3rd Place: Assessment of the Real-world Use of Procalcitonin at a Large Academic Institution

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Assessment of the Real-world Use of Procalcitonin at a Large Academic Institution

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BACKGROUND

- Procalcitonin (PCT) is a highly sensitive and specific biomarker of inflammation and bacterial infections[1].
- Specific levels (e.g. PCT ≥ 0.25-0.50 ng/mL) can be used to guide antibiotic initiation and prompt antibiotic discontinuation in conjunction with clinical judgment[1,2].
- PCT-driven antibiotic treatment has been shown to shorten antibiotic exposure by 2-3.5 days and reduce antibiotic usage by 30% in critically ill patients without increasing adverse clinical outcomes[2-4].

OBJECTIVE

- The purpose of this quality improvement project is to examine the real-world use of PCT at Lehigh Valley Health Network (LVHN) and assess the clinical impact of PCT-driven antibiotic usage.

METHODS

- A retrospective chart review of 739 inpatient admissions to the LVH-Cedar Crest and LVH-Muhlenberg campuses from January 1st to March 31st 2018, who underwent PCT testing.
- Exclusion criteria: patients <18 years of age, transferred patients, invalid test results, and death within 24 hours of PCT results.
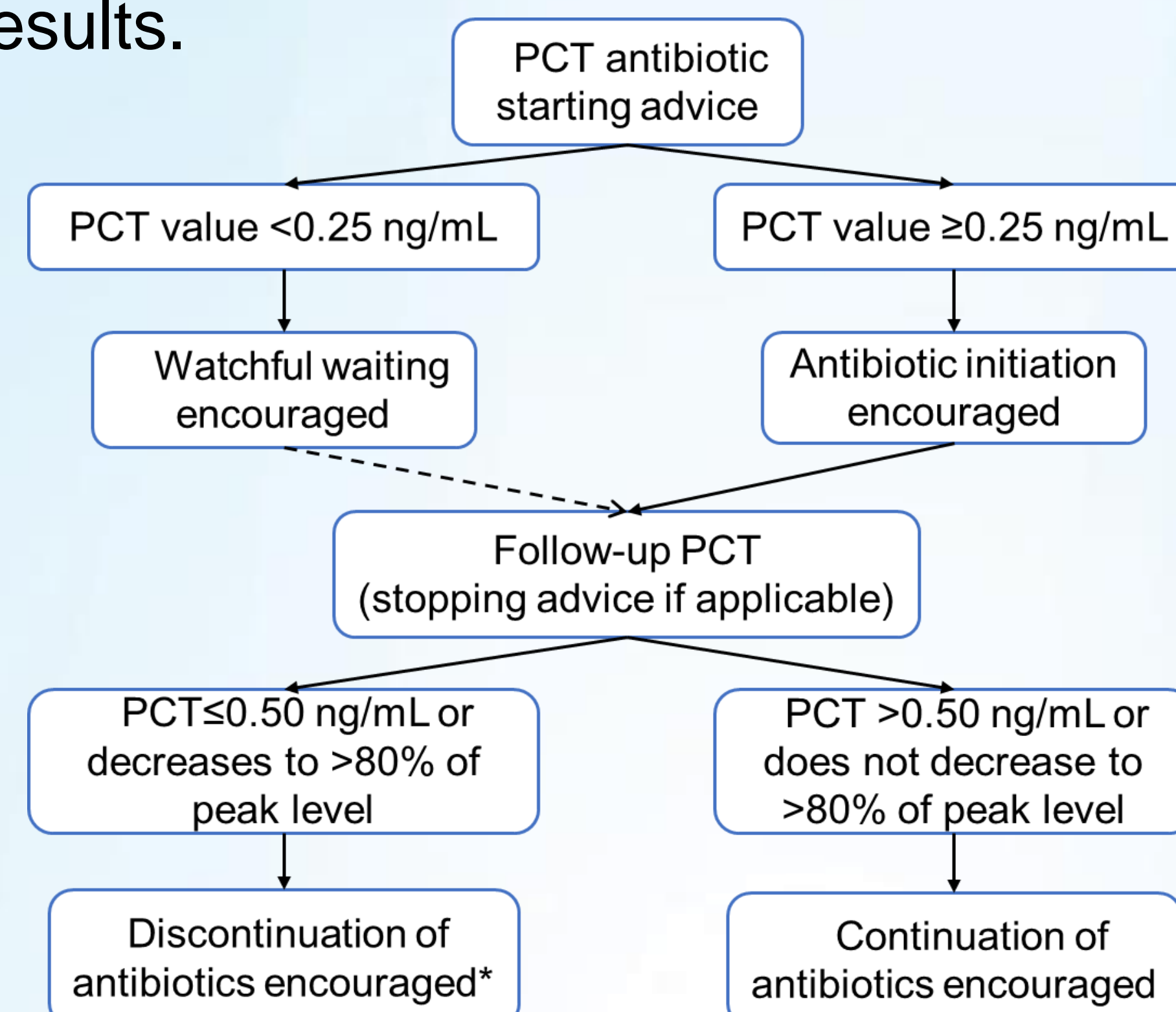
PCT antibiotic starting advice
→ PCT value <0.25 ng/mL → Watchful waiting encouraged
→ PCT value ≥0.25 ng/mL → Antibiotic initiation encouraged

Follow-up PCT (stopping advice if applicable)
→ PCT≤0.50 ng/mL or decreases to >80% of peak level → Discontinuation of antibiotics encouraged*
→ PCT >0.50 ng/mL or does not decrease to >80% of peak level → Continuation of antibiotics encouraged

Figure 1. Literature-based Procalcitonin (PCT) protocol for antibiotic administration[1,2]. *PCT results should not trump clinician judgment.

RESULTS

Table 1. Demographics and clinical data, stratified by concordant and discordant PCT starting and stopping antibiotic use.*†

Characteristic	Full study cohort (N=739)	Start Concordant (N=487)	Start Discordant (N=200)	Stop Concordant (N=109)	Stop Discordant (N=39)
Age, years, median (IQR)	70 (58-80)	69 (58-80)	72 (60-82)	66 (54-79)	69 (57-79)
Female gender, n (%)	375 (50.7)	242 (49.7)	101 (50.5)	45 (41.3)	18 (46.2)
Race, n (%):					
Asian	5 (0.7)	3 (0.6)	1 (0.5)	3 (2.8)	0 (0)
African American	25 (3.4)	16 (3.3)	9 (4.5)	3 (2.8)	4 (10.2)
Caucasian	669 (90.5)	439 (90.1)	180 (90.0)	97 (88.8)	32 (82.1)
Multi-racial	17 (2.3)	13 (2.7)	4 (2.0)	3 (2.8)	1 (2.6)
Other/Unavailable	23 (3.1)	16 (3.3)	6 (3.0)	3 (2.8)	2 (5.1)
Total # PCTs per patient per encounter, median (range)	1 (1-6)	1 (1-6)	1 (1-5)	2 (1-6)	2 (1-6)
Start PCT result, n (%):					
<0.25 ng/mL	367 (49.7)	187 (38.4)	154 (77.0)	32 (29.3)	20 (51.3)
≥0.25 to ≤0.50 ng/mL	95 (12.9)	75 (15.4)	16 (8.0)	16 (14.7)	2 (5.1)
>0.50 ng/mL	277 (37.5)	225 (46.2)	30 (15.0)	61 (56.0)	17 (43.6)
Antibiotics received, n (%)	644 (87.1)	414 (85.0)	178 (89.0)	108 (99.0)	39 (100)
Order Location, n (%):					
LVH-Cedar Crest	476 (64.4)	302 (62.0)	138 (69.0)	71 (65.1)	26 (66.7)
LVH-Muhlenberg	263 (35.6)	185 (38.0)	62 (31.0)	38 (34.9)	13 (33.3)

Abbreviations: IQR, interquartile range; PCT, Procalcitonin; LVH, Lehigh Valley Health Network.
Assessment of provider concordance and discordance to PCT advice given a 24- hr. window for any PCT-driven antibiotic alterations, before and after PCT result reception. *n=52 cases of N/A start adherence, n=591 cases of N/A stop adherence.
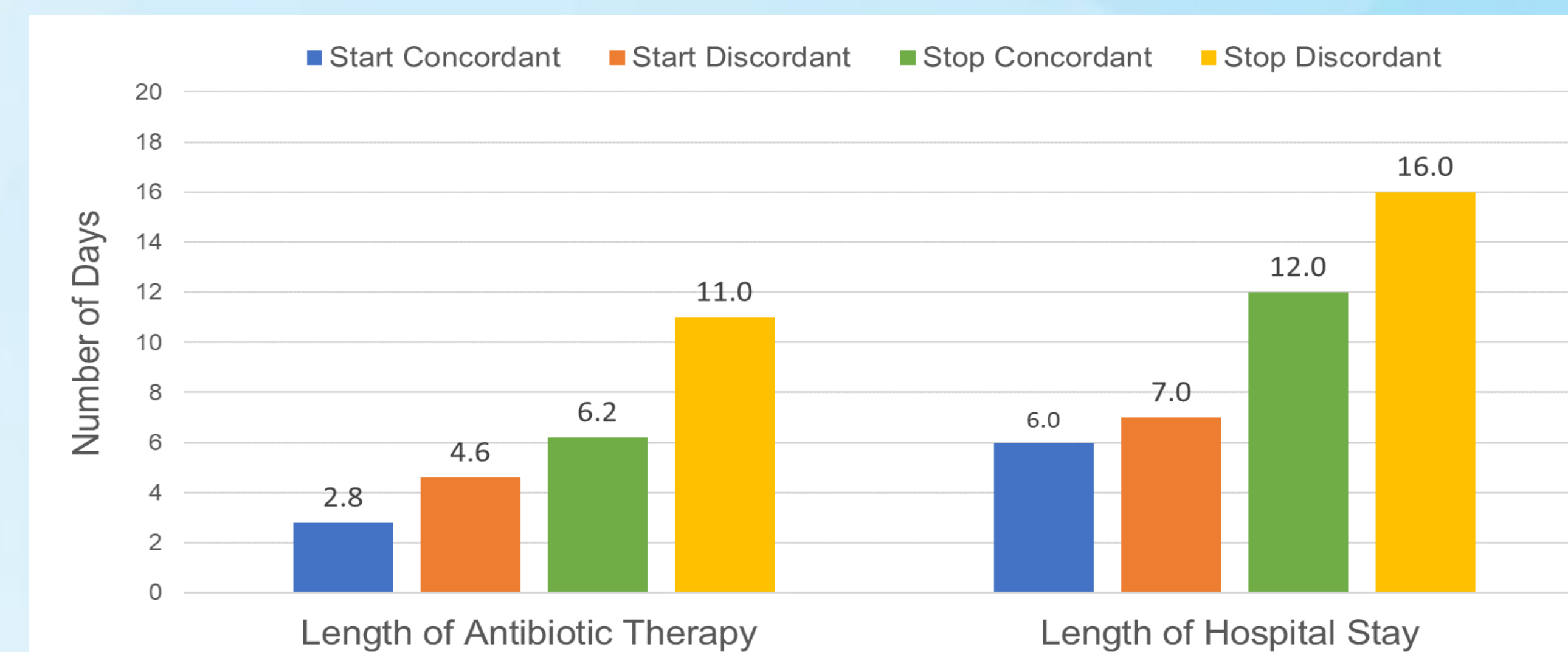† Concordant defined as: followed suggested PCT protocol. Discordant defined as: did not follow the suggested PCT protocol[2].

Length of Antibiotic Therapy: Start Concordant 2.8, Start Discordant 4.6, Stop Concordant 6.2, Stop Discordant 11.0
Length of Hospital Stay: Start Concordant 6.0, Start Discordant 7.0, Stop Concordant 12.0, Stop Discordant 16.0

Figure 2. Median length of antibiotic therapy and hospital stay (days) stratified by PCT-driven antibiotic adherence N=739.

30-day Mortality Rate: Start Concordant 12.9, Start Discordant 13.5, Stop Concordant 20.2, Stop Discordant 28.2
30-day Readmission Rate: Start Concordant 22.9, Start Discordant 34.5, Stop Concordant 23.9, Stop Discordant 41.0
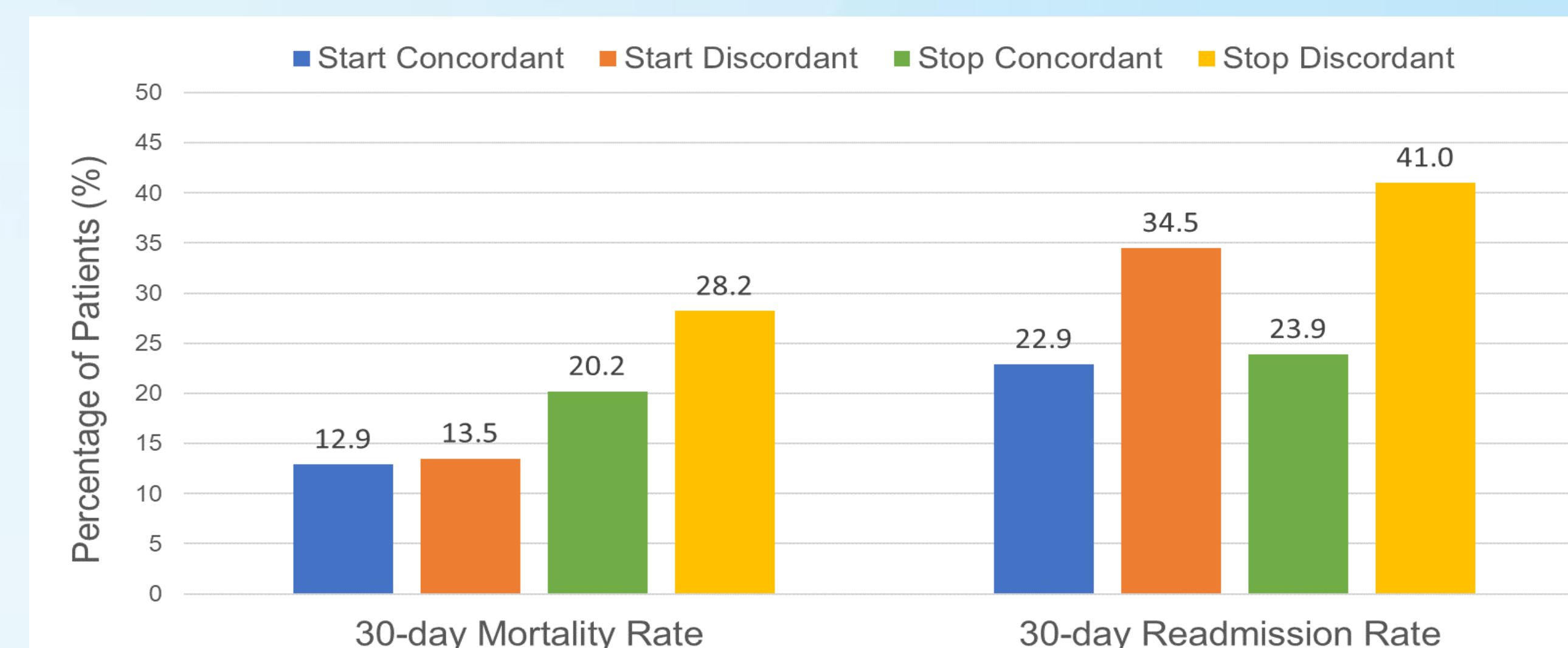
Figure 3. 30-day all-cause mortality and readmission rates (%) stratified by PCT-driven antibiotic adherence N=739.

RESULTS

Pie chart — Procalcitonin ordering by provider specialty:
- Emergency Medicine: 17.3%
- Internal Medicine Attendings: 30.9%
- Medical Residents: 33.6%
- Pulmonary Disease/Critical Care: 8.7%
- General Surgery: 3.1%
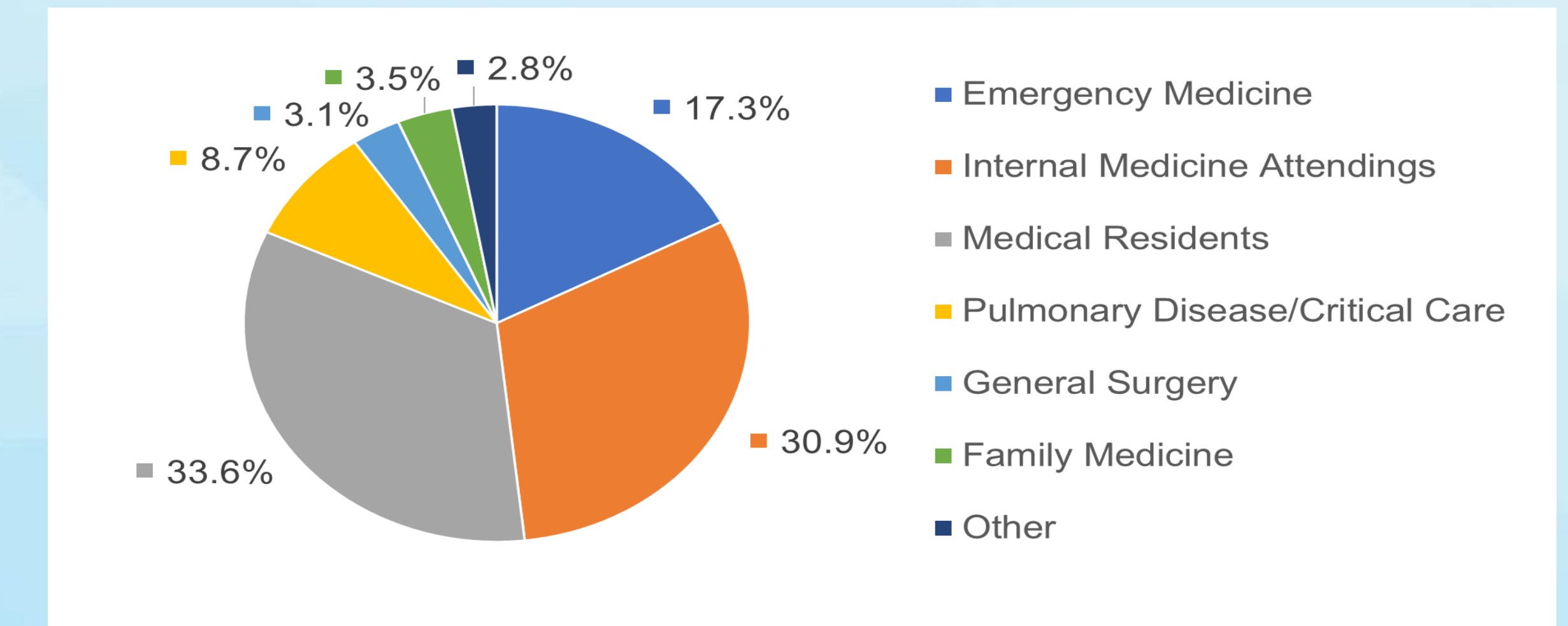- Family Medicine: 3.5%
- Other: 2.8%

Figure 4. Procalcitonin ordering by provider specialty.

- 3,531 PCT tests were performed at LVHN in 2018 – accounting for $436,925.94 in charges.
- Some patients (n=41, 5.5%) received >2 PCT tests (range= 3-6) during a single hospital admission.
- Patients with a negative (<0.25 ng/mL) first PCT result were more likely (23.0% vs 77.0%) to have non-PCT driven antibiotic initiation (Table 1).
- For concordant follow-up PCT testing, antibiotic discontinuation occurred 4.8 days earlier and the median length of hospital stay was 4 days shorter (Table 1).

CONCLUSIONS

- Discordant PCT test results and antibiotic usage occurred in 27.1% of cases during antibiotic initiation and in 26.4% of cases for applicable follow-up PCT testing.
- An increase in the days of antibiotic therapy, length of stay, 30-day mortality, and 30-day readmission rates were noted in discordant antibiotic start and stop cohorts, this warrants further analysis (Figure 2,3).
- Increased education regarding appropriate Procalcitonin test usage and interpretation is needed at LVHN.
- Future Directions: explore effectiveness of properly used PCT tests to decrease hospital spending on excessive antibiotic-use and in turn, examine the impact on risks for antibiotic-resistance

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