

# Reducing Catheter-associated Urinary Tract Infections

**HIMSS Enterprise Davies Award  
Site Visit**

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# Introduction

- Why CAUTI
- VCU baseline (pre-intervention)
- IT collaboration
- Interventions
- Current projects
- Results
- Impact
- Lessons learned

# Local Problem

# Reducing Catheter-associated Urinary Tract Infections (CAUTI)

- **Why CAUTI**
- VCU baseline (pre-intervention)
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- Impact
- Lessons learned

# Why CAUTI?

## Patient impact

- Most common healthcare-associated infection (HAI)
- Accounts for more than 30% of all HAIs
- Most catheters inserted are unnecessary
- 13,000 deaths associated with UTIs each year
- Leading cause of secondary blood stream infections
- Antibiotic resistance

## National focus

- One of the first HAI selected for non-payment by Medicare
- 2016 HHS national goal to reduce CAUTI by 25% by 2020

# Why CAUTI?

## Financial impact

- CDC national economic burden of \$340 million annually
  - \$1,000 is average cost associated with CAUTI
- 2018 study put national cost closer to \$1.7 billion<sup>1</sup>
- AHRQ has additional cost for hospital-onset CAUTI at \$13,793<sup>2</sup> per event
- Increased length of stay
  - 2-4 extra hospital days<sup>3</sup> per CAUTI event
- Mortality: attributed to 36 deaths per 1,000 CAUTI<sup>4</sup>

1. Hollenbeak, CS, Schilling, AL. The attributable cost of catheter-associated urinary tract infection in the United States: A systematic review. *American Journal of Infection Control*, 2018; 46(7):751-757.
2. <https://www.ahrq.gov/professionals/quality-patient-safety/pfp/haccost2017-results.html>
3. Gould C. Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention. Catheter-associated urinary tract infection (CAUTI) toolkit. Activity C: ELC prevention collaboratives. [http://www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit\\_3\\_10.pdf](http://www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit_3_10.pdf).
4. CDC/NHSN – CMS hospital compare data - Scott, RD. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. [http://www.cdc.gov/ncidod/dhqp/pdf/Scott\\_CostPaper.pdf](http://www.cdc.gov/ncidod/dhqp/pdf/Scott_CostPaper.pdf)

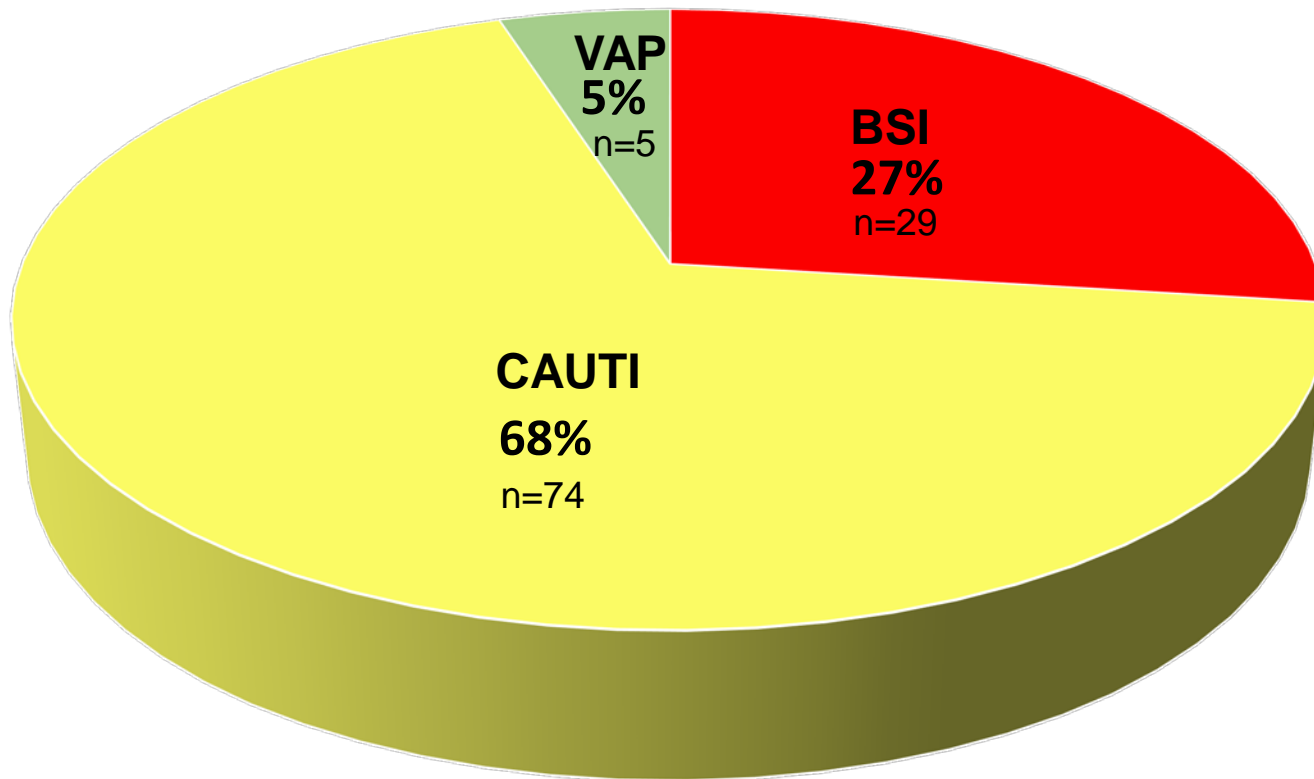
# Design and Implementation

# Reducing Catheter-associated Urinary Tract Infections

- Why CAUTI
- **VCU baseline (pre-intervention)**
- IT collaboration
- Interventions
- Current projects
- Results
- Impact
- Lessons learned



# CAUTI Baseline Data – Adult ICUs 2012



- 74 CAUTIs in 2012
- 68% (74/108) device associated HAI due to CAUTI
- CAUTI rate 3.1 per 1000 device days

# How Health IT Was Used

# Reducing Catheter-associated Urinary Tract Infections

- Why CAUTI
- VCU baseline (pre-intervention)
- **IT collaboration**
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# Collaboration with IT

- Department-based IT liaison
- Information and Documentation Technology Committee (IDTC)
- Enterprise analytics team

# Reducing Catheter-associated Urinary Tract Infections

- Why CAUTI
- VCU baseline (pre-intervention)
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# Timeline of Interventions for CAUTI Reduction

2013

- Creation of hospital policy to address insertion, maintenance, indications for use, and nurse-driven protocol for removal of unnecessary catheters
- EMR documentation section added in iView for nursing to document daily assessment of need for urinary catheter

2014

- Infection prevention begins monthly audit and feedback of urinary catheter daily assessment of need compliance

2015

- EMR documentation in iView revised for Nursing documentation - new drop-down fields for urinary catheter necessity criteria
- Reference hyperlink added into iView for end-users to review policy indications for appropriate criteria

2016

- EMR order set created for providers – must enter order for catheter, include indication for need, order for continuation of catheter after 72-hour removal
- EMR generated automatic order for nurses to discontinue urinary catheter 72 hours after insertion

2017

- Urine test stewardship begins in adult ICUs (assisted with Enterprise Analytic report)
- ICU Panculture Power Orders adjusted to remove UA with reflex as preselected item
- Updated intermittent catheterization algorithm hyperlinked into iView

2018

- EMR decision support for urine culture testing to align practice with IDSA/SCCM guidelines (in progress)
- Care Compass task to fire to remind nurses to remove urinary catheter at 72-hour mark (in progress)

# CAUTI Bundle

2013

## Maintenance

- Review for necessity
- Maintain a closed system
- Unobstructed flow
- Hand hygiene

2015 & 2016

## Insertion

- Only for appropriate indications
- Only properly trained personnel to insert/maintain
- Aseptic technique and sterile equipment
- Consider alternatives

2016

## Removal

- Leave in place only as long as needed

AHRQ – *On the CUSP*: Stop CAUTI project: Technical Interventions To Prevent CAUTI. Content last reviewed October 2015. Agency for Healthcare Research and Quality, Rockville, MD.  
<http://www.ahrq.gov/professionals/quality-patient-safety/hais/cauti-tools/guides/implguide-pt3.html>  
2009 CDC/HICPAC Guidelines: [http://www.cdc.gov/HAI/ca\\_uti/uti.html](http://www.cdc.gov/HAI/ca_uti/uti.html)

# Clinician Awareness

ICE	L/T/D	Inserted	Days Since Insertion	LAST WEIGHT	SKIN RISK		
iac Surgery	Arterial Line Right Radial artery	07/27/2018	4	0 days			
iac Surgery	Orogastric	Date Not Documented		0 days			
iac Surgery	Pulmonary artery catheter Right Neck	07/27/2018	4	0 days			
iac Surgery	Cordis Right Neck	07/27/2018	4	0 days			
iac Surgery	Chest tube	Date Not Documented		0 days			
iac Surgery	Foley catheter	07/27/2018	4	8 days			
iac Surgery	Peripheral access Left Forearm	07/26	5	3 days			
				+4	0	1 days	
				+2	0	4 days	
				+4	7	5 days	

CORES 4.0.0

Internal Med - IPA

SEX: M BIRTH DATE: 26-JAN-1939 AGE: 79 Years

LOCATION: NSC 041 A ADMIT: 09-AUG-2018 ADT SERVICE: IP-Medicine-Tea... ATT: MARCELO MD, CATHERINE...

**PATIENT CODE STATUS: Do Not Resuscitate, Start: 08/08/18 19:53:00 EDT (08/08/18 19:53)**

Code Status Order (Pt.)

Days Status

Patient Code Status Do Not Resuscitate, Start: 08/08/18 19:53:00...

**SIT AWARE / ACTIONS / PLAN**

Action List (Srv) (0 active tasks)

Add new task - Due Date -

Active Tasks (0)

View Other Team's Tasks (0)

Completed Tasks (0)

Sit. Awareness / Cont. Plan (Team) Today 09:38

NF: f/u cardiology recommendations  
f/u lactate, BMP, and cardiac enzymes  
f/u family decision about moving to ACE/heart failure for dobutamine (call Chao)

Low threshold to consult MRICU for decompensated heart failure, acute liver

**ISSUES**

Patient Summary (Team) Today 09:38

Pt with acute liver failure, HFREF s/p ICD. several days of nausea found to have acute liver injury in setting of daily APAP, acute decompensated heart failure.

**I&O - TUBES/LINES/DRAINS**

Intake and Output (Pt.)

Shift length	08/10	08/09	08/09	08/09	08/09
	Morning S	24h Total	Night Shift	Day Shift	Morning S
<b>Intake (ml)</b>	<b>420.00</b>	<b>2455.80</b>	<b>427.80</b>	<b>924.00</b>	<b>1104.00</b>
Infusion	0.00	653.80	227.80	142.00	284.00
Medication	100.00	602.00	200.00	302.00	100.00
Oral	320.00	1200.00	0.00	480.00	720.00
<b>Output (ml)</b>	<b>400.00</b>	<b>1225.00</b>	<b>375.00</b>	<b>850.00</b>	<b>0.00</b>
Urine Output	400.00	1225.00	375.00	850.00	0.00
<b>Net (ml)</b>	<b>20.00</b>	<b>1230.80</b>	<b>52.80</b>	<b>74.00</b>	<b>1104.00</b>

Diet Orders (Pt.)

Days Status

Sodium diet: 2 grams Start 08/09/18 15:43:00 EDT

**Tubes/Lines/Drains (Team)**

Lines: (selected visit) 24 hr. I/O: Inserted: Team Notes:

Peripheral access 08/9/2018 Right... 8/9 6:46

Tubes: (selected visit) 24 hr. I/O: Inserted: Team Notes:

No active tubes found.

Drains: (selected visit) 24 hr. I/O: Inserted: Team Notes:

Foley catheter 08/8/2018 16 Fr fro... (1625) 8/9 6:00

**Tubes/Lines/Drains (Other) (Team)**

08-10-2018

- Safety dashboard – lines and tubes
- Provider sign-out tool includes lines and tubes



2013

# Daily Assessment of Need – Nursing Documentation

2014

2013 – Policy development for indwelling urinary catheters (UC)

- Insertion criteria
- Daily RN documentation of need
- Intermittent catheterization algorithm

2015

2016

2017

2018

	14:05	13:05	12:05	11:05	10:05
▲ Foley catheter 11/28/2010 22 Fr Right Pre-h...	<input checked="" type="checkbox"/>				
Urine Color	Yellow				
Urine Description	Clear				
Urine Odor					
◆ Voiding					
Comment, Urine Output					
◆ Catheter Reviewed For Necessity	Does not...				
◆ *Catheter Reviewed Action	Catheter Reviewed Action ✕				
◆ Provider Notified	<input checked="" type="checkbox"/> Catheter removed				
Urinary Catheter Verified By	<input checked="" type="checkbox"/> Provider notified				
Urinary Catheter Comment	<input type="checkbox"/> Other				
▲ Voided	<input checked="" type="checkbox"/>				
Urine Color					
Urine Description					
Urine Odor					

2013

# Daily Review for Necessity

2014

Point prevalence surveillance

- IT support daily through Enterprise Analytics Report

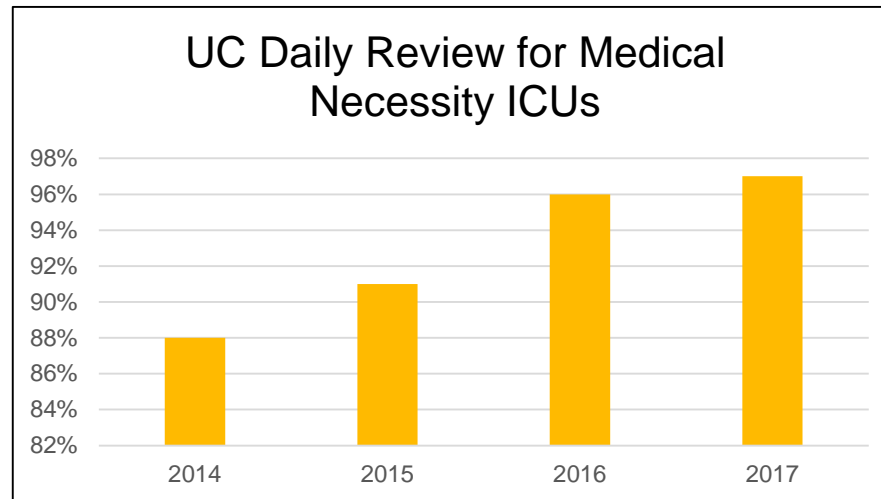
2015

2016

2017

2018

C10D												Number Of		6
Patient	MRN	Date	Med Svc	Unit Date	Bed Days	Central Line	PICC	Fem	UC	FOLEY	Vent			
		08/09/2018	IP-Cardiac Surgery	08/09/2018	1	1	0	0	0	1	1			
		08/09/2018	IP-Cardiac Surgery	07/24/2018	17	1	0	1	0	0	1			
		08/09/2018	IP-Thoracic	08/07/2018	3	1	0	0	0	1	1			
		08/09/2018	IP-Cardiac Surgery	08/04/2018	6	1	0	0	0	1	1			
		08/09/2018	IP-Vascular	08/09/2018	1	0	0	0	0	0	0			
		08/09/2018	IP-Cardiac Surgery	08/09/2018	1	1	0	0	0	1	1			
					<b>Sum:</b>	<b>5</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>5</b>			



2013

# iView Urinary Catheter Documentation

2014

- Added drop-down menu of approved indications for UC
- Policy hyperlinked

2015

▲ Urine Output Descri...					
▲ Foley catheter 08/9/...			<input checked="" type="checkbox"/>		
Urine Color			Yellow		Yellow
Urine Description			Clear		Clear
Urine Odor			Odorless		Odorless
▼ Voiding Comment, Urine Out...					
▼ Catheter Reviewed F...			Meets cri...		Meets cri...
▼ *Meets Criteria for C...			*Meets Criteria for Catheter		
Urinary Catheter Ver...			<input type="checkbox"/> Accurate urine output monitoring		
Urinary Catheter Co...			<input type="checkbox"/> Chemically paralyzed		
▲ Integumentary			<input type="checkbox"/> Stage III/IV pressure ulcers with incontinence		
Integumentary System Reas...	No chan...		<input type="checkbox"/> Incontinence associated dermatitis with incontinence		
Skin Integrity Head			<input type="checkbox"/> Urinary obstruction		
Skin Integrity Torso			<input type="checkbox"/> Strict intake and output		
Skin Integrity Pelvic Region			<input type="checkbox"/> Surgical procedure		
Skin Integrity Extremities			<input type="checkbox"/> Medical condition		
Nsg Comment, Integ			<input type="checkbox"/> Patient comfort - end of life care		
▲ SCT Braden Assessment			<input type="checkbox"/> Urinary retention		

2016

2017

2018

2013

# Provider Order Entry

2014

Provider must enter order for insertion

2015

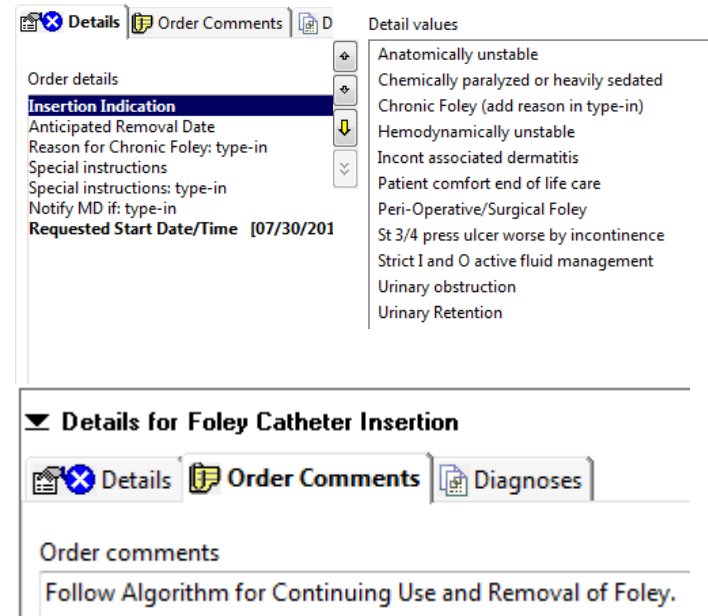
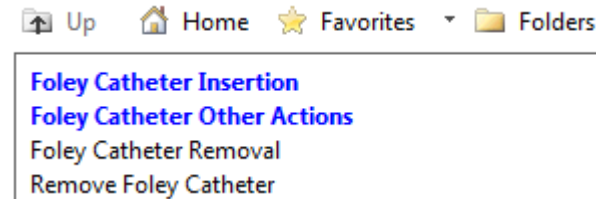
2016

With an approved indication

2017

Detail statement maintains independent RN removal, per policy

2018



2013

# Automated Removal Order

2014

When nurses create the Foley catheter band, an automated removal order is generated for 72 hours after insertion

2015

2016

- GenitoUrinary
  - GenitoUrinary System Reassessment
  - Nsg Comment, GU
  - Urine Output Description
    - Foley catheter 07/30/2018 16 ...

<input checked="" type="checkbox"/>	Foley Catheter Removal	Ordered	Start: 08/02/18 12:23:31 EDT
-------------------------------------	------------------------	---------	------------------------------

2017

2018

2013

# Provider Alerts

2014

24 hours after UC has been inserted, providers receive an alert

- Remove catheter as ordered (72 hours)
- Remove catheter immediately (*new order fires to remove*)
- Continue use after 72 hours

2015

2016

2017

2018

The screenshot shows a Cerner alert window titled "Foley Catheter Requirement". The alert text reads: "The Foley Catheter is scheduled to be removed on: 01/31/16 22:49:14". Below this, it states: "Requirement -All Foley Catheters are to be removed within 72 hours of insertion unless a reason for continuation is provided." It then asks the user to "Select from one of the options below:" and lists three options under "Add Order for:":

- Foley Catheter Evaluated -> OK to remove as scheduled after 72 hours
- Foley Catheter Removal -> Remove Foley Now.
- Foley Catheter Continuation -> Continue Foley catheter past 72 hours**

An "OK" button is visible at the bottom of the alert window.

2013

# Provider Continuation Order

2014

2015

2016

2017

2018



## Foley Catheter Requirement

The patient has a Foley Catheter without a removal date .

Requirement - All Foley Catheters are to be removed within 72 hours of insertion unless a reason for continuation is provided.

Select from one of the options below:

Add Order for:

- Foley Catheter Removal -> Remove Foley Now.
- Foley Catheter Continuation -> Continue Foley

OK



Alert will fire every 24 hours if details are not entered for continuation

2013

# Provider Continuation Order

2014

Order Name: Foley Catheter Continuation Mt: 10/15/15 8:12:00, Constant Indicator

▼ Details for Foley Catheter Continuation

Details | Order Comments | Diagnoses

Order details

**Continuation Indication [Hemodynamically unstable]**

Reason for Chronic Foley: type-in

Special instructions

Special instructions: type-in [Continue Foley ...]

Continue Foley another

Continue Foley until?

Requested Start Date/Time [10/15/15 8:12:00]

Detail values

- Anatomically unstable
- Chemically paralyzed or heavily sedated
- Chronic Foley (add reason in type-in)
- Hemodynamically unstable**
- Incont associated dermatitis
- Patient comfort end of life care
- Required for medical condition
- St 3/4 press ulcer worse by incontinence
- Strict I and O active fluid management
- Urinary obstruction
- Urinary Retention

2015

2016

2017

2018

▼ Details for Foley Catheter Continuation

Details | Order Comments | Diagnoses

Order details

**Continuation Indication [Hemodynamically unstable]**

Reason for Chronic Foley: type-in

Special instructions

Special instructions: type-in [Continue Foley ...]

Continue Foley another

**Continue Foley until?**

Requested Start Date/Time [10/15/15 8:12:00]

Detail values

[None]

▼ Details for Foley Catheter Continuation

Details | Order Comments | Diagnoses

Order details

**Continuation Indication [Hemodynamically unstable]**

Reason for Chronic Foley: type-in

Special instructions

Special instructions: type-in [Continue Foley ...]

**Continue Foley another**

Continue Foley until?

Requested Start Date/Time [10/15/15 8:12:00]

Detail values

- (None)
- 24 hours
- 48 hours
- 72 hours
- Indefinite



2013

2014

2015

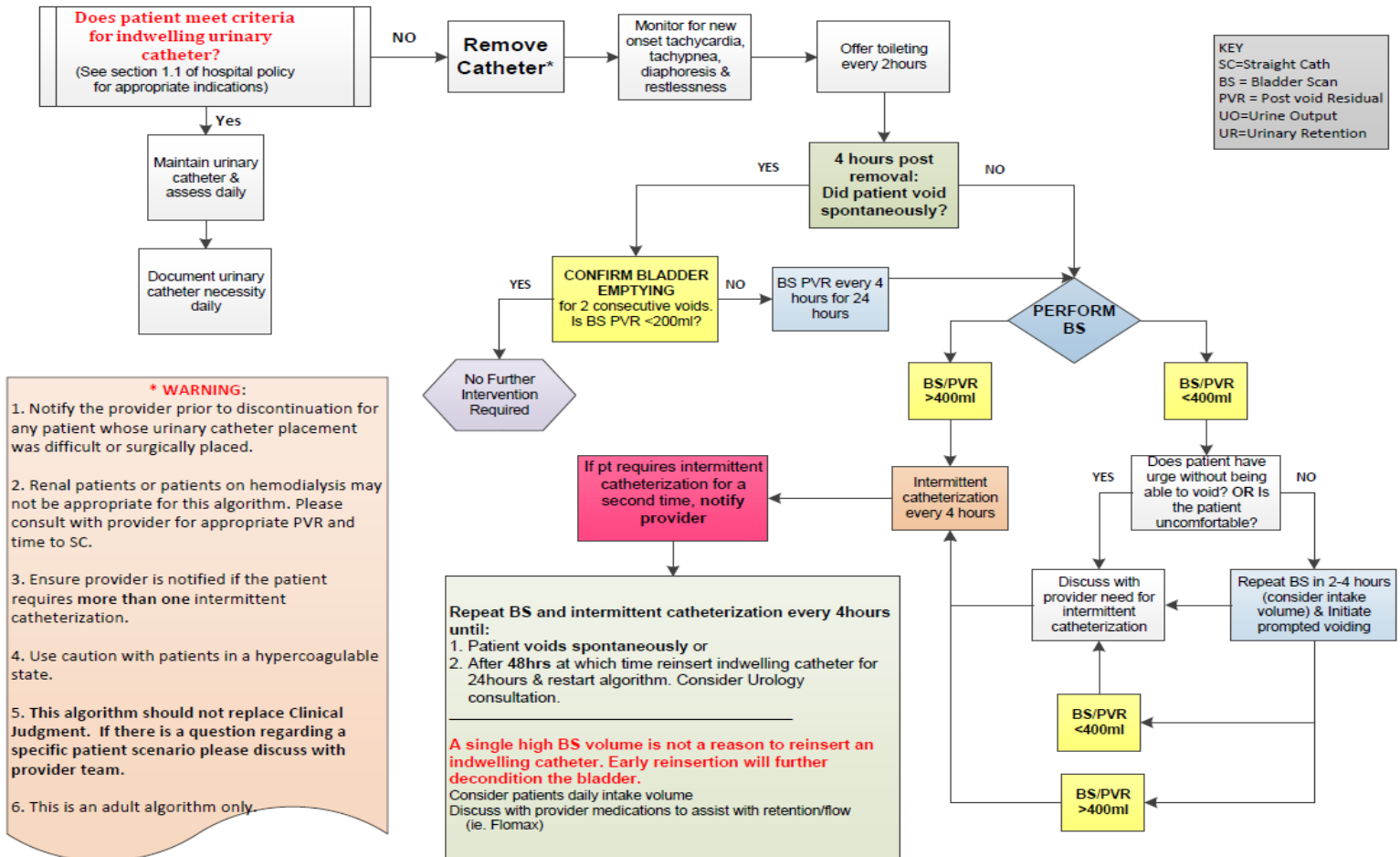
2016

2017

2018

# Updated Intermittent Catheterization Algorithm Embedded into iView

## Assessment for Adequate Bladder Emptying - ADULTS



2013

# Urine Test Stewardship – Adult ICUs

2014

- Reduce unnecessary urine testing
- Test only patients at high risk for invasive infection
  - Kidney transplant
  - Neutropenic
  - Recent GU surgery
  - History or evidence of urinary obstruction

2015

2016

2017

2018

1. Mullin KM et al. *Infect Control Hosp Epidemiol*. 2017 Feb;38(2):186-188 DOI: [10.1017/ice.2016.266](https://doi.org/10.1017/ice.2016.266)
2. O'Grady NP et al. *Crit Care Med*. 2008 Jun; 36(4): 1330-1349 DOI: [10.1097/CCM.0b013e318169eda9](https://doi.org/10.1097/CCM.0b013e318169eda9)

2013

# Urine Test Stewardship – Adult ICUs

2014

ICU pan culture order set

2015

2016

2017

2018

ICU: Pan Culture Labs (Initiated Pending)

Laboratory

<input checked="" type="checkbox"/>			Blood Culture (Culture, Blood)
<input checked="" type="checkbox"/>			Blood Culture (Culture, Blood)
<ul style="list-style-type: none"><li>• Select the following UA with reflex order <u>if</u> patient meets one of the following criteria:<ul style="list-style-type: none"><li><input type="radio"/> Kidney transplant recipient</li><li><input type="radio"/> Neutropenia</li><li><input type="radio"/> Recent GU surgery</li><li><input type="radio"/> Evidence of urinary obstruction</li></ul></li></ul>			
<input type="checkbox"/>			UA Stat w mic on Pos reflex Ur Culture
<input type="checkbox"/>			Respiratory Culture

2013

2014

2015

2016

2017

2018

# Dashboard for Adult ICU Urine Cultures

Urine Culture Stewardship

## Health System Infection Prevention Program Monthly Dashboard

For additional information:

Mullin KM et al. *Infect Control Hosp Epidemiol*. 2017 Feb;38(2):186-188 DOI: 10.1017/ice.2016.266  
 O'Grady NP et al. *Crit Care Med*. 2008 Jun; 36(4): 1330-1349 DOI:10.1097/CCM.0b013e318169eda9

### March 2018

2017 Baseline Urine Culture rates p/100 device days						
	CICU	CSICU	MRICU	NSICU	STICU	Average
2017 Baseline	23.0	10.4	21.4	23.0	17.8	19.6
<b>2018 Goal</b> 20% reduction	<b>18.4</b>	<b>8.6</b>	<b>17.1</b>	<b>18.4</b>	<b>14.2</b>	<b>15.7</b>
2018 Urine Culture rates p/100 device days						
January	25.7	11.8	15.1	29.7	15.4	19.5
February	27.3	15.4	17.8	24.1	14.6	19.8
March	24.2 ▼	8.0 ▼	18.0 □	28.4 ▲	17.5 ▲	19.2 □
April						
May						
June						
July						
Aug						

Recommendation: use  
 ACCCM/IDSA Guidelines  
 for new fever work-up<sup>2</sup>



Obtain urine cultures only in  
 patients at high risk for  
 invasive infection:

- Kidney Transplant recipients
- Neutropenia
- Recent GU surgery
- Patients with evidence of Urinary obstruction

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- Why CAUTI
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# Urine Test Stewardship - EMR decision support

2013

2014

2015

2016

2017

2018

Discern: KST-TEST, PENNY (1 of 2)



## Testing Urine Alert

- Urine culture (UA with reflex) should NOT routinely be ordered 48 hours AFTER admission, unless there is a valid indication

- **DO NOT ORDER culture**

- Pregnancy
- Fever in neutropenia
- Fever with kidney transplant
- Fever with known urinary obstruction/indwelling stent
- Fever with recent urological procedure
- Fever with classic UTI signs
  - Unexplained flank/suprapubic pain
  - Dysuria
- Spinal cord injury with **new** or **worsening** urinary symptoms
- Order culture for another reason not listed

2013

2014

2015

2016

2017

2018

# Care Compass – Task for Removal



# Value Derived

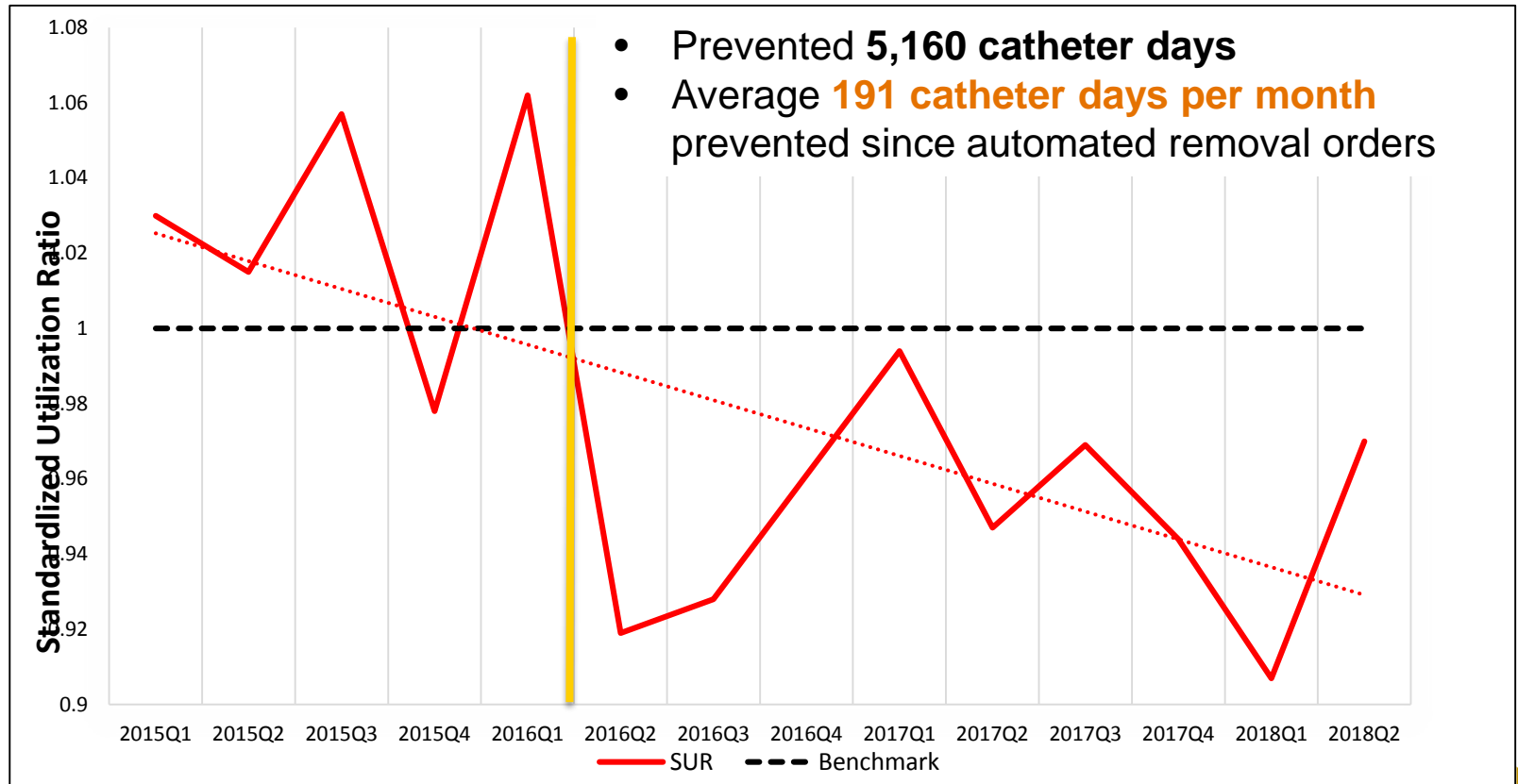


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# UC Standardized Utilization Ratio (SUR)

2015-present



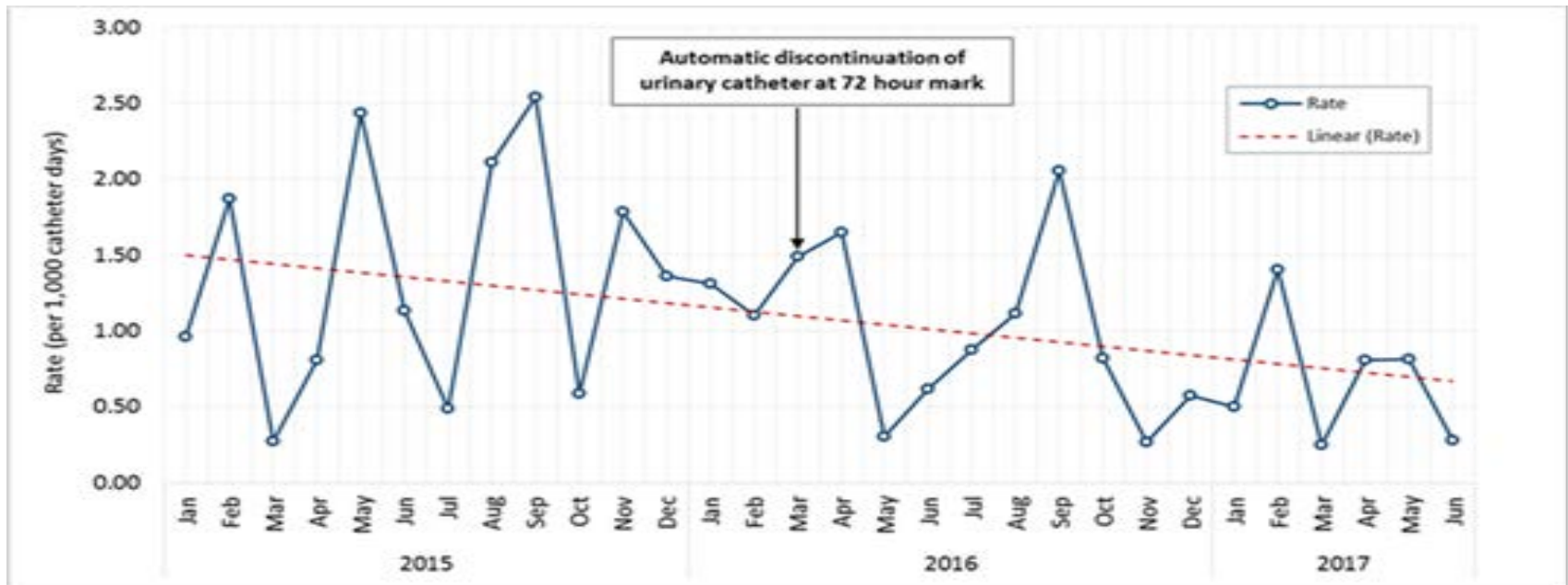
2015 RN  
documentation

2016 provider orders &  
automatic removal

2017 UCX test  
stewardship

2018

# Automatic 72-hour Removal Orders



## CAUTI Rates Pre- & Post-implementation of EMR-generated Automatic Discontinuation

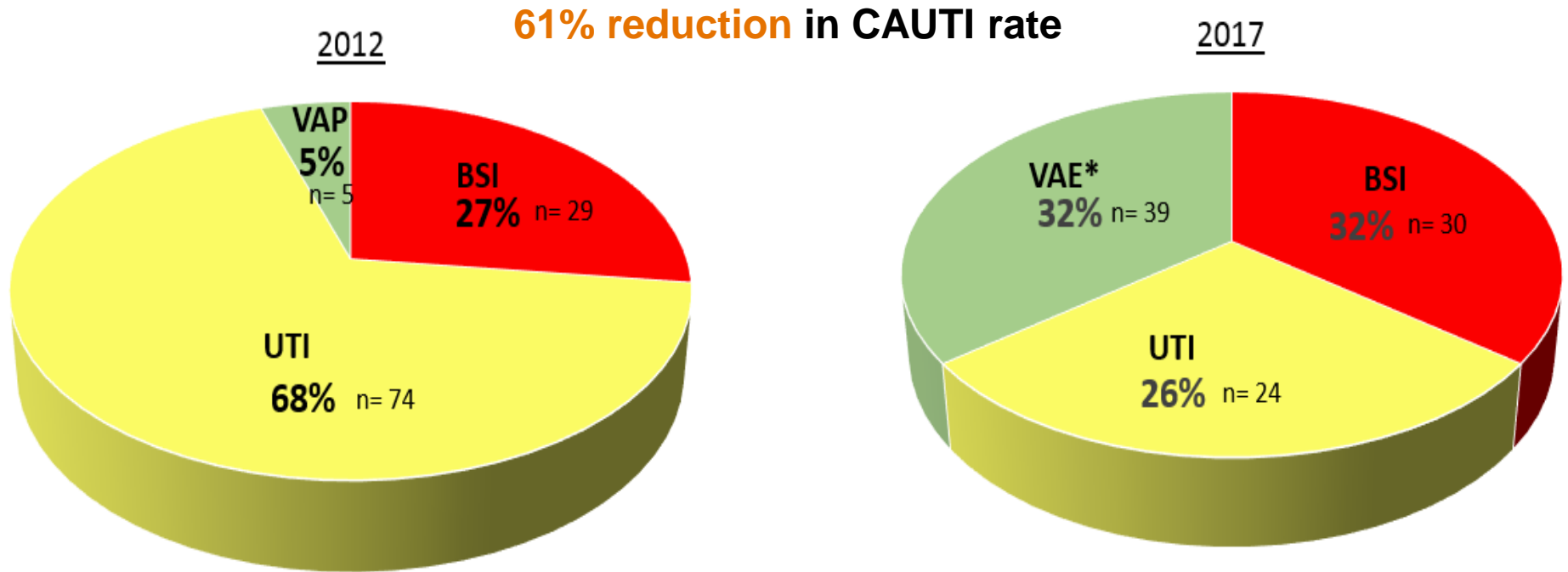
	CAUTI Rate*	Standardized Infection Ratio	P-Value**
Pre-implementation	1.34	0.77	0.0083
Post-implementation	0.81	0.47	

Table 1: Mean CAUTI rates and standardized infection ratios for pre- (15 months) and post (15 months)-implementation

\*Rates per 1,000 catheter days

\*\*Two-proportion Z-test comparing CAUTI rate means

# CAUTI Results – Adult ICUs

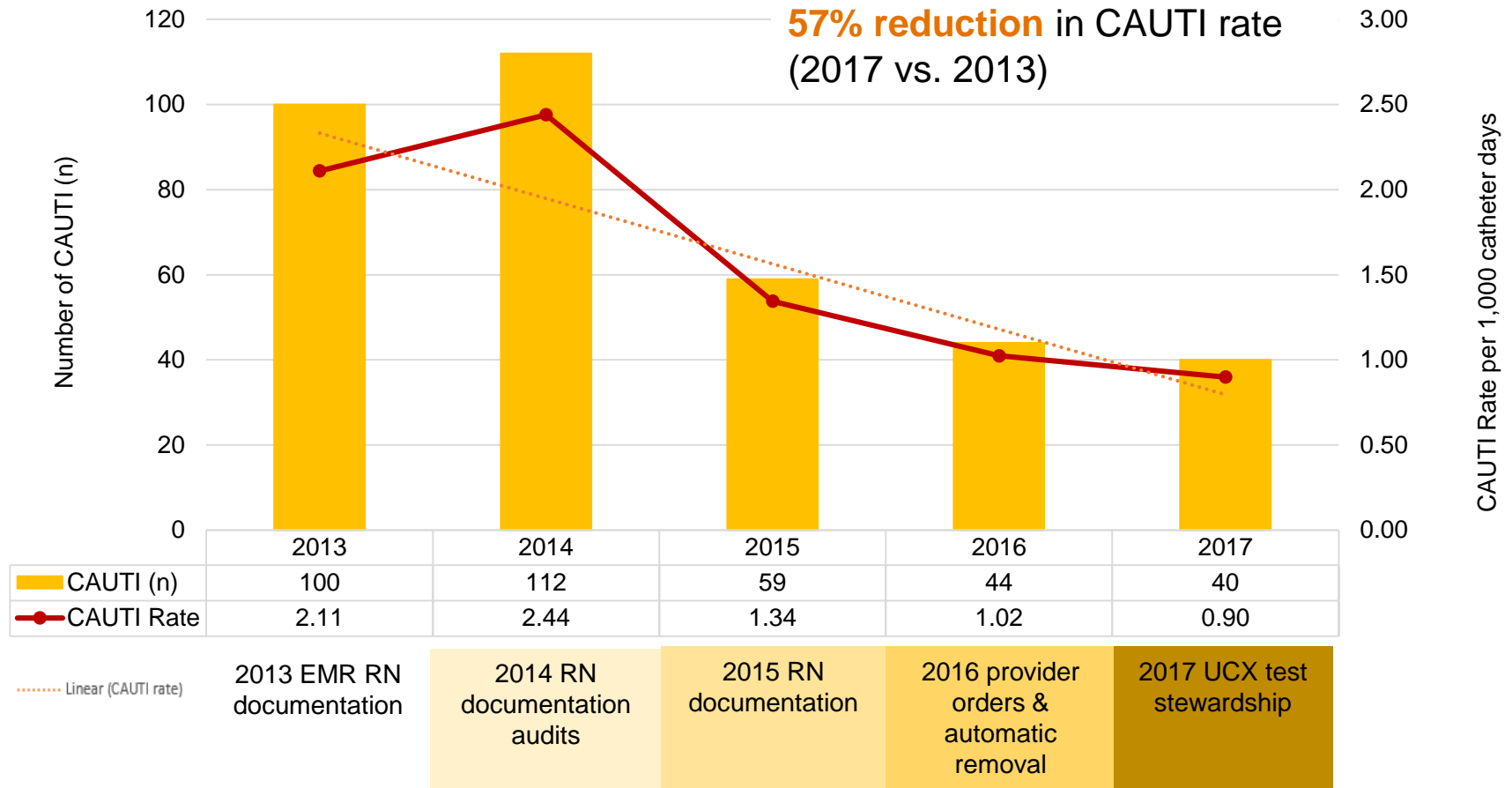


- 74 CAUTIs
- 68% (74/108) device-associated HAI due to CAUTI
- CAUTI rate=3.1 per 1,000 device days

- 24 CAUTIs
- 26% (24/93) device-associated HAI due to CAUTI
- CAUTI rate=1.2 per 1,000 device days

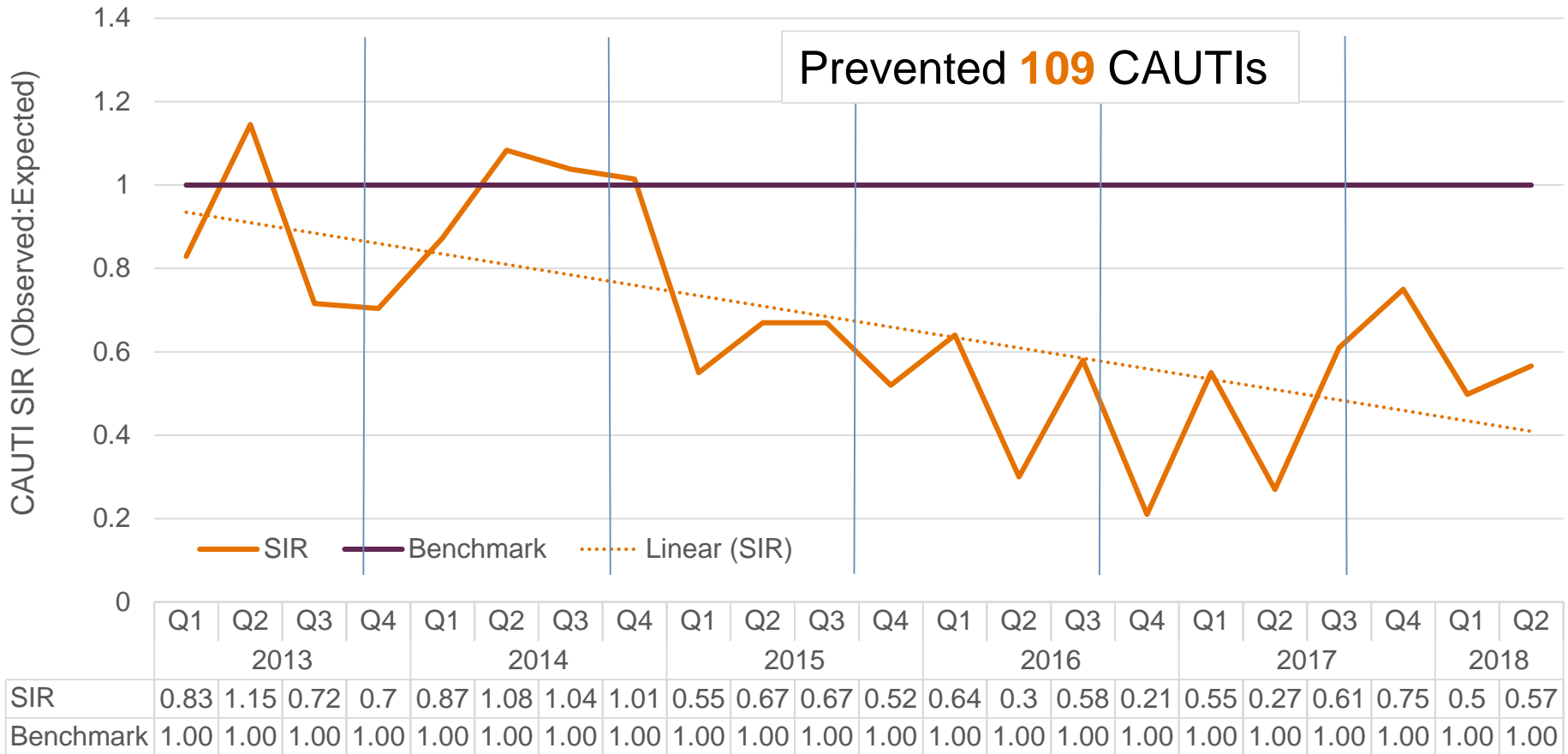
# VCUHS CAUTI Rates

2013-2017



# VCUHS CAUTI Standardized Infection Ratio (SIR)


2013-2018 ytd



# Urine Test Stewardship – Adult ICUs

- Analysis of ICU pan culture order change
- 3 months pre-/post-intervention testing fidelity
- Significant improvement in test fidelity (P-value 0.0074)
- 18% reduction in testing in June

2017 Baseline Urine Culture rates p/100 device days						
	CICU	CSICU	MRICU	NSICU	STICU	Average
2017 Baseline	23.0	10.4	21.4	23.0	17.8	19.6
<b>2018 Goal</b> 20% reduction	<b>18.4</b>	<b>8.6</b>	<b>17.1</b>	<b>18.4</b>	<b>14.2</b>	<b>15.7</b>
2018 Urine Culture rates p/100 device days						
January	25.7	11.8	15.1	29.7	15.4	19.5
February	27.3	15.4	17.8	24.1	14.6	19.8
March	24.2	8.0	18.0	28.4	17.5	19.2
April	31.8	7.5	14.9	23.5	12.0	17.9
May	25.3	11.1	16.5	18.2	12.8	16.8
June	22.1 ▼	10.2 ▼	16.8 ◻	14.9 ▼	15.9 ▲	16.0 ▼
July						
Aug						

 One CAUTI in JUNE for these units!!!

# Reducing Catheter-associated Urinary Tract Infections

- Why CAUTI
- VCU baseline (pre-intervention)
- IT collaboration
- Interventions
- Current projects
- Results
- **Impact**
- Lessons learned



# Estimated Impact

- Currently a Top 10 Vizient performer for CAUTI
- 61% reduction in ICU CAUTI since 2012
- 50% reduction in non-ICU CAUTI since 2012

## Since 2015

- Reduced catheter days: **5,160**
- CAUTIs prevented: **109**
  - Prevented **4 deaths**
- Cost savings estimate: **\$10,900-\$1.5 million**
- Reduction in number of beds used: **218**
  - Gained additional **36-72** hospital admissions

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- **Lessons learned**

# Lessons Learned

- Have all stakeholders at table in beginning
- Start with automated removal orders
- Data drives quality improvement
- Feedback and support essential
- Leveraging IT through EMR decision support impacts change
- Make it easy to do right thing
- Make decision support tools that help end user

# Questions?