

Preventing Catheter-Associated Urinary Tract Infections
Dr. Mariah Obino, Kisii Hospital, Kenya, & Dr. Gayani Tillekeratne, Duke University
A Webber Training Teleclass

Preventing Catheter-Associated Urinary Tract Infections

With a Focus on Resource-Limited Settings

Dr. Mariah Obino, MBChB, Kisii Hospital, Kenya
Dr. Gayani Tillekeratne, MD MSc, Duke University

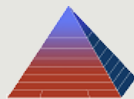
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Some slides adapted from "Hospital-Acquired Urinary Tract Infections," Diane Newman, RNC, MSN & Phil Hanno MD, Division of Urology, University of Pennsylvania.

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June 25, 2015



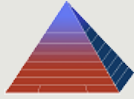
Objectives

- ◆ Define catheter-associated UTI (CA-UTI)
- ◆ Epidemiology & risk factors for CA-UTI
- ◆ Pathogenesis & microbiology of CA-UTI
- ◆ Evidence-based strategies for reducing CA-UTI
 - ◆ Proper indications
 - ◆ Proper insertion & maintenance
- ◆ Our study: A multi-faceted intervention to reduce CA-UTI in Kenya

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Definition

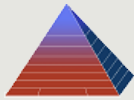
Urinary Tract Infection (UTI) is a clinically detectable condition of some part of the urinary tract caused by disease-causing microorganisms.

CA-UTI: Infection in a patient with a catheter in-situ or within 48 hours of catheter removal, as shown by signs or symptoms compatible with UTI with no other identified source of infection, along with 1000 or more colony-forming units per mL of 1 or more bacterial species.

The catheter can be: urethral, condom or suprapubic

2009 Infectious Diseases Society of America (IDSA) guidelines

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CA-UTI defined

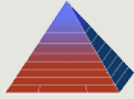


- Bacteriuria = bacteria in the urine
- After 30 days of having a catheter 100% will have bacteriuria
- Bacteriuria is *not* an infection and should not be treated, it represents colonization

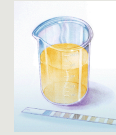
Silverblatt, et al. (2000) Preventing the spread of vancomycin-resistant enterococci in a long term care facility, *JAGS*, 48:1211-1215.
Terpenning, et al.(1994) Colonization and infection with antibiotic-resistant bacteria in a long-term care facility, *JAGS*, 42(10): 1062-1069.

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CA-UTI defined



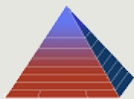
- **Urinalysis**

- A positive leukocyte esterase in combination with positive nitrates strongly suggests a UTI.

- **Urine culture**

- A positive urine culture will show bacteriuria, but that alone is not enough to diagnose a symptomatic UTI. The patient must also have symptoms of a UTI, including fever, suprapubic tenderness or costovertebral angle pain.

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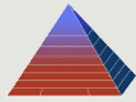


Common s/s of UTI like:
-URGENCY, FREQUENCY AND
DYSURIA

... are voiding symptoms and
**WILL NOT BE PRESENT IN
PATIENTS WITH INDWELLING
URINARY CATHETERS!**

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Classification of CA-UTI

Asymptomatic

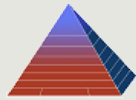
- Not really infection, but colonization
- Asymptomatic bacteruria is universal in patients with long term indwelling urinary catheters
- Antimicrobial therapy will *not* prevent bacteruria or symptomatic infection.

Symptomatic

- 1 of the following with no other recognized causes
 - **Fever (>38C) or hypothermia (<36C)**
 - **Suprapubic tenderness**
 - **Costovertebral angle pain or tenderness**

Fever with hematuria or catheter obstruction has a high probability of being from a urinary source.

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Catheter associated UTIs – not a small problem!

In the United States:

- 25% of hospitalized patients have a catheter
- 40% of hospital-acquired infections are UTIs
- 80% of hospital-acquired UTIs are catheter associated

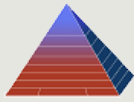


Saint (2000) Clinical and economic consequences of nosocomial catheter-related bacteriuria. *Am J Infect Control.* 28:68-75.

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The biggest risk factor for a UTI...

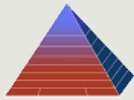
...Having a catheter!

The longer the catheter is in place, the higher the risk for infection

- Single catheterization: 1 - 2%
- Short term (<7 days): 10- 40%
- Long term (>30 days): 100%
- Once catheter is placed, daily incidence is 3-10%
- 10-30% of pts with short-term catheterization (2-4) days develop asymptomatic bacteriuria
- 90-100% of patients who undergo long-term catheterization develop bacteriuria

Kalsi, et al. (2003) Hospital-acquired urinary tract infection. *Int J Clin Pract.* 57(5):388391.

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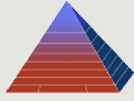


So when is a catheter indicated?

- Acute urinary retention or obstruction (e.g. enlarged prostate)
- Need for accurate measurements of urinary output in critically ill patients
- To assist in healing of open sacral or perineal wounds of incontinent patients
- Patient requires prolonged immobilization (i.e. bone fracture)
- Perioperative...for intra-op patients for accurate input/output measurements, abdominal surgery and C-sections (to empty/collapse the bladder)...usually removed immediately post-op
- Surgical indications like post urethral dilatation in managing strictures, post delivery risk of vesico-vaginal fistula (following obstructed labour)
- Hospice/palliative care

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Examples of inappropriate use of catheters

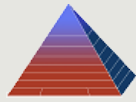
- Urinary incontinence
- Use of diuretics
- Bedrest or decreased mobility
 - Unconscious pts
- Convenience of hospital staff
- For routine monitoring of intake and output
- Physician uncertainty about the patient's medical course

Jain P, Parada JP, David A, Smith LG. Overuse of the indwelling urinary tract catheter in hospitalized medical patients. Arch Intern Med. 1995;155:1425-9.

A little more on why catheters can cause UTIs...

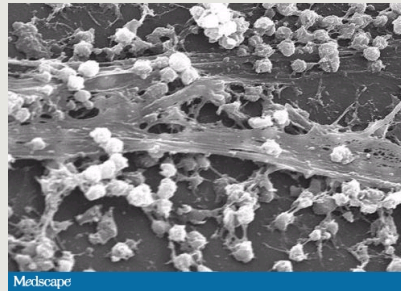
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Biofilms

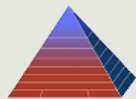
- Micro-organisms colonize the internal surface of catheters and form biofilms
- Organisms can detach from the biofilm and become free-floating which can then lead to symptomatic infection



Electron micrograph depicting round *Staphylococcus aureus* bacteria, with biofilm, the sticky-looking substance woven between the bacteria.

Stokowski, L.A. 2009 Nursing perspectives Preventing Catheter Associated Urinary Tract Infections. Medscape Nurses

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Involved species

- Involved species: enteric pathogens like *E. coli* are most common
- Others: *Pseudomonas* species, *Enterococcus* species, *S. aureus*, coagulase-negative staphylococci, *Enterobacter* species, and yeast.
- *Proteus* and *Pseudomonas* species are the organisms most commonly associated with biofilm growth

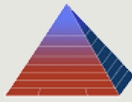


Brusch JL et al. Catheter-Related Urinary Tract Infection. Medscape, 2013.

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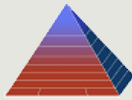


Catheter care affects biofilm formation

- The catheter irritates the urethra and decreases its defense against bacteria
- With decreased defenses, there is a port of entry for infection
- Loss of the protective mucosal layer promotes development of the bacterial biofilm which binds along the catheter wall.

Trautner, B.W., & Darouiche, R.O. (2003). Role of biofilm in catheter-associated urinary tract infection. *American J Infection Control*, 32,177-183.

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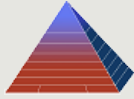
When infections are acquired

- On insertion of catheter
 - Via cross contamination or inadvertent catheterization into the vagina
 - Not ensuring aseptic technique
- Catheter Care
 - Ascending colonization
 - Within the catheter lumen (endoluminal) from the drainage bag
 - Between the catheter and urethra (extraluminal or periurethral)
- Maintenance
- Cross-contamination when emptying drainage bags

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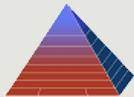
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Other risk factors for CA-UTIs

1. Long duration of catheterization
2. Colonization of drainage bag... leads to ascending infection
3. Diarrhea
4. Diabetes
5. Female gender
6. Errors in catheter care and insertion
7. Immunocompromised patients (e.g. on corticosteroids, symptomatic HIV)

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The risks of catheter-associated UTIs

Bacteremia

- Occurs when bacteria enter the bloodstream

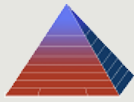
Urosepsis

- Systemic inflammatory response to infection (sepsis) that appears to originate from a urinary tract source
- Patient will have signs and symptoms of SIRS (temperature $>38^{\circ}\text{C}$ or $<36^{\circ}\text{C}$, WBC $>12 \times 10^9$ or $<4 \times 10^9$, RR >20 , HR $>90\text{bpm}$) combined with signs and symptoms of a UTI

Holroyd-Leduc, Sen, Bertenthal, Sands, Palmer, Kresevic, et al. (2007). The relationship of indwelling urinary catheters to death, length of hospital stay, functional decline, and nursing home admission in hospitalized older medical patients. *J American Geriatrics Society*, 55, 227-233.

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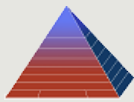


How to prevent catheter-associated UTIs

- Make sure catheter is indicated!
- Follow appropriate infection control strategies
 - Proper catheter insertion
 - Proper catheter maintenance
- REMOVE CATHETER AS SOON AS POSSIBLE!



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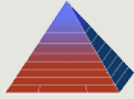
Proper insertion of a catheter

- Personnel
 - Should only be performed by persons trained in the proper insertion of a catheter



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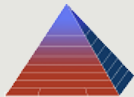


Proper insertion of a catheter

- Aseptic technique
 - Perform hand hygiene immediately before & after catheter insertion or manipulation
 - Use sterile equipment
 - Sterile gloves
 - Sterile drapes
 - Sterile sponges
 - Antiseptic/ sterile solution for periurethral cleaning
 - Single-use packet of lubricant jelly

http://www.cdc.gov/hicpac/cauti/02_cauti2009_abbrev.html

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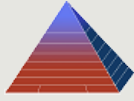
Proper insertion of a catheter

- New England Journal of Medicine -> Videos in Clinical Medicine

<http://www.nejm.org/multimedia/medical-videos>

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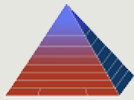
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Step-by-step instructions: catheter insertion

1. Perform **hand hygiene**
2. Perform peri-care
3. **Re-perform hand hygiene**
4. Don sterile gloves
5. Place sterile fenestrated drape over patient
6. Use smallest bore catheter possible that will allow adequate drainage
7. Spread the labia and keep retracted with non-dominant hand until the catheter is inserted.
This hand is now non-sterile

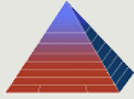
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Step-by-step instructions: catheter insertion

1. With dominant hand, pick up anti-septic soaked cotton wool to cleanse each side of the labia minora using downward strokes & cleanse the meatus.
2. Pick up the catheter 3-4 in (8-10 cm) from the tip & insert into the urethra until urine begins to flow.
3. If the vagina is inadvertently catheterized, **obtain a new sterile catheter**. Leave the first catheter in place as a landmark.

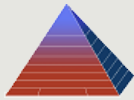
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Step-by-step instructions: catheter insertion

1. If urinary catheter is to be left in place, insert the catheter 1 in (2.5 cm) further into the urethra, then fill balloon.
2. Use water, not saline or air, to inflate the balloon.
3. **Anchor the catheter** tubing to the thigh
4. Place the bag in **dependent position**

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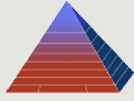
Proper maintenance of a catheter

- Maintain a closed drainage system
 - If breaks in system, replace catheter/ system
- Maintain unobstructed urine flow
 - Free from kinking
 - Place bag in dependent position (below the level of the bladder)
- Empty bag **regularly** (ie EVERY 8 hrs or with volumes >400 mLs)
- Minimize urethral trauma after insertion by stabilizing or anchoring the catheter
 - PROPER PLACEMENT IS KEY!

http://www.cdc.gov/hicpac/cauti/02_cauti2009_abbrev.html

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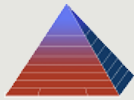
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Proper maintenance of a catheter

- Catheter should be changed if urine is not draining appropriately
 - **DO NOT CHANGE CATHETER OTHERWISE!**
- Use standard precautions during any manipulation of the catheter or collecting system
- Unless clinical indications exist, do not use systemic antimicrobials to prevent CAUTIs
- Gently clean perineal area daily and after each stool with non-deodorant soap & water

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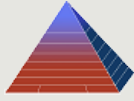


Proper maintenance of a catheter

- **REMOVE CATHETER AS SOON AS POSSIBLE!**
- Perform daily review of need for catheter

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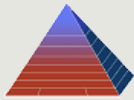
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Managing reduced mobility/ incontinence

- Urinary incontinence predisposes to skin irritation & ulcers
- Absorbent pads, urinals, bedpans, and frequent linen changes can reduce risk
 - May not be available/ possible in some settings
 - Can family be recruited to help with linen changes?
- In many cases, risk of morbidity and mortality from CAUTI will be greater than from ulcer

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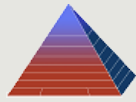


Condom catheters

- Preferable over indwelling urinary catheter because improves patient comfort, minimizes urethral trauma
- Not appropriate for
 - Accurate urine measurement
 - Management of obstruction
- Decreased rate of UTIs compared to indwelling catheters
 - *If patient able to cooperate, minimize catheter manipulation*

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Preventing CAUTIs

- Quality improvement programs
 - Provision of guidelines
 - Adequate education & training
 - Access to appropriate supplies
 - Surveillance

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Our study



Contents lists available at [ScienceDirect](#)

American Journal of Infection Control

journal homepage: www.ajicjournal.org



Major article

A multifaceted intervention to reduce rates of catheter-associated urinary tract infections in a resource-limited setting

L. Gayani Tillekeratne MD^{a,*}, Darren R. Linkin MD, MSCE^{a,b}, Mariah Obino MBBS^c, Afua Omar MBBS^c, Mary Wanjiku MBBS^c, David Holtzman MD, MSc^a, Jennifer Cohn MD, MPH^{a,b}

^a Hospital of the University of Pennsylvania, Philadelphia, PA

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^c School of Medicine, University of Nairobi, Nairobi, Kenya

Key Words:

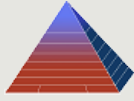
Health care-associated infections
Quality improvement interventions
Developing settings
Infection surveillance and prevention

Background: Health care-associated infections such as catheter-associated urinary tract infections (CAUTIs) are prevalent in resource-limited settings. This study was carried out to determine whether a multifaceted intervention targeting health care personnel would reduce CAUTI rates in a public hospital located in a resource-limited setting.

Methods: A one group, pretest-posttest study was carried out from March to July 2012 in a public district hospital in Nairobi, Kenya. Patients admitted to adult medical wards, and who received urinary catheters,

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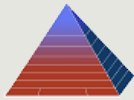


Mbagathi District Hospital, Nairobi

- 169-bed hospital
- Only public district hospital in Nairobi
- Serves an annual 73,783 patients each year



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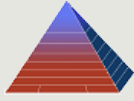
Study aims

- To perform surveillance for CAUTIs at Mbagathi
- To decrease rate of CAUTIs
 - Interventional, quality-improvement study

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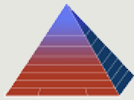
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Study Design

- Study design
 - Longitudinal, time-series study with intervention
 - 4 weeks surveillance → 8 weeks surveillance
 - 1 week intervention → 1 week intervention
 - 4 weeks surveillance → 8 weeks surveillance
- Hospitalized adult patients, March– July 2012, who received a urinary catheter as part of standard care

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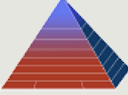
Surveillance definitions

- Indwelling urinary catheter in place at time of collection or w/i 48 hours before
- AND
- At least one of the following signs or symptoms with no other recognized cause
 - fever >38C
 - suprapubic tenderness
 - CVA tenderness
 - frequency/ urgency/ dysuria if cath removed
- AND
- A positive urinalysis demonstrated by at least one of the following:
 - Positive dipstick for LE or nitrite
 - Pyuria
 - Microorganisms seen on Gm stain of unspun urine AND a positive urine culture $\geq 10^3$ and $< 10^5$ CFU/mL with no more than 2 spp

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Intervention

- Didactics/ educational sessions
 - Indications for catheter placement
 - Catheter placement & maintenance
- Reminder signs
- Weekly nurse matron rounds

Prevent UTIs!

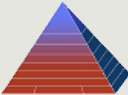


Remove your patient's urinary catheter.

Indications:

1. Acute retention/obstruction
2. Need for accurate I/O's in critically ill patients
3. Assist in healing of open sacral/perineal wounds
4. Patients requiring prolonged immobilization
5. Perioperative use (should be removed in PACU)
6. For comfort in end of life care

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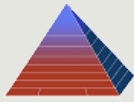


Results

- 125 patients received urinary catheters
 - 82 in the pre-intervention phase
 - 43 in the post-intervention phase
- 77 (61.6%) patients were female
- Mean age was 39.1 years
- Mean duration of admission was 12.6 days
- 79 (71.2%) patients were HIV-infected
- 58.1% died during the hospitalization

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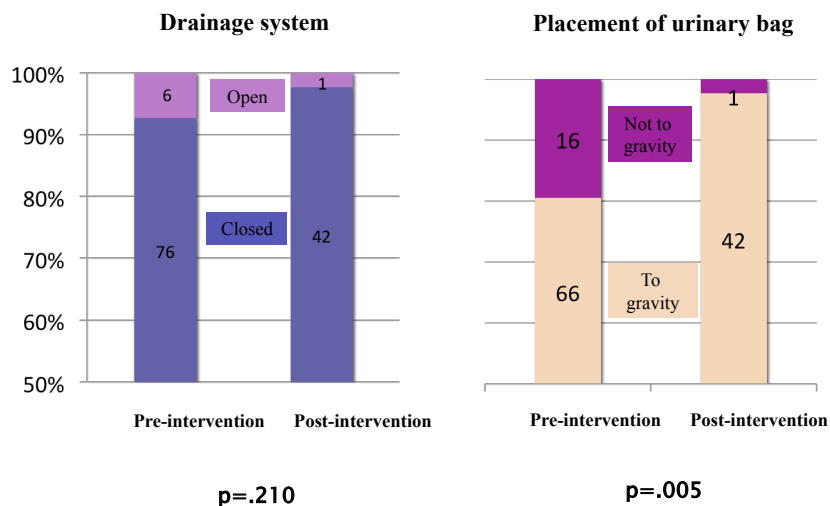


Results

- 13 (10.4%) patients received catheters for guideline-recommended indications
 - urinary retention, need for accurate I/Os
- 20 (17.6%) patients had **incontinence** listed as a reason for urinary catheter placement.
- 114 (91.2%) patients had **decreased mobility** listed as a reason for urinary catheter placement.

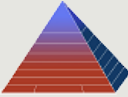
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Results



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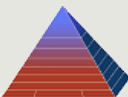


Results

Catheter characteristics in the pre- and postintervention periods with appropriate *P* values

	Preintervention period, n (%)	Postintervention period, n (%)	<i>P</i> value
	N = 82	N = 43	
Indications for catheterization*			
Urinary incontinence	20 (24.4)	2 (4.7)	.003
Urinary retention	3 (3.7)	2 (4.7)	.741
Need for accurate ins/outs	4 (4.9)	1 (2.3)	.434
Open sacral/perineal ulcer	2 (2.4)	1 (2.3)	.975
Decreased mobility	75 (91.5)	39 (90.7)	.850

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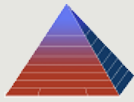


Results

Measure	Pre- intervention period	Post- intervention period	<i>p</i> -value
Mean duration of catheterization	6.9 days	5.6 days	.322
Catheter utilization ratio	0.14	0.09	<.001
Number of CAUTIs	13	0	
CAUTIs per 1000 catheter-days	30.4	0	.002
CAUTIs per 1000 patient-days	4.6	0	.028

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Summary/ conclusions on reducing CAUTIs

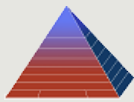
Prevention

- Avoid catheters if at all possible!
- If a catheter is necessary, place it aseptically
- Manage incontinence **without** a catheter -> funding priorities

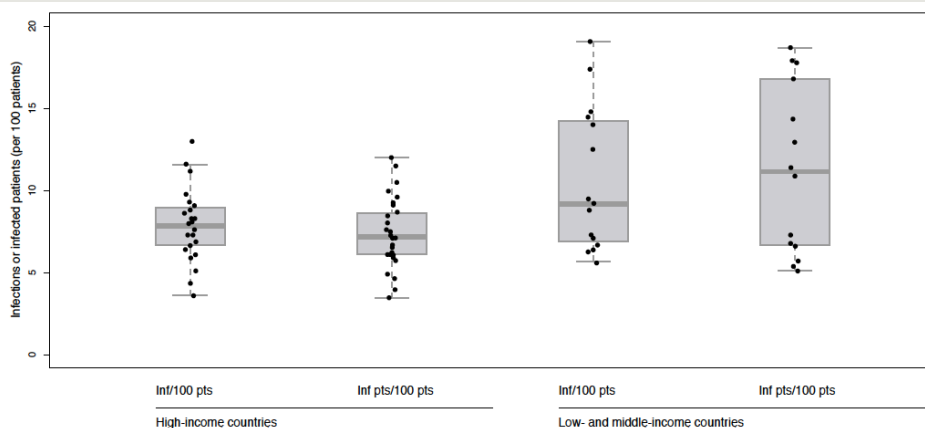
Interventions

- Remove catheters as soon as possible
- Maintain closed systems
- Change bag frequently
- Carefully monitor patients with catheters for any signs of infection
- Perform surveillance for CAUTIs

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HCAI prevalence in high versus low- and middle-income countries, 1995- 2010

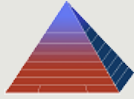


World Health Organization. (2011). The Burden of Health Care-Associated Infection Worldwide.

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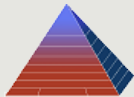


Takeaway

- Preventing CAUTIs is important for ensuring the health of our patients
- Even in resource-limited settings, simple measures can reduce CAUTIs
- Take action today!



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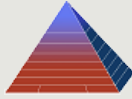
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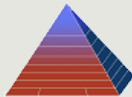


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- <http://www.corporatewellnessmagazine.com/focused/road-to-health/>

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