

Cost-impact analysis of PCT-guided antibiotic stewardship for hospitalized patients with sepsis or lower respiratory tract infections in a US hospital

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Objectives

Procalcitonin (PCT) is a biomarker that can distinguish bacterial from non-bacterial infections and hereby support clinical decision-making on initiation and discontinuation of antibiotic therapy. Cost analyses on PCT-guided antibiotic stewardship using real-world US hospital data have not yet been performed. The objective was to conduct a model-based cost-impact analysis of using a PCT-algorithm to guide antibiotic prescription for patients hospitalized with sepsis or lower respiratory tract infections (LRTI) versus standard of care (SOC) in a US hospital setting.

Methods

A cost-impact analysis was conducted, comparing costs of care of patients admitted to the Five Rivers Medical Center (FRMC), Pocahontas (AR), US, with sepsis or LRTI before and after implementation of PCT-guided antibiotic stewardship. A previously published health economic model [1] was populated with patient-level data collected in the four years before and the four years after implementation of the PCT-algorithm (Figure 1). For each pathway in the decision tree, the probability of that pathway was multiplied with the costs that were incurred along the way. Sample sizes before and after PCT implementation were n=13 and n=90 for sepsis, and n=755 and n=860 for LRTI, respectively. Literature data was used for parameter inputs not captured in the patient-level data. Main input parameters are shown in Table 1. The analyses were conducted from the societal perspective. The time horizon covered the length of hospital stay. Main outcomes were total average costs per patient and numbers of patients with *C. difficile* and antibiotic resistant (ABR) infections. One-way sensitivity analyses were conducted.

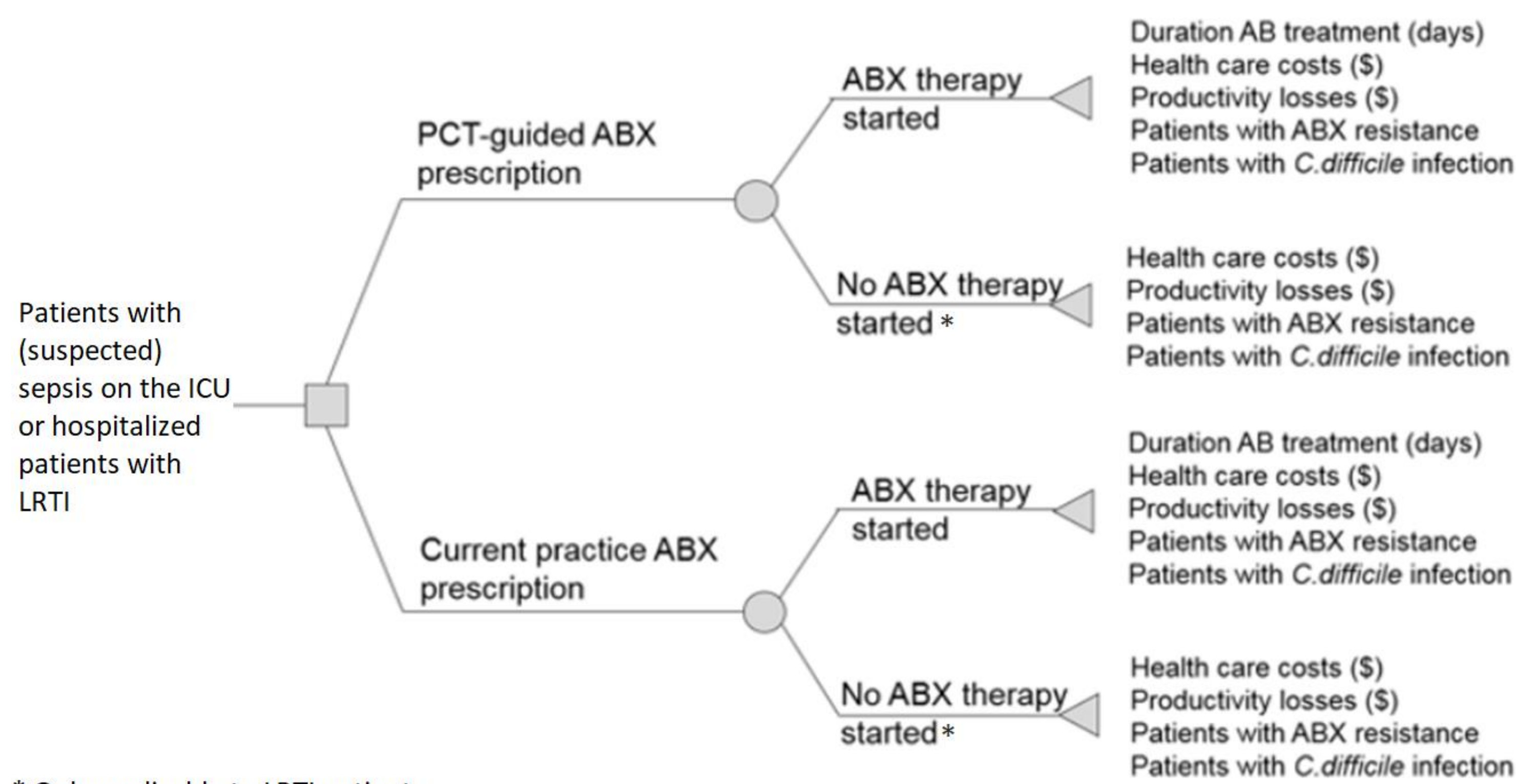


Figure 1: Decision tree for patients with sepsis and with LRTI

ABX antibiotics; AB antibiotic; ICU intensive care unit; LRTI lower respiratory tract infection; PCT procalcitonin

Table 1: Main input parameters

	Sepsis		LRTI	
	SOC	PCT	SOC	PCT
Length of stay general ward	2.9	5.3	3.8	3.3
Length of stay intensive care unit	15.0	4.5	7.9	5.4
Patients prescribed antibiotics (%)	100	100	87.7	75.4
Antibiotic days of therapy	22.8	10.3	15.2	9.4
Additional length of stay general ward owing to antibiotic resistance	4.6	4.6	8.1	8.1

LRTI lower respiratory tract infection; PCT procalcitonin; SOC standard of care

Results

PCT-guided care for hospitalized sepsis and LRTI patients resulted in a shorter length of stay, reduced antibiotic use, fewer mechanical ventilation days, and lower numbers of patients with *C. difficile* and ABR infections. Total average incremental costs per patient for PCT-guided care were -\$25,611 (-49%) for sepsis and -\$3,630 (-23%) for LRTI, respectively, indicating cost-savings (Figure 2). The expectation for PCT-guided care to be cost-saving was robust to changes in input parameters. The amount of cost-savings for sepsis were most sensitive to (1) effect on ICU days, (2) ICU costs and (3) effect on general ward days and for LRTI (1) effect on general ward days, (2) general ward costs and (3) percentage patients receiving antibiotics.

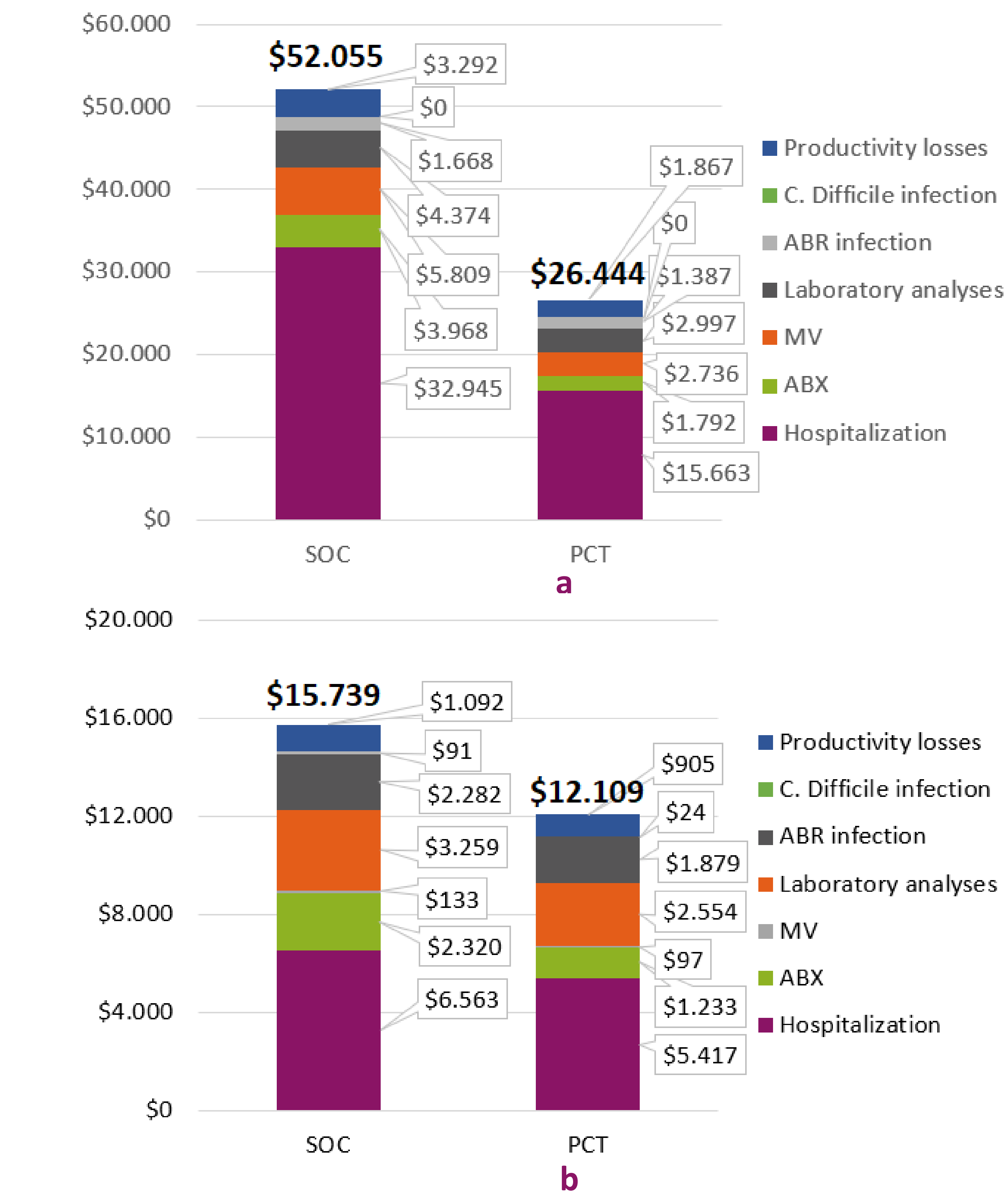


Figure 2: Total costs per category for sepsis (a) and LRTI (b)

ABR antibiotic resistance; ABX antibiotics; LRTI lower tract respiratory infection; MV mechanical ventilation; PCT procalcitonin; SOC standard of care

Conclusion

PCT-guided antibiotic stewardship for sepsis and LRTI patients was expected to save costs and result in lower *C. difficile* and ABR infection rates, in comparison to standard of care, in a US hospital setting.

References

[1] Mewes J, Pulia M, Mansour M, Broyles M, Nguyen H, Steuten L (2019). The cost impact of PCT-guided antibiotic stewardship versus usual care for hospitalised patients with suspected sepsis or lower respiratory tract infections in the US: a health economic model analysis. PLOS ONE 14, e0214222.