Timing of Catheter-Associated Urinary Tract Infections (CAUTIs) and Non-CAUTI Hospital-Onset Urinary Tract Infections – Implications for Mitigating Infection Risk

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Background

Catheter-associated urinary tract infections (CAUTIs) are among the most common healthcare-associated infections (HAIs).[1] A focus on a very strict definition of CAUTI[2] may cause organizations to overlook those hospital-onset urinary tract infections (HOUTIs) not meeting the CAUTI definition. Those non-CAUTI HOUTIs have been found to be 7 times as prevalent as CAUTIs, incur $6,100 in incremental hospital costs, extend length of stay (LOS) by 3 days, and may be responsible for 3 times the prevalence of secondary hospital-onset bacteremia and fungemia.[3] What is not well-understood about either CAUTIs or non-CAUTI HOUTIs are the timing and likely causative pathogens associated with these infections.

Objectives

Determine the timing of HOUTIs in the hospital setting by type of infection (CAUTI and non-CAUTI HOUTIs) and examine the pathogens responsible for those different types of infections.

Methods

The study design and population are described in greater detail elsewhere.[3] In short, a retrospective real-world analysis was conducted using de-identified data from the BD Insights Research Database (BD, Franklin Lakes, NJ) for adult inpatients admitted to 41 hospitals between October 2015 and June 2019. Patients <18 years, those admitted for an infection, those presenting with another HAI, and/or those having a stay of <2 days were excluded. HOUTIs were algorithmically identified from positive, non-contaminated urine cultures. CAUTIs were confirmed by hospital infection preventionists. For this analysis, all CAUTIs and non-CAUTI HOUTIs also had an antimicrobial, consistent with the urinary pathogen, ordered ±2 days of the positive urine culture. The times from admission to collection of the specimen yielding the positive culture were analyzed based on type of infection, sex, and patient location.

Results

74.5% of all HOUTI specimens were collected outside the ICU (Table 1). In aggregate, the median time to infection presentation for CAUTI was slightly longer than for non-CAUTI HOUTI (Table 1). This remained pronounced if the patient did not spend time in the ICU (Tables 2, Figures 1 and 2). Figure 3 shows the distribution of days from admission to collection of the positive specimen by pathogen and type of infection. The pathogens responsible for CAUTI and non-CAUTI HOUTIs did not differ appreciably and *P. aeruginosa* was responsible for a slightly larger proportion of the infections in male patients compared to female patients (Table 3).

Table 1: Demographics and Outcomes

	Non-CAUTI HOUTI (N=3177)	CAUTI (N=434)	All HOUTI (N=3611)
Sex			
Male	1,056 (33.2%)	205 (47.2%)	1,261 (34.9%)
Female	2,121 (66.8%)	229 (52.8%)	2,350 (65.1%)
Total LOS (days)			
Mean (SD)	17.9 (15.8)	24.1 (23.3)	18.6 (17.0)
Median [Q1, Q3]	13.0 [8.00, 22.0]	17.0 [11.0, 28.0]	14.0 [9.00, 23.0]
Any Time Spent in ICU During Stay			
No	1,568 (49.4%)	107 (24.7%)	1,675 (46.4%)
Yes	1,609 (50.6%)	327 (75.3%)	1,936 (53.6%)
ICU LOS (days)			
Mean (SD)	8.90 (9.68)	17.3 (21.8)	10.3 (13.0)
Median [Q1, Q3]	5.75 [2.59, 11.9]	12.1 [4.93, 22.7]	6.33 [2.83, 13.6]
Missing	1,568 (49.4%)	107 (24.7%)	1,675 (46.4%)
Non-ICU LOS (days)			
Mean (SD)	13.4 (14.0)	11.1 (13.9)	13.1 (14.0)
Median [Q1, Q3]	10.0 [6.00, 16.2]	7.22 [2.14, 13.8]	9.63 [5.57, 16.0]
Time from Admission to Specimen Collection of Positive HOUTI (days)			
Mean (SD)	9.22 (9.15)	11.4 (11.8)	9.48 (9.53)
Median [Q1, Q3]	6.00 [4.00, 11.0]	8.00 [5.00, 13.0]	6.00 [4.00, 11.0]
HOUTI Specimen Collected in ICU			
No	2,487 (78.3%)	203 (46.8%)	2,690 (74.5%)
Yes	690 (21.7%)	231 (53.2%)	921 (25.5%)

Table 2: Days from Admission to Positive Specimen Collection Date

HOUTI	Collected in ICU	Count (Patients)	Median	Mean	SD	Q_1	Q_3
Non-CAUTI HOUTI	No	1,568	5	7.6	7.6	4	9
Non-CAUTI HOUTI	Yes	1,609	8	10.9	10.1	5	13
CAUTI	No	107	7	8.7	7.8	4	11
CAUTI	Yes	327	8	12.2	12.3	5	14

Figure 1: Days From Admission to Positive Specimen Collection Date in Patients with CAUTI (truncated on day 30)

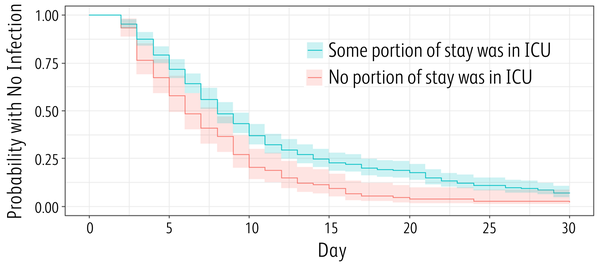


Table 3: Distribution of HOUTI Pathogens

Male Patients	Non-CAUTI HOUTI		CAUTI	
Pathogen*	Patients	Percentage	Patients	Percentage
Enterobacteriaceae	554	46.9%	116	53.2%
Enterococcus species	252	21.4%	36	16.5%
Pseudomonas aeruginosa	138	11.7%	32	14.7%
Other Fungi and Yeast	78	6.6%	---	---
Coag. negative staphylococci	43	3.6%	11	5.0%
Other gram negative	42	3.6%	8	3.7%
Staphylococcus aureus	35	3.0%	7	3.2%
Other environ. gram negative	26	2.2%	5	2.3%
Other Commensal	8	0.7%	2	0.9%
Other gram positive	4	0.3%	1	0.5%
	1,180	100.0%	218	100.0%

Female Patients	Non-CAUTI HOUTI		CAUTI	
Pathogen*	Patients	Percentage	Patients	Percentage
Enterobacteriaceae	1,354	56.6%	151	59.4%
Enterococcus species	477	19.9%	60	23.6%
Other Fungi and Yeast	191	8.0%	1	0.4%
Pseudomonas aeruginosa	125	5.2%	21	8.3%
Other gram negative	95	4.0%	12	4.7%
Coag. negative staphylococci	37	1.5%	3	1.2%
Other gram positive	36	1.5%	---	---
Staphylococcus aureus	32	1.3%	3	1.2%
Other Commensal	27	1.1%	---	---
Other environ. gram negative	19	0.8%	3	1.2%
Streptococcus pneumoniae	1	0.0%	---	---
	2,394	100.0%	254	100.0%

*The categorization employed is consistent with the CDC BSI categories. The Other Fungi and Yeast category across both types of infections, and across both sexes, was composed of 58.1% *Candida albicans*, 32.2% *Candida glabrata*, 3.7% *Candida tropicalis*, and the balance other *Candida* species.

Figure 2: Days From Admission to Positive Specimen Collection Date in Patients with Non-CAUTI HOUTI (truncated on day 30)

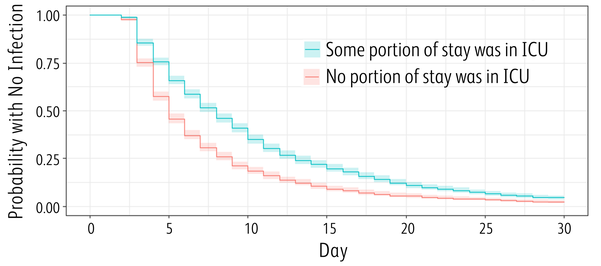
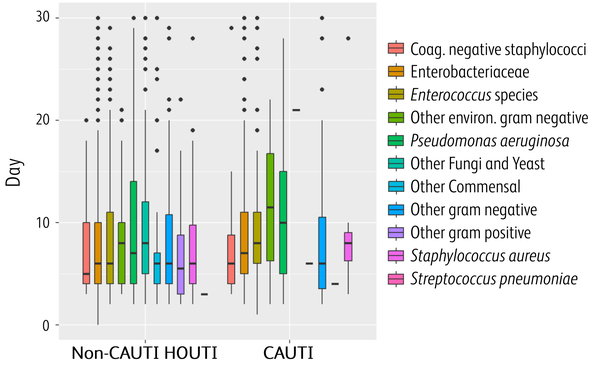


Figure 3: Days From Admission to Specimen Collection Date by Pathogen* (truncated on day 30)



Limitations

As is described elsewhere,[3] the use and duration of indwelling urinary catheters and other urine management interventions were not known. Patient symptoms or other testing or interventions that may have preceded the specimen collection resulting in the positive culture were not known, nor were the urine culture stewardship practices of the hospitals.

Conclusions

Non-CAUTI HOUTIs are more prevalent than are CAUTIs and they present earlier during a patient's course of care in patients who do not spend time in the ICU. Almost half of CAUTIs and three-quarters of non-CAUTI HOUTIs present outside the ICU. Infection prevention efforts – particularly those aimed at mitigating non-CAUTI HOUTIs – should begin early and focus beyond the ICU.

References

[1]Letica-Kriegel AS, Salmasian H, Vawdrey DK, et al. Identifying the risk factors for catheter-associated urinary tract infections: a large cross-sectional study of six hospitals. *BMJ Open*. 2019;9(2):e022137. Published 2019 Feb 21.

[2]Centers for Disease Control and Prevention. Urinary tract infection (catheter-associated urinary tract infection [CAUTI] and non-catheter-associated urinary tract infection [UTI]) events. National Healthcare Safety Network, 2024. https://www.cdc.gov/nhsn/pdfs/pscmanual/7psccauticurrent.pdf. Published January 2024. Accessed April 29, 2024.

[3]Kelly T, Ai C, Jung M, Yu K. Catheter-associated urinary tract infections (CAUTIs) and non-CAUTI hospital-onset urinary tract infections: Relative burden, cost, outcomes and related hospital-onset bacteremia and fungemia infections. *Infect Control Hosp Epidemiol*. Published online February 20, 2024.

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