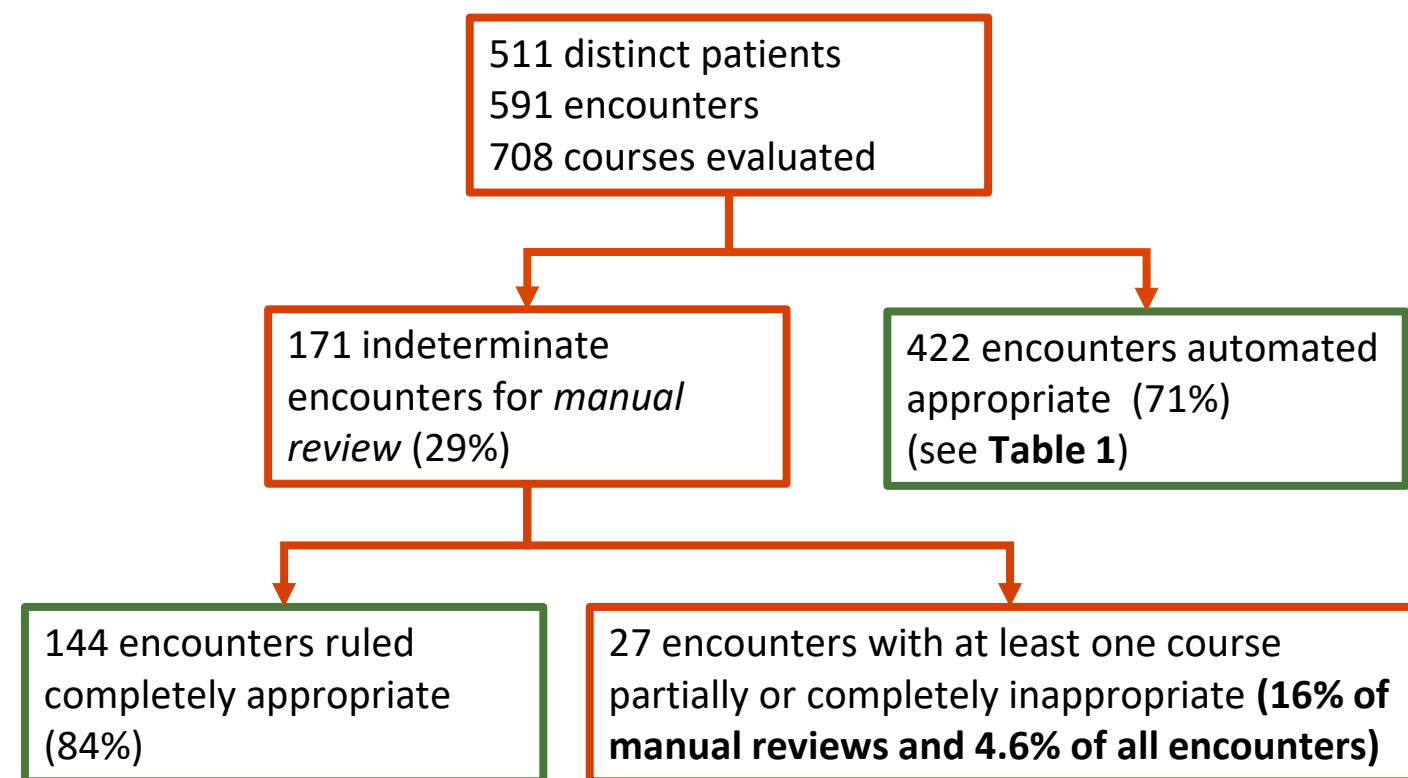

Table 1. Rationale for appropriateness classification based on electronically abstracted data only and with chart review

Reason for appropriate ruling	% of auto appropriate	% of overall encounters
≤48 hr., 1 course vanc./clind. empiric	93	66
≤24 hr., 1 course surgical prophylaxis	33	24
Bug-Drug match	5	4
Cystic fibrosis patient	4	3

Note: Categories not mutually exclusive

Table 2. Characteristics of OHSU pediatric inpatients receiving Gram-positive active agents - July 2017-2018

Patient and Visit Characteristics		
Demographics	*% or median*	*n/N*
Age (IQR)	7 (2-13)	
Female sex	43	222/511
Non-Hispanic white	66	339/511
Visit characteristics		
Length of stay in days (IQR)	5 (3-10)	
Admitted through ED	47	280/591
Admission source		
Clinic or physician's office	33	197/591
Non-Healthcare facility	37	220/591
Transfer from other hospital	29	173/591
MRSA Diagnosis	7	42/591
Penicillin/Cephalosporin allergy	15	78/511
ID physician consult		
Yes	50	85/171
Undetermined	9	16/171

Figure 2. Total, appropriate, and inappropriate days of therapy by type of indication for the two most common Gram-positive active agents used in our study sample
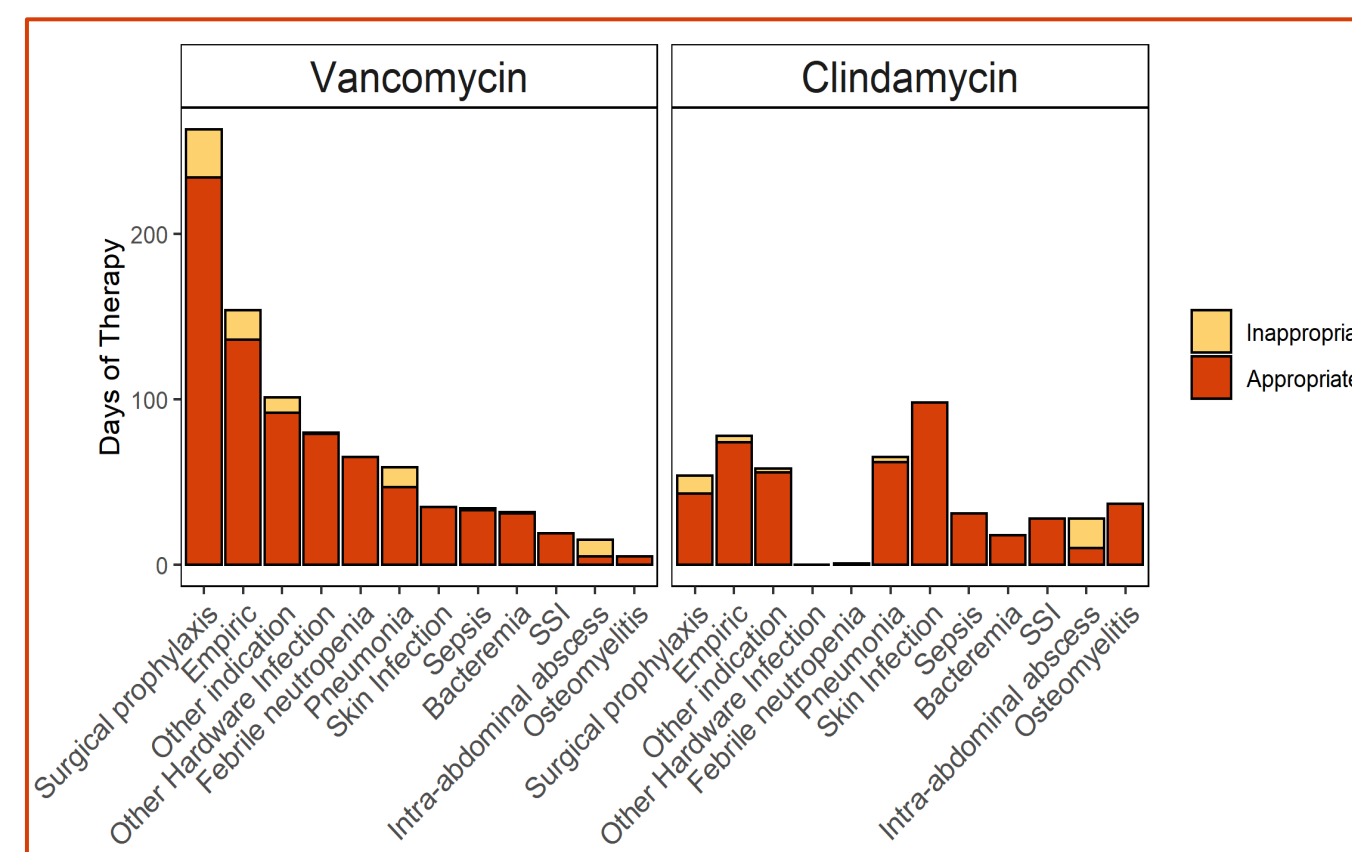

Table 3. Total, appropriate, and inappropriate days of therapy by antibiotic type

Antibiotic Class	N (%)	Total DOT	Appropriate DOT	Inappropriate DOT
Vancomycin	495 (70)	1030	974	56
Clindamycin	179 (25)	572	536	36
Linezolid	20 (3)	125	125	0
*Other	14 (2)	27	27	0
Total	708 (100)	1754	1662	92

*Other antibiotics include daptomycin and ceftaroline

RESULTS CONTINUED

* The most common indications for gram-positive therapy were surgical prophylaxis (28% of encounters) and empiric therapy (10%) (Figure 2)
* Vancomycin prescriptions had the largest number of inappropriate days of therapy (56), and clindamycin had the largest proportion of inappropriate days of therapy (6.3%) (Table 3)
* The reason for inappropriate rulings for empiric or prophylaxis indications was most often "longer than necessary duration," which was the case for 16 of 21 (76%) occurrences

CONCLUSIONS

* Inappropriate antibiotic use for Gram-positive infections was low in our patient population for the agents studied
* We identified limiting the duration for patients receiving prophylactic or empiric therapy as a potential stewardship intervention target
* Study strengths include use of a comprehensive dataset, collaboration with infectious disease experts on the OHSU pediatric stewardship team, and a standardized chart review process
* Limitations include the possibility of human error in the chart review process, and a lack of statistical power due to low rates of inappropriate prescribing

REFERENCES

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FOR MORE INFORMATION

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