

Empiric Vancomycin Dosing in Pediatrics – Are we Giving Enough?

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Background

- Vancomycin is commonly used in the pediatric population.
- Increasing resistance patterns are leading to higher trough recommendations.
- The Infectious Disease Society of America (IDSA) recommends:
 - Uncomplicated infections should target trough serum concentrations of 10-20 mg/L.
 - A target of 5-15 mg/L is still used in clinical practice.
 - Complicated infections (bacteremia, endocarditis, meningitis, osteomyelitis and pneumonia) should target trough serum concentrations of 15-20 mg/L.
- Empiric dosing of 40-60 mg/kg/day divided every 6 to 8 hours has provided subtherapeutic levels both anecdotally at our institution as well as within the literature.
- Our study aims to determine the suitability of the empiric vancomycin regimen and what percent of empiric dosing provides concentrations within IDSA target trough ranges.

Objectives

- Determine the percentage of patients within FHA with appropriate serum trough levels after initial empiric dosing.
- If appropriate, suggest changes to empiric vancomycin dosing.
- Determine the proportion of patients requiring a trough of 15-20 mg/L (complicated infections).
- Determine the average number of vancomycin levels required to be drawn.
- Determine the need to transfer to higher level of care, add-on antimicrobial therapy and length of stay between patients for different trough ranges.

Methods

- Retrospective chart review
 - Within Fraser Health (RCH, ARH, and SMH).
 - Between May 1st 2004 and May 31st 2012.
- Inclusion: Patients who received IV vancomycin with at least one trough concentration taken.
- Exclusion: Neonates (postmenstrual age less than 45 weeks) and patients over the age of 16 years.
- Statistical analysis using descriptive statistics.

Results

Characteristic (n=226)		Mean ± SD (range)	
Mean age (yrs)		6.1 ± 4.9 (0.13-15.7)	
Mean weight (kg)		27.2 ± 20.7 (4.4-110.0)	
Male		132 (58.4)	
Type of infection	Complicated 137 (60.6)	Bacteremia	18 (8.0)
		Endocarditis	2 (0.9)
		Meningitis	40 (17.7)
		Osteomyelitis	18 (8.0)
		Pneumonia	59 (26.1)
		Skin	82 (36.3)
		Other	7 (3.1)
Concomitant Drugs	Other 89 (39.4)	Ibuprofen PRN	76 (33.6)
		Acyclovir	17 (7.5)
		Chemo	5 (2.2)
		Gentamicin	4 (1.8)
		Ibuprofen	3 (1.3)
		Rifampin	1 (0.4)
		MRSA	43 (19.0)
MSSA	22 (9.7)		
S. coag neg	11 (4.9)		
S. pneumo	9 (4.0)		
Other	22 (9.7)		
Negative	109 (48.2)		
No cultures	10 (4.4)		

Table 1: Patient Characteristics

Result (n=226)	N (%)
Had a pharmacy note	142 (62.8)
Transferred to BCCH	32 (14.2)
Antibiotic added	19 (8.4)
Troughs < 5 mg/L	10 (52.6)
Troughs 5-10 mg/L	5 (26.3)
Troughs 10-15 mg/L	4 (21.1)
Administration	
Q6H	51 (22.6)
Q8H	165 (73.0)
Q12H	10 (4.4)
Mean starting dose (mg/kg/day)	51.4 ± 9.1 (26.1-71.7)
Mean vancomycin dose changes per patient	0.72 ± 1.1 (0-9)
Mean duration of vancomycin (days)	4.4 ± 4.4 (1-42)
Mean number of levels taken per patient	2.5 ± 1.7 (1-11)
Mean length of stay (days)	8.0 ± 7.5 (1-65)
Troughs < 5 mg/L (n= 69)	6.9 ± 4.9 (1-33)
Troughs 5-10 mg/L (n= 115)	11.2 ± 10.39 (1-36)
Troughs 10-15 mg/L (n= 35)	3.4 ± 1.1 (2-5)
Troughs > 15 mg/L (n= 7)	

Table 2: Patient Results

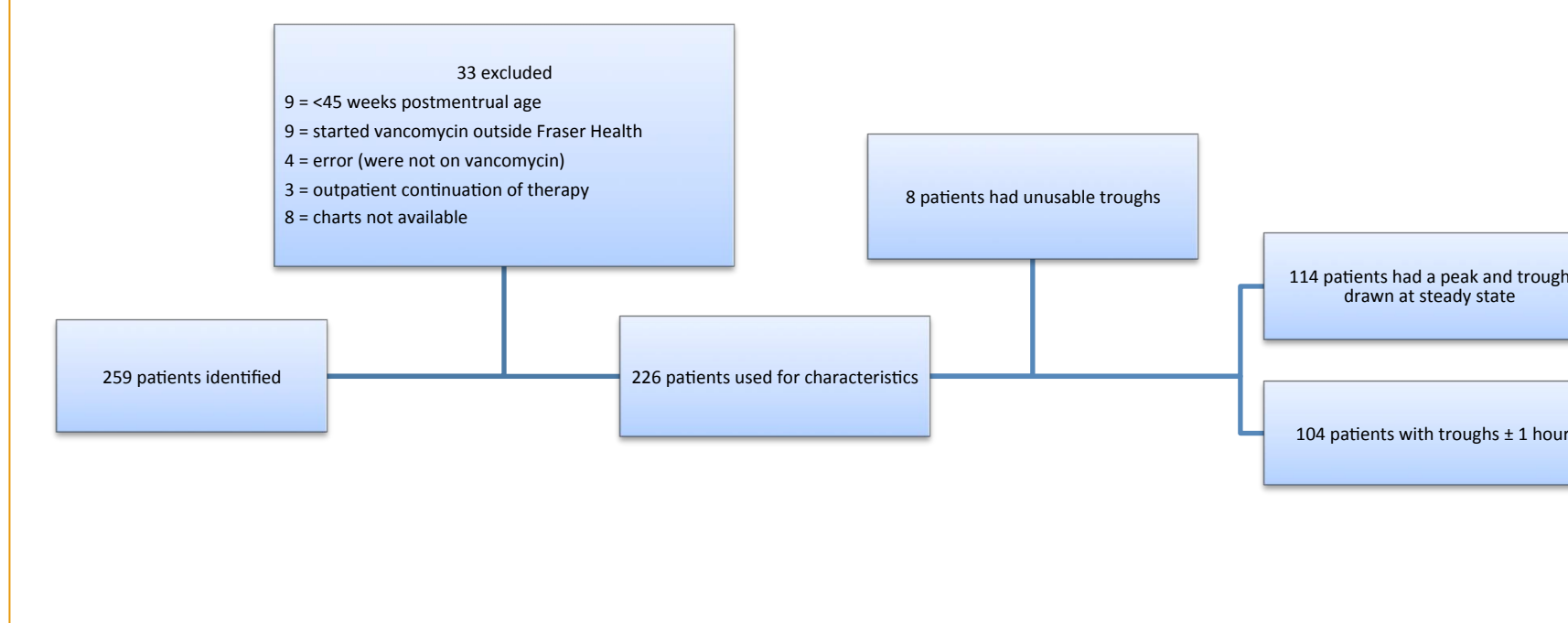


Figure 1: Patient Inclusion Flowchart

Variable (n=114)	Mean ± SD (range)
Mean Trough	6.9 ± 3.1 (1.8-18.3)
Mean Peak	32.7 ± 13.0 (12.6-76.7)
Mean Vd	0.65 ± 0.36 (0.19-2.1)
Mean T1/2	3.1 ± 1.1 (1.1-7.9)

Table 3: Pharmacokinetic Results

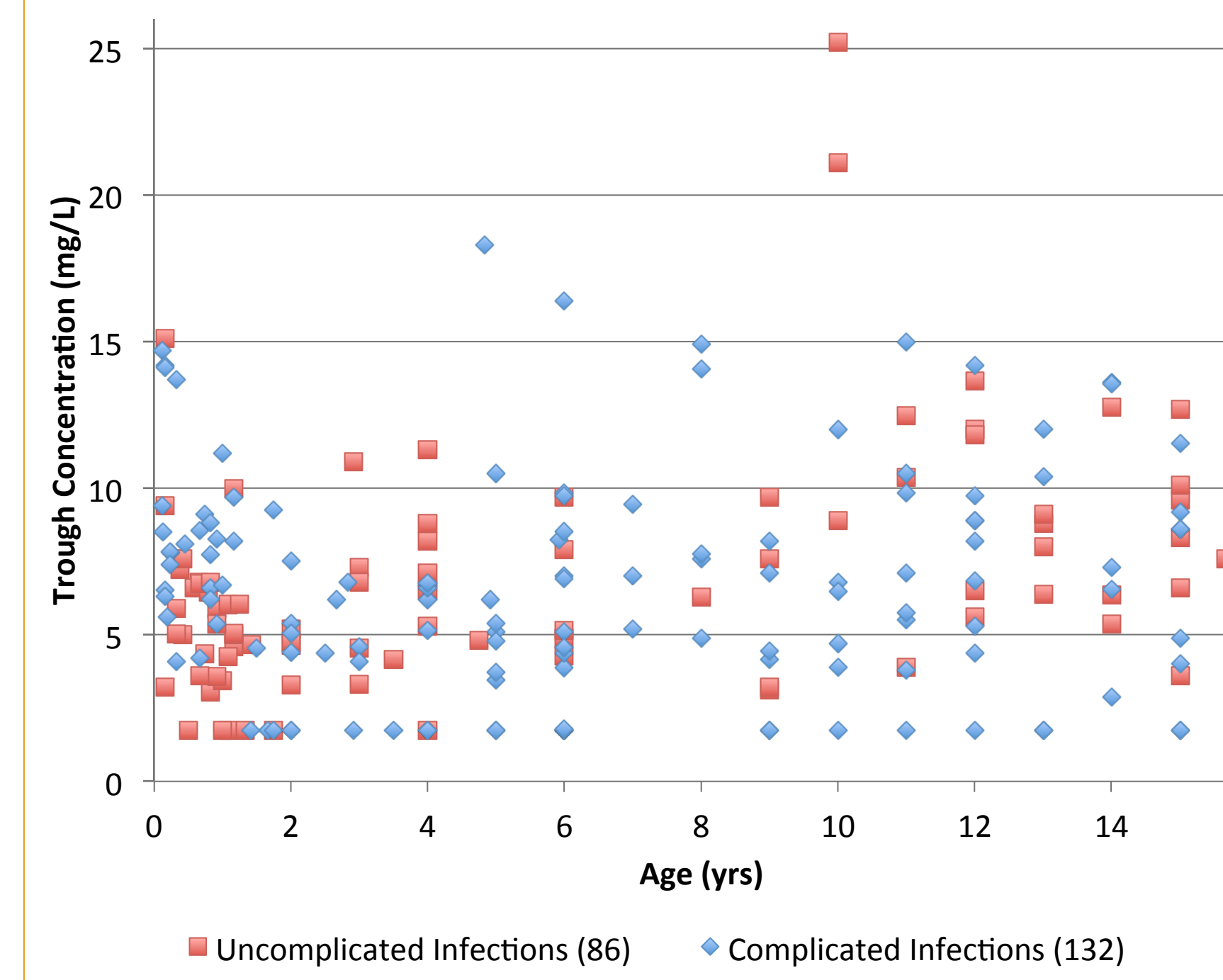


Figure 2: Trough Concentrations by Age

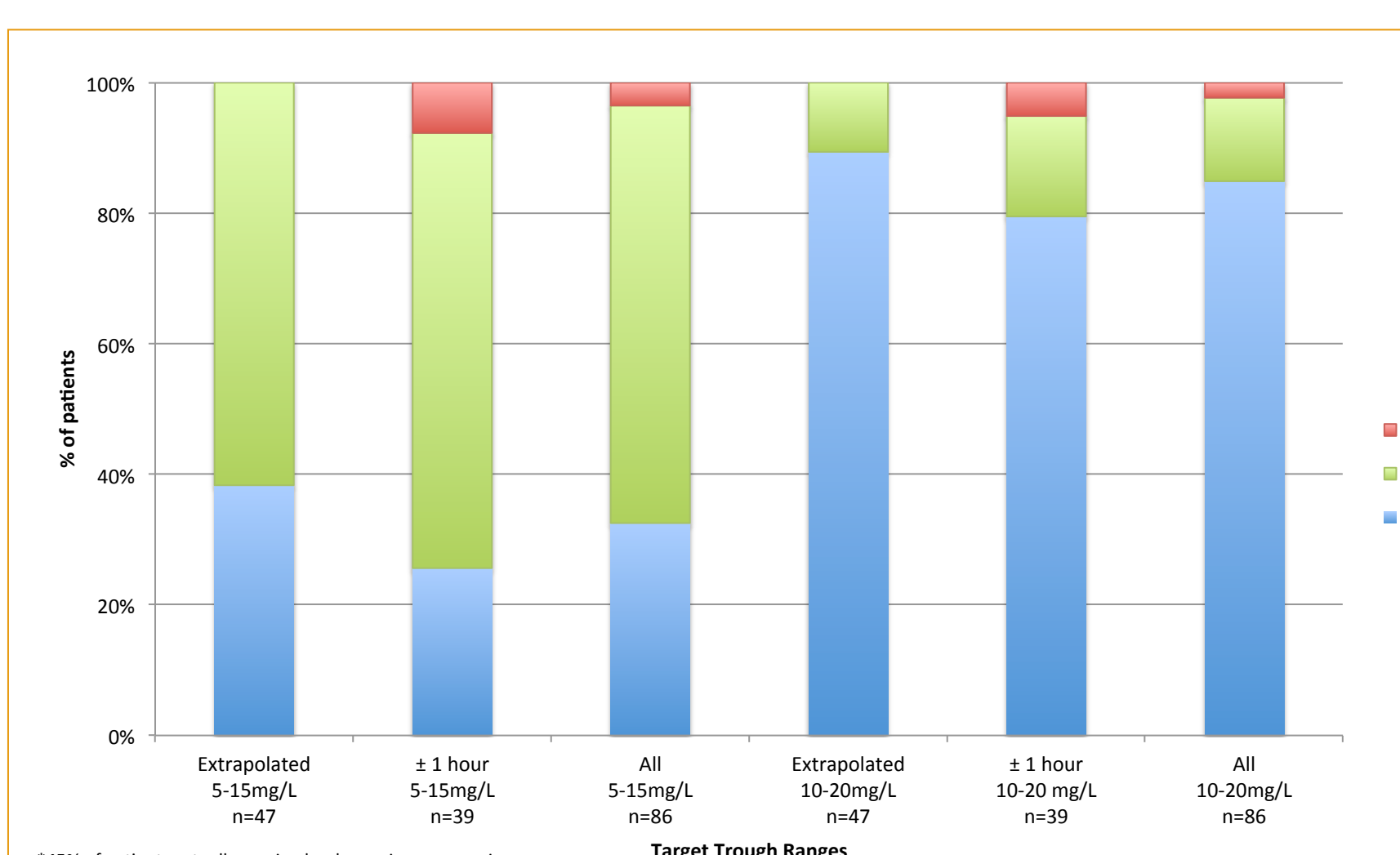


Figure 3: Patients Within Target (Uncomplicated)

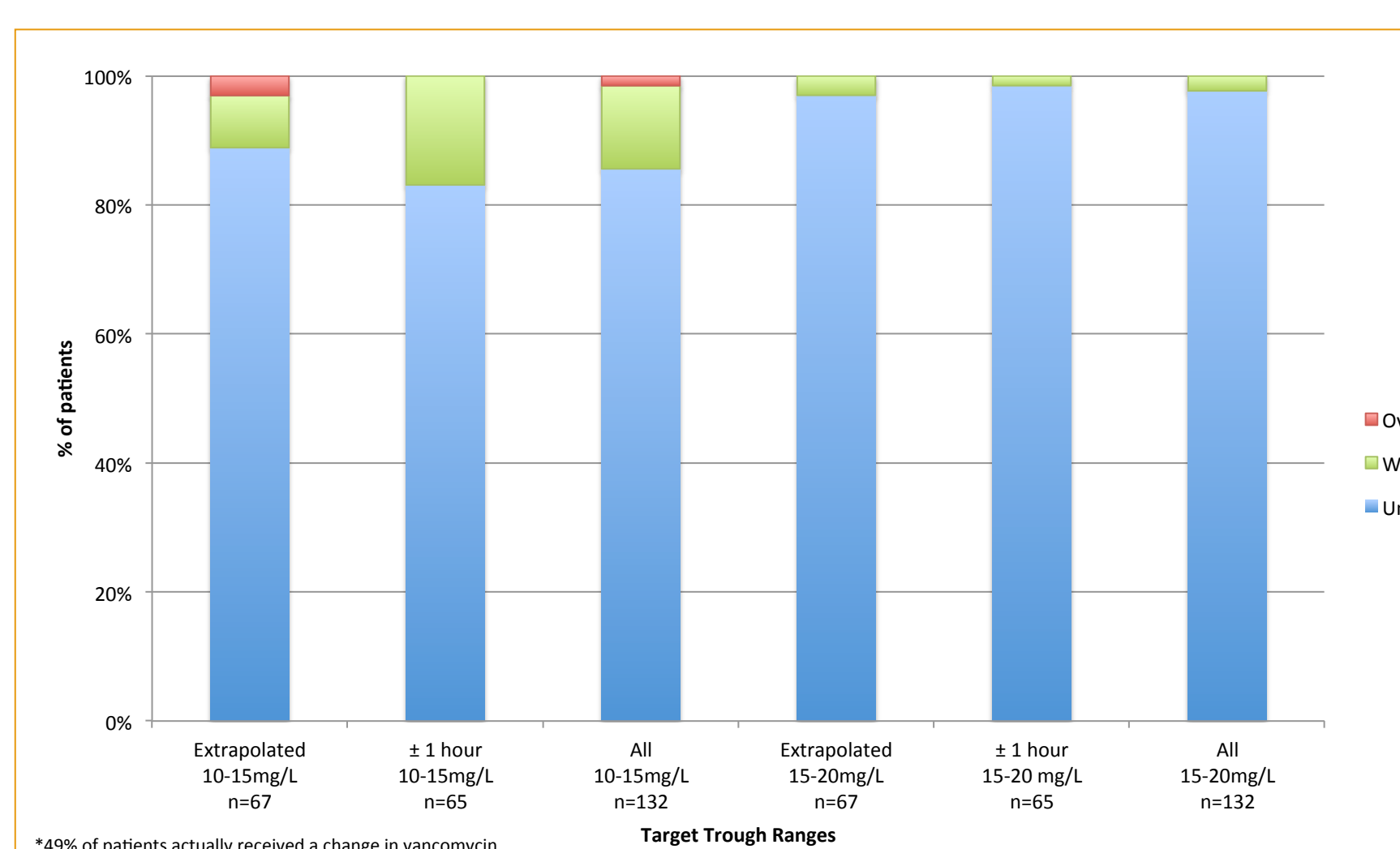


Figure 4: Patients Within Target (Complicated)

Proposed Regimen

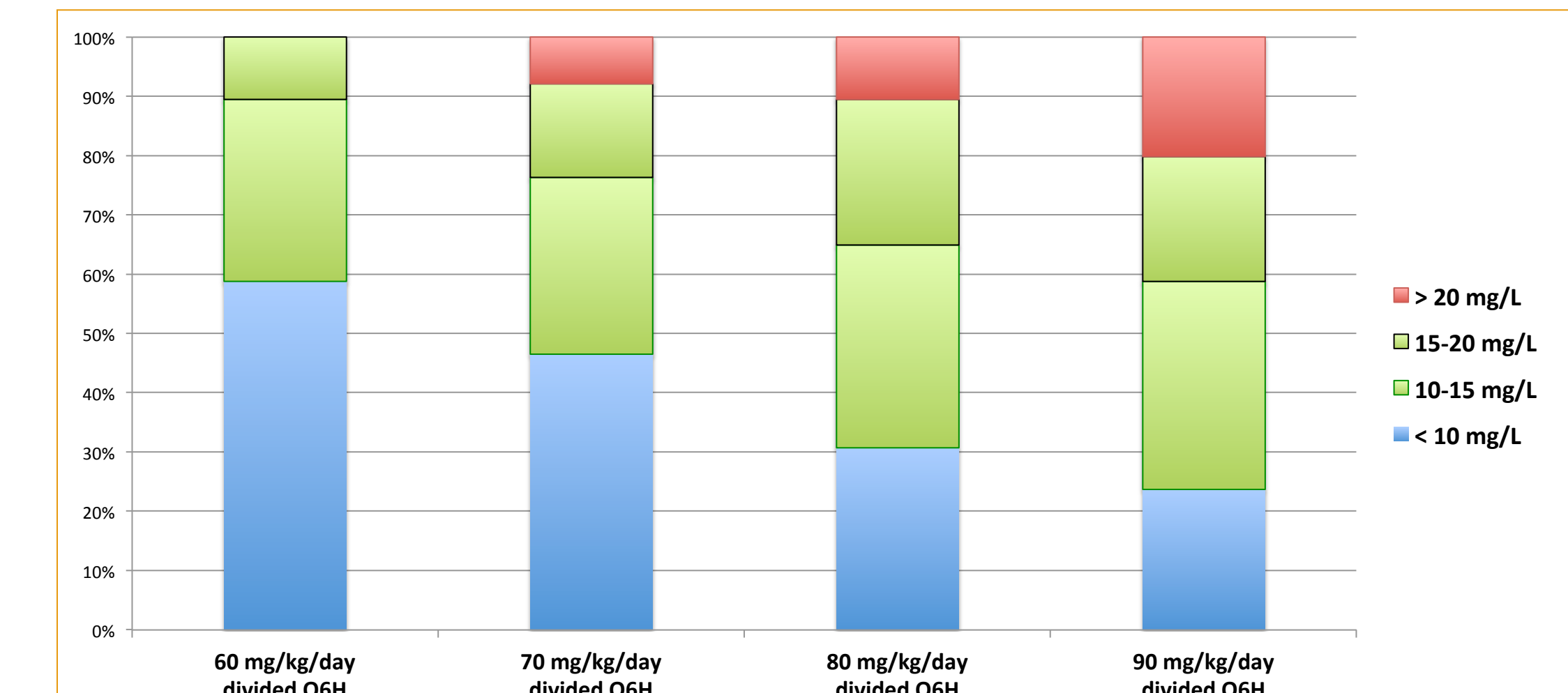


Figure 5: Possible Regimens: Anticipated Troughs

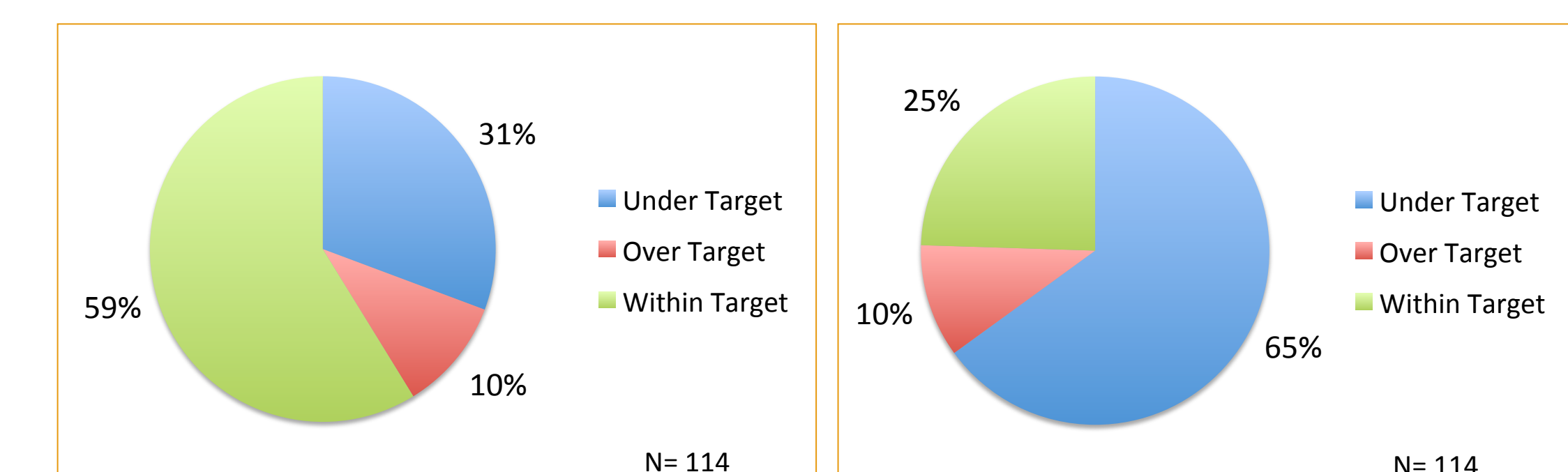


Figure 6: Uncomplicated Infections Within Target (80 mg/kg/day div Q6H)

Figure 7: Complicated Infections Within Target (80 mg/kg/day div Q6H)

Limitations

- Retrospective.
- Actual administration time can be within 30 minutes of documented time.
- Limited number of patients with peak and trough levels drawn at steady state.

Conclusions

- Empiric dosing within Fraser Health is providing subtherapeutic levels.
 - Uncomplicated infections (39% of infections)
 - 13% within target of 10-20 mg/L
 - Complicated infections (61% of infections)
 - 2% within target of 15-20 mg/L
- Suggest changing empiric vancomycin regimen to 80 mg/kg/day divided Q6H.
 - 59% will be within target for uncomplicated infections
 - 25% will be within target for complicated infections
- Follow prospectively to determine success of proposed regimen.

