

# Epidemiology and prevention of catheter-associated urinary tract infections (CAUTI) in hospitalized children



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## Background

- Catheter-associated urinary tract infections (CAUTI) are among the most common healthcare-associated infections in hospitalized adults in the U.S.
- Research and quality improvement efforts have yielded valuable information about effective strategies to prevent adult CAUTI
- Little is known about the epidemiology and prevention of pediatric CAUTI

## Objectives

- Describe patient and infection characteristics of hospitalized children with CAUTI
- Determine the impact of implementation of a CAUTI prevention bundle derived from existing adult prevention strategies

## Methods

- A retrospective cohort study of incident pediatric CAUTI at The Children's Hospital of Philadelphia (CHOP) from June 2009 to July 2012.
- Univariate analyses were conducted to summarize patient characteristics, hospital-level infection data and microbiology of CAUTI
- Comparisons were made using Fisher's exact test or Wilcoxon rank-sum (Mann-Whitney) test as appropriate, with a 2-tailed p value of <0.05 indicating statistical significance.
- The impact of the prevention bundle on monthly CAUTI rates was assessed using Poisson regression with 95% confidence intervals.
- Analyses were performed using STATA version 10.0 (Stata Corp., College Station, TX).

## Results:

- Forty-four patients with a median age of 9.5 years (IQR: 0.4 to 17.5) experienced CAUTI over the three year study period
- The majority of patients were female, received care in an ICU and had one or more chronic comorbid conditions. Half had known risk factor(s) for CAUTI (Table 1)
- Nearly 90% (n=39) of patients had a recognized indication for initial catheter placement, but only 70% (n=31) had an indication at CAUTI onset (p = 0.043) (Table 2).
- Most common indications were urinary retention/obstruction, hemodynamic instability/urine output monitoring and surgical procedure > 4 hours.
- There were no differences in length of stay, median catheter dwell time, presence of recognized indication or microbiology of infection between pre- and post-bundle patients (Table 3)
- Implementation of the CAUTI prevention bundle was associated with a 50% reduction CAUTI rates (95% CI: -1.28 to -0.12, p = 0.0189). (Figure).

Table 1: Patient Characteristics

Characteristic	n(%)
Sex	
Female	33 (75)
Male	11 (25)
Patient Unit	
Cardiac Intensive Care	11 (25)
Hematology-Oncology	3 (7)
Medical-Surgical	5 (11.5)
Neonatal Intensive Care	5 (11.5)
Pediatric Intensive Care	20 (45)
Chronic Comorbid Conditions	
Neuromuscular	16 (36)
Cardiovascular	20 (45)
Respiratory	30 (68)
Renal	15 (34)
Gastrointestinal	15 (34)
Hematologic or immunologic	5 (11.5)
Metabolic	3 (7)
Other congenital or genetic defect	9 (21)
Malignancy	8 (18)
None	1 (2)
Genitourinary Condition	
Anatomic	8 (19)
Functional	4 (9)
None	32 (73)
CAUTI Risk Factors*	
Immunocompromised	5 (11.5)
Pregnancy	1 (2)
Transported with catheter in place**	3 (7)
Intermittent catheterization at home	6 (14)
Other***	1 (2)
None	22 (50)

\*Six patients had >1 risk factor  
 \*\*Transported off home unit < 72 hours prior to CAUTI onset  
 \*\*\*Included catheter placed at outside hospital prior to admission

Table 2: Indications for indwelling urinary catheter: Initial vs. within 24 hours of CAUTI onset

Indication†	At Placement	At Infection
	n (%)	n (%)
Urinary retention/obstruction	19 (43)	18 (41)
Hemodynamic instability or urine output monitoring	17 (39)	16 (36)
Surgical procedures >4 hrs	6 (14)	0
Receipt of caustic chemotherapy	2 (5)	1 (2)
Palliative care	1 (2)	1 (2)
Pressure ulcer in incontinent patients	1 (2)	1 (2)
Other*	2 (5)	4 (9)
None	3 (7)	9 (20)

\*Other indications not pre-identified included temperature monitoring & epidural in place  
 †Patients may have had more than one indication

Table 3: Impact of Prevention Bundle

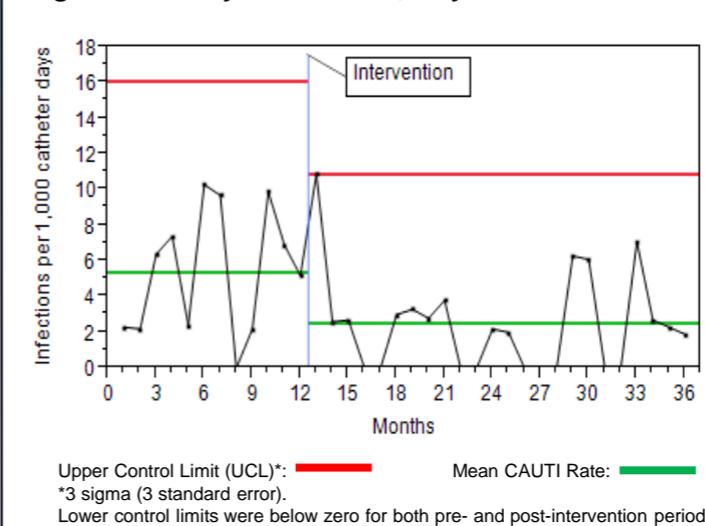
Characteristic*	Pre-Bundle	Post-Bundle	p-value
Median monthly CAUTI rate	5.79 (2.23 to 8.54)	2.26 (0 to 3.16)	0.031
Median monthly catheter utilization ratio <sup>^</sup>	0.03 (0.03 to 0.04)	0.03 (0.03 to 0.04)	0.218
Median hospital days to CAUTI	17 (11 to 41)	13 (6 to 29)	0.545
Median catheter dwell time to CAUTI	5 (3 to 15)	4 (2 to 8)	0.547
Recognized indication at placement	19 (90)	21 (91)	1.000
Recognized indication at CAUTI	15 (71)	18 (78)	0.732
Organism			
Lactobacillus	0	1 (4)	0.154
Enterobacteriaceae	11 (52)	13 (57)	
Enterococcus	0	3 (13)	
Pseudomonas aeruginosa	8 (38)	3 (13)	
Yeast	2 (10)	3 (13)	

Summarized as n(%) or Median(Interquartile Range) as appropriate  
<sup>^</sup>catheter utilization ratio calculated catheter days to patients days

## CAUTI Prevention Bundle

- Place catheter only when recognized indication present
- Use aseptic catheter insertion technique
- Maintain catheter based on principles of asepsis
- Position patient and collection device to assist urine drainage
- Review catheter necessity daily
- Promptly remove catheter when indication(s) no longer met

Figure: Monthly CAUTI rates, July 2009 to June 2012



## Conclusions

- CAUTI is a relatively common healthcare-associated infection in hospitalized children
- Many pediatric CAUTI can be prevented through implementation of a prevention bundle based on adult CAUTI prevention practices
- Future research is needed to identify additional interventions to prevent CAUTI