

Economic Impact of Healthcare-Associated Infections in Cardiac Surgery



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on behalf of the CTSN investigators

Background

Health Care Associated Infections (HAIs) are the most common non-cardiac complication among cardiac surgery patients.

As a major cause of morbidity and mortality, prolonged hospital length of stay (LOS) and readmissions, HAIs are one of the greatest threats to patient safety.

A large body of evidence has demonstrated that many HAIs are preventable, and their reduction could lead to better outcomes and substantial health care savings. Recognizing the value of these efforts to the health care budget, requires detailed information on the economic impact of broad range of HAIs in cardiac surgery.

Objective

To determine the inpatient hospital cost due to all major types of HAI in cardiac surgery patients, during the first two months after surgery.

Methods

Subjects: 4320 adult (≥18 years old) patients who had cardiac surgery in 2010 in 9 U.S. hospitals participating to the Cardiothoracic Surgery Network (CTSN).

Data: Prospectively collected clinical data were linked to patient level financial data obtained from the University Health Consortium (UHC) or directly from the sites.

Adjudication: All types of postoperative infections were reviewed and adjudicated by an independent committee of infectious disease experts using definitions adapted from the Center for disease control and Prevention / National HealthCare Safety Network.

Statistical Analysis: Generalized Linear Model with a log link function and a gamma distribution was used to adjust for patient-related confounders. The incremental cost—the extra cost specifically attributable to HAIs—was then calculated using the recycled prediction method. Standard errors and confidence intervals were derived by 1000 bootstrap resampling runs.

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Results

Characteristics of the cohort: average age 64.3 years; gender 66% male; **Most common procedures:** isolated valve (31%), isolated CABG (29%), and CABG/valve (12%).

Frequency of HAI

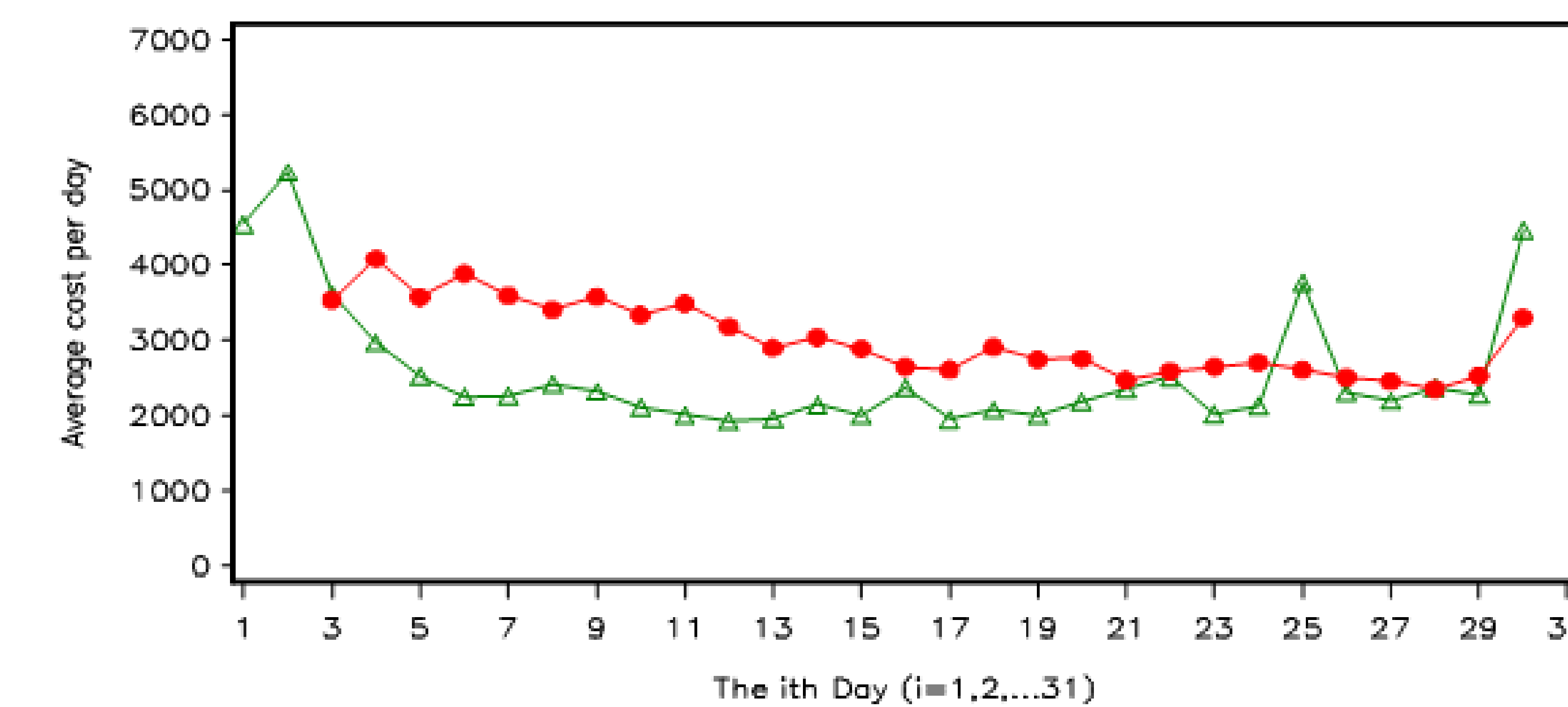
Type of infection	At index		At readmission	
	# of Events	Patients ^c N (%)	# of Events	Patients ^c N (%)
Pneumonia	73	72 (1.67)	33	33 (0.76)
Bloodstream Infection	31	28 (0.65)	14	14 (0.32)
CDiff	28	28 (0.65)	17	15 (0.35)
Deep Incision Surg site infection (Chest) ^a	6	6 (0.15)	18	17 (0.44)
Deep Incision Surg site infection (Groin) ^a	2	2 (0.05)	5	5 (0.13)
Mediastinitis	5	5 (0.12)	5	5 (0.12)
Myocarditis or pericarditis	3	3 (0.07)	2	2 (0.05)
Empyema	2	2 (0.05)	1	1 (0.02)
Pocket infection ^b	1	1 (1.27)	1	1 (1.27)
Device-related percut site infection	0	0 (0)	1	1 (0.02)
Endocarditis	0	0 (0)	2	2 (0.05)
Total	151	119 (2.7)	99	88 (2.0)

^a Denominator for patients with a deep SSI is patients having a sternotomy (N=3891)

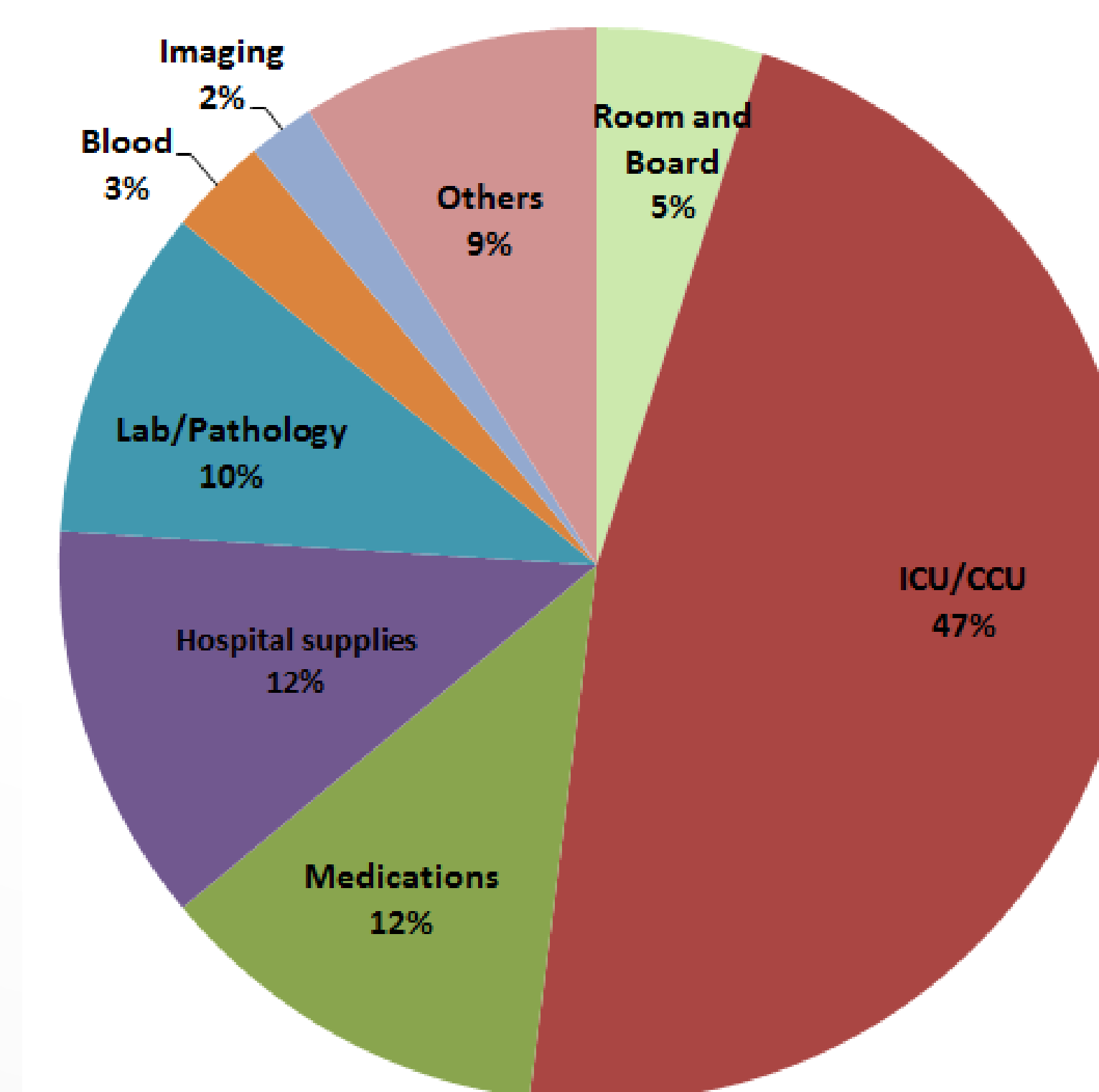
^b Denominator for patients with pocket infection is patients who had VAD placed, replaced, or removed for heart transplant (N=79)

^c Denominator for other patients is entire population (N=4320)

Costs during the Index Hospitalization



Factors contributing to the cost of HAI



Index hospitalization Cost

Infection	COST (95%CL)		LOS (95% CL)	
	Unadjusted mean	Adjusted (GLM*) Incremental	Unadjusted mean	Adjusted (GLM*) Incremental
Yes (N=119)	\$ 110,155 (94,664, 12,5646)	\$ 37,922 (28,617, 47,091)	33.4 days (29.4, 37.5)	14 days (11, 17)
No (N=4201)	\$ 31,530 (30,654, 32,407)	(Ref)	9.4 days (9.2, 9.7)	(Ref)

*GLM: Generalized Linear Model

Readmission Cost

Readmissions Type	Mean Cost of readmission (95% CL)	Mean Cost due to HAI	Mean LOS of readmission (95% CL)	Mean LOS due to HAI
Due to Infection (N=52)***	\$ 33,512 (20,903, 46,121)	\$ 33,512*	11.5 days (8.7, 14.4)	11.5 days
Not due to Infection (N=493)***	\$ 12,742 (10,488, 14,996)	\$ 1,285**	6 days (5.6, 6.6)	0.6 days

*Given that such readmissions would not exist had an HAI not occurred, the entire cost of these readmissions is considered fully attributable to HAI.

** Patients who had an HAI during their index hospitalization have an increased risk of all-cause readmissions reflected in the reported \$ amount.

***Cost data was available only for readmissions within network

Conclusions

In an era that emphasizes early discharge and the need to reduce the national cost of readmissions, this study shows that the LOS (14 additional days) and the cost (incremental \$37,922) of the index hospitalization are heavily influenced by infection rates. Similarly, the cost of infection-driven readmissions are 3x greater than other readmissions. These data provide critical insights about improvement targets that will both achieve our goals of better outcomes and lower costs.

Limitations

- Only inpatient costs were considered in this analysis
- GLM adjusts for confounding due to patient heterogeneity, but it does not account for the time-dependent nature of HAIs.