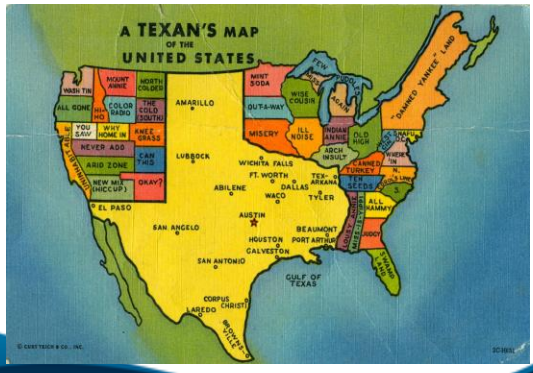
Implementing Effective Infection Prevention in Small Community Settings

Ed Septimus, MD, FACP, FIDSA, FSHEA
Medical Director Infection Prevention and Epidemiology
Professor Internal Medicine Texas A&M College of Medicine
Professor, Distinguished Senior Fellow, School of Public Health, George Mason University

HCA



HCA

Agenda

- Introduction
- Infection Control Approaches
  - Vertical vs horizontal
- Implementation strategies
  - CLABSI
  - CAUTI
  - Behavioral
- Conclusions

HCA

Introduction

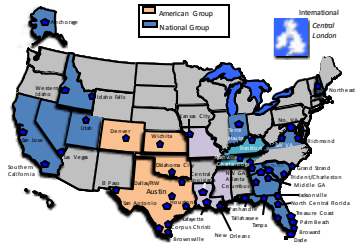
HCA Clinical Snapshot

20 million patient contacts annually

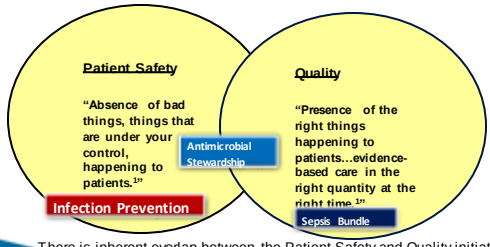
Approximately 5% of major hospital services in U.S.:

- Admissions > 1.5 million
- Patient Days > 7.6 million
- Deliveries > 0.25 million
- Total Surgeries > 1.3 million
- ED Visits > 6.9 million

- 165 Hospitals, 115 Freestanding Surgery Centers, > 550 Physician Practices in 20 states and London
- Hospitals range from complex tertiary referral and academic medical centers to urban and suburban community medical centers
- ~ 215,000 employees, including ~ 72,000 nurses and 30,000 allied health professionals
- > 50,000 affiliated physicians, including > 3,300 employed physicians and practitioners
- More than 38,000 licensed beds



Patient Safety vs. Quality



There is inherent overlap between the Patient Safety and Quality initiatives

Source: Hospitals and Health Networks. Available at:

Healthcare Associated Infections (HAIs)

In 2000, HAIs became a national priority

- 1.7 million HAI cases/year [1]
- 100,000 deaths/year
- Top 10 cause of death in US
- $6.5-10 billion annually [2]
- Most preventable

HCA

1. Klevens et al. Public Health Rep. 2007;122(2):160-6.
2. Zimlichman E, et al. JAMA Intern Med. 2013;173:2039-2046.

Estimated Number of Healthcare-Associated Infections in U.S. Hospitals by Subpopulation and Major Site of Infection, United States, 2002

Major site of infection	Well-baby nursery	High-risk nursery	Intensive care unit (adults and children)	Outside of intensive care units (adults and children)[a]	Unadjusted total	Adjusted total[b]	Percentage
Urinary tract	1,413	2,418	102,200	424,060	530,091	561,667	32
Bloodstream	5,652	14,797	81,942	133,368	235,759	248,678	14
Pneumonia	1,785	4,400	100,689	129,519	236,393	250,205	15
Surgical site	21	967	28,725	244,385	274,098	290,485	22
Other	10,188	10,687	80,732	263,810	365,417	386,090	17
Total	19,059	33,269	394,288	1,195,142	1,641,758	1,737,125	100

[a]See proportions applied from description in Figure.
[b]Adjusted for inclusion of federal hospitals by multiplying non-newborn values by 1.06

HCA

Pub Health Rep 2007;122:160-6

"The greatest danger for most of us is not that our aim is too high and we miss it, but that our aim is too low and we reach it ."

- Michelangelo

HCA

HAI and Cost

HAI Infections[1] (percent)	Estimated Costs[2] ($)	LOS[2] (days)
Pneumonia (21.8)†	40,144(VAP)	13.1
Surgical-site infection (21.8)	20,785	11.2
GI infection ‡ (17.1)	11,285(*C. diff*)	3.3
UTI(12.9)¥	896 (CAUTI)	Not reported
Primary BSI (9.9)§	45,814 (CLABSI)	10.4

† 39.1 % associated with mechanical ventilation

‡ 70.9% *C. difficile*

¥ 67.7 % associated with a catheter

§ 84% associated with a central catheter

Annual cost 9.8 billion

Top 5 HAIs [2]

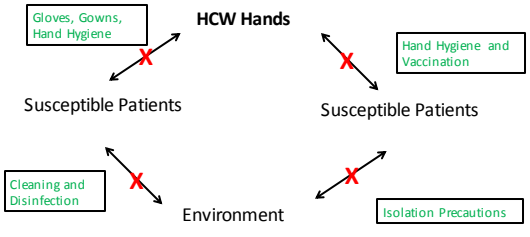
1. *N Engl J Med* 2014; 370:1198-1208
2. *JAMA Intern Med* 2013; 173:2039-2046

Culture change

"Many infections are inevitable; some might be preventable"

"Each infection is potentially preventable, unless proven otherwise"

Infection Prevention: adherence to evidenced-based infection prevention practices + breaking the chain of infection



The Art of the Possible

- **IT IS POSSIBLE to reduce HAIs**
  - 2003: The irreducible minimum by current knowledge: **20%** [1]
  - 2011: The estimated limit of HAI preventability: **55-70%** [2]

CLABSI	65-70%
CAUTI	65-70%
SSI	55%
VAP/VAE	55%

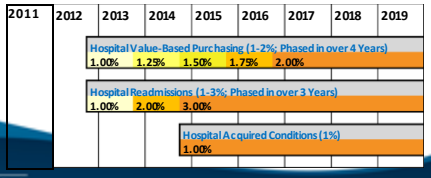
- **We must achieve much more**
  - *C. difficile*
  - Can we eradicate MDROs?
  - Antibiotic stewardship

HCA

[1] Harbarth et al. J Hosp Infect. 2003;54(4):258-66
[2] Umscheid et al. ICHE 2011;32(2):101-114

CMS Linking Federal Reimbursement to Clinical Performance

- CMS is implementing three distinct independent programs that have payment tied to the clinical performance of the hospital.
  - Value –Based Purchasing Program
  - Readmissions Reduction Program
  - Hospital Acquired Conditions Reduction Program



HCA

Original CDC Metrics in Action Plan

Infection	Baseline Period	5-Year Target	Metric Measure	Target SIR or Rate	
Central Line-Associated BSI	2006-08	50% reduction	SIR	0.50	↓
Catheter-Associated UTI	2009	25% reduction	SIR	0.75	↑
Surgical Site Infection	2006-08	25% reduction	SIR	0.75	↓
MRSA Bacteremia (Hospital-based)	2010-11	25% reduction	SIR	0.75	↓
Invasive MRSA Infections (Population-based)	2007-08	50% reduction	Rate	13.5 per 100,000 population	↓
C. difficile Infection	2010-11	30% reduction	SIR	0.70	↑

HCA

2020 HHS HAI 5-Year Action Plan

Infection	Baseline Period	5-Year Target
Central Line Associated BSI	2015	50% Reduction
Catheter-Associated UTI	2015	25% Reduction
Surgical Site Infection Admissions	2015	30% Reduction
MRSA Bacteremia (Hospital-based)	2015	50% Reduction
Invasive MRSA Infection (Population-based)	2007-08	75% Reduction
C difficile Infection	2015	30% Reduction
C difficile Hospitalization (Population-based)	2015	30% Reduction

HCA

Infection Prevention Approaches

HCA

Infection Prevention Approaches

- **Vertical:** Substantially reduces a pathogen specific
  - Active surveillance(e.g. MRSA, *C. difficile*, MDRO)
  - Contact precautions(e.g. MRSA colonization or MRSA, *C. difficile* infection, MDRO)
  - Decolonization (e.g. MRSA)
  - Vaccination (e.g. influenza, Tdap)
- **Horizontal:** Substantially reduces all infections and is not pathogen specific
  - Standard precautions (HH, cough etiquette, PPE, ?universal gloving)
  - Environmental cleaning and disinfection
  - Antimicrobial stewardship
  - **CHG bathing**
  - **Bundles of care** (e.g. CLABSI, SCIP, Vent)
  - Selective digestive tract decontamination
  - **Behavior modification**

HCA

Modified Int J of Infect Dis. 14S4;2010:S3

Decolonization in Academic Adult ICUs

- Multicenter, cluster-randomized, nonblinded crossover trial. Nine intensive care and bone marrow transplantation units in six hospitals were randomly assigned to bathe patients either with no-rinse 2% chlorhexidine–impregnated cloths or with nonantimicrobial washcloths for a 6-month period, exchanged for the alternate product during the subsequent 6 months.
- All units performed active surveillance testing for MRSA and VRE throughout the study period.
- The intervention was associated with a significant reduction in hospital-acquired bloodstream infections (28% lower with CHG *P*=0.007) and reduced acquisition of VRE, but not MRSA
- The effect was greater in patients who were in the unit longer.
- A total of 7727 patients were enrolled during the study.

HCA

N Engl J Med 2013;368:533-42

Decolonization in Academic PICUs

- **10 Pediatric ICUs, 5 academic medical centers, 4957 patients**
  - Randomized cross-over design (6 months each) CHG cloths vs. routine bathing
  - Excluded those with
    - Anticipated LOS ≤ 2 days
    - Lumbar drains
    - Severe skin issues
- **Outcome**
  - Incidence of bacteremia was significantly lower with CHG bathing (*P*=0.044)
  - Bacteremia secondary to a central line was significantly lower with CHG bathing (*P*=.021)

HCA

Lancet. 2013;381:1099-1106

REDUCE MRSA Trial: Randomized Evaluation of Decolonization vs. Universal Clearance to Eliminate MRSA

Targeted versus Universal Decolonization to Prevent ICU Infection

Susan S. Huang, M.D., M.P.H., Edward Septimus, M.D., Ken Kleinman, Sc.D., Julia Moody, M.S., Jason Hickok, M.B.A., R.N., Talisen R. Avery, M.S., Julie Lankiewicz, M.P.H., Adrijana Gombosev, B.S., Leah Terpstra, B.A., Fallon Hartford, M.S., Mary K. Hayden, M.D., John A. Jernigan, M.D., Robert A. Weinstein, M.D., Victoria J. Fraser, M.D., Katherine Haffenreffer, B.S., Eric Cui, B.S., Rebecca E. Kaganov, B.A., Karen Lolans, B.S., Jonathan B. Perlin, M.D., Ph.D., and Richard Platt, M.D., for the CDC Prevention Epicenters Program and the AHRQ DECIDE Network and Healthcare-Associated Infections Program*

- Hospital Corporation of America
- Harvard Pilgrim Healthcare Institute/Harvard Medical School
- University of California Irvine
- Rush University
- CDC Prevention Epicenters Steering Committee

HCA

N Engl J Med 2013;368:2255-2265

Pragmatic Trial

- The clinical staff conducted this quality improvement campaign in the way their unit always have, and this gave them ownership.
- Implementation was led locally by Quality and Infection Prevention teams, with ICU directors and staff with support from senior leadership and the corporate team
- Contributions from nursing, pharmacy, supply chain, microbiology lab, others enabled success
- Generalizable

Cluster Randomized Trial

Randomized hospitals and all their adult ICUs to:

- **Arm 1: Routine Care**
  - Screened all patients; isolated known MRSA+
- **Arm 2: Targeted Decolonization**
  - Screened all patients; isolated if known MRSA+
  - Decolonized if MRSA+
- **Arm 3: Universal Decolonization**
  - No screening; isolated if known MRSA+ or other MDRO
  - Decolonized all

Decolonization Regimens

- **Arm 2: Targeted Decolonization**
  - Nasal mupirocin twice daily for 5 days
  - 2% chlorhexidine cloth baths daily for 5 days
- **Arm 3: Universal Decolonization**
  - Nasal mupirocin twice daily for 5 days
  - 2% chlorhexidine cloth baths daily for ICU duration

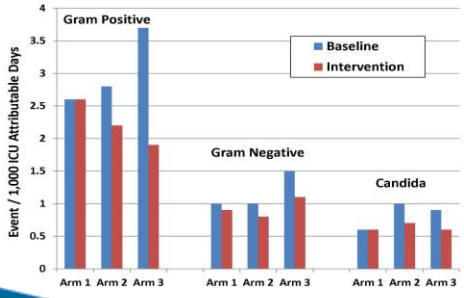
Conclusions for ICU Settings

- Universal decolonization
  - 37% reduction in MRSA clinical isolates
  - 44% reduction in all-cause bloodstream infection
  - Trend in reduction of MRSA bacteremia which was not statistically significant*
  - Required no screening
  - Reduce need for contact precautions
- Targeted decolonization
  - 22% reduction in all-cause bloodstream infection
- **Horizontal vs Vertical Approaches**
  - **Universal better than targeted**

HCA

*trial was powered to have 80% power to detect a 40% reduction in MRSA bacteremia in arm 2 and 60% relative reduction in arm 3

Bloodstream Reduction by Pathogen Type



HCA

Impact on Blood Culture Contamination

Does Chlorhexidine Bathing in Adult Intensive Care Units Reduce Blood Culture Contamination? A Pragmatic Cluster-Randomized Trial

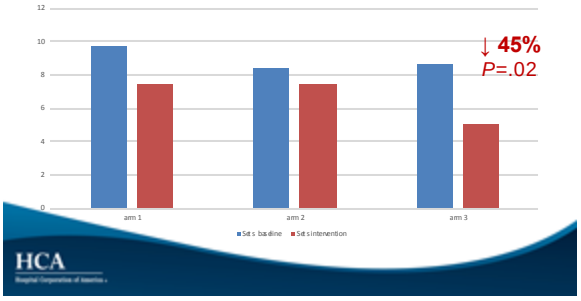
Edward J. Septimus, MD;[1,2] Mary K. Hayden, MD;[3] Ken Kleinman, ScD;[4] Taliser R. Avery, MS;[4] Julia Moody, MS;[3] Robert A. Weinstein, MD;[5] Jason Hickok, MBA, RN;[1] Julie Lankiewicz, MPH;[4] Adrijana Gombosev, BS;[6] Katherine Haffenreffer, BS;[4] Rebecca E. Kaganov, BA;[4] John A. Jernigan, MD, MS;[7] Jonathan B. Perlin, MD, PhD;[1] Richard Platt, MD, MS;[4] Susan S. Huang, MD, MPH[8]

HCA

Infect Control Hosp Epidemiol 2014;35(S3):S17-S22

Blood Culture Contamination Percentage

Logistic regression models demonstrated a significant difference across the arms when comparing the reduction in
contamination between baseline and intervention periods in both unadjusted (*P*=02) and adjusted (*P*=02) analyses.
Arm 3 resulted in the greatest reduction in blood culture contamination rates, with an unadjusted odds ratio (OR) of 0.56 (95% confidence interval [CI], 0.044–0.71) and an adjusted OR of 0.55 (95% CI, 0.43–0.71).



Cost Impact

Cost Savings of Universal Decolonization to Prevent Intensive Care Unit Infection: Implications of the REDUCE MRSA Trial

Susan S. Huang, MD, MPH;[1] Edward Septimus, MD;[2] Taliser R. Avery, MPH;[3] Grace M. Lee, MD, MPH;[3] Jason Hickok, MBA, RN;[4] Robert A. Weinstein, MD;[5] Julia Moody, MS;[4] Mary K. Hayden, MD;[6] Jonathan B. Perlin, MD, PhD;[4] Richard Platt, MD, MS;[5] G. Thomas Ray, MBA[7]

Infect Control Hosp Epidemiol 2014;35:S23-S31

Take Away Points: Cost Impact

- Universal Decolonization was the dominant strategy
  - Lowest intervention costs
  - Lowest total ICU costs
- For every 1,000 admissions, Universal Decolonization
  - Saved $171,000
  - Prevented 9 bloodstream infections
- Lowest cost strategy
  - Across a range of MRSA prevalence
  - Regardless of type of screening (PCR or chromogenic agar)
  - Across a wide range of bloodstream infection costs

Approaches for Preventing Healthcare-Associated Infections: Go Long or Go Wide?

Edward Septimus, MD;[1] Robert A. Weinstein, MD;[2] Trish M. Perl, MD, MSc;[3] Donald A. Goldmann, MD;[4,5] Deborah S. Yokoe, MD, MPH[6]

- Recommendations
  - Use robust quality improvement methods to ensure reliable performance of basic infection prevention practices known to mitigate transmission of MDROs and the infections they cause
  - Ensure adherence to evidence based universally applied HAI prevention strategies including hand hygiene, antimicrobial stewardship, and adequate environmental cleaning
  - Applying other evidence-based, horizontal strategies such as universal decolonization in settings where benefits are likely to outweigh risks and costs
  - Use active surveillance testing and other vertical approaches selectively when epidemiologically important pathogens are newly emerging and rare to a given institution or region or to control outbreaks of specific pathogens

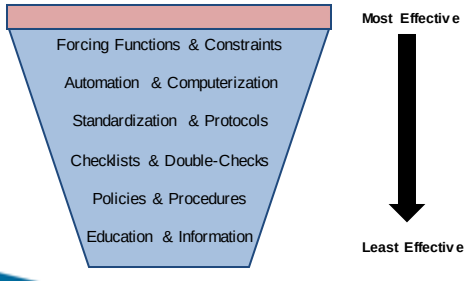
HCA

Infect Control Hosp Epidemiol 2014; 35:797-801

Implementation

HCA

Risk Reduction Strategies



HCA

ISMP Medication Safety Alert! Medication Error Prevention Toolbox from the June 2, 1999 issue

In the beginning

- Assemble the team which should include frontline HCW
- Understand patient safety culture is local
- Engage senior executives who should meet with team regularly
- Review evidenced-based strategies
- Gap analysis
- Action plan-prioritize/tiered approach with timetable
- Teamwork and communication training

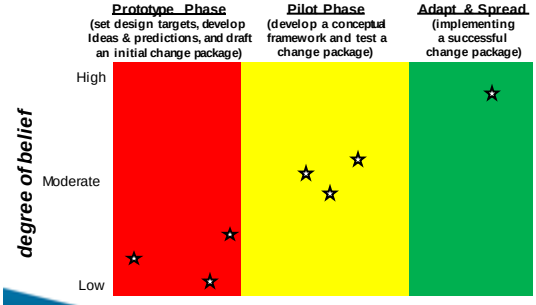
HCA

Implementation continued

- Pilot testing before house wide kickoff
- House wide kickoff
  - Teamwork and communication plan
  - Presentations to stakeholders
  - Workshops/ CME
  - Follow meetings
- Coaching calls
- Site visits

HCA

Degree of Belief in Change Ideas



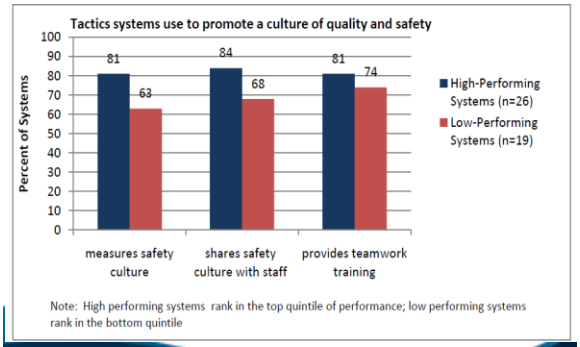
HCA

Selection of Academic/Public Partners

- Shared vision and priorities
- Mutual respect
- Complimentary strengths
- Teamwork and communications

What is the role of *culture* and *teamwork* in improving performance (safety)?

- Culture is the set of beliefs , values and "norms" that shape the way organizations think and act…it's the "way we do things around here."
- You must understand it before successful prevention measures can be implemented.
- Understanding culture improves teamwork, effectiveness, and sustainability is critical independent of resources.



HCA

A Guide to Achieving High Performance
Commonwealth Fund March 2010

Team Success

"The Ultimate difference between a company and its competition is, in fact, the ability to execute."

- Larry Bossidy

One Size Does Not Fit All

Customize based on local culture and resources

HCA

Engaging the Staff in the Work: Building the Team

- Champion(s)
- Supporters
- Leadership

HCA

New Response: Promote Culture Change

- Promote infection prevention, zero tolerance and accountability
  - Reject notion that HAIs are inevitable
  - Demand adherence to evidenced-based infection prevention practices
  - Hold everyone accountable
  - Empower all members of health care team to ensure compliance
  - Does not mean zero HAIs

HCA

AIM for Zero

- Permanent culture change to zero tolerance for all HAIs
- Empowered team members to "speak up" when protocols are not followed
- Includes maintenance bundle in addition to insertion bundle
- Bundles applied house wide not just in ICU
- Across the continuum of care
- Education, Competency and Privileging of Staff, Physicians and LIPs [Licensed Independent Practitioners]
- Strong clinical and executive leadership(corporate and local)

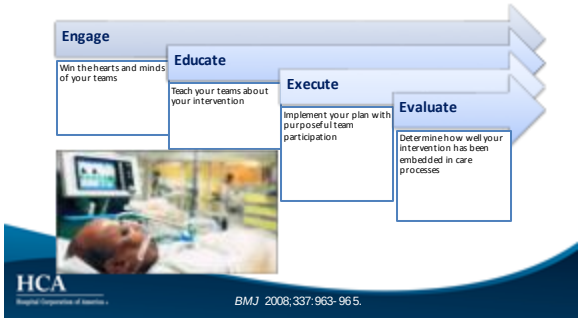
HCA

Different Direction

Contextual journey	Traditional Journey
▪ INSIDE OUT ▪ Observe then define ▪ **Observation for understanding** ▪ Anthropology foundation ▪ Solutions are uncovered, guided by insiders, those directly involved-creates **ownership**	▪ OUTSIDE IN ▪ Define then observe ▪ **Observation for compliance** • Manufacturing foundation ▪ Solutions are pre-defined, guided by outsiders, those indirectly involved-**buy-in**

HCA

4 Es Model for Implementation and Sustainability



HCA

BMJ 2008;337:963-965.

The *Compendium* process

- **Implementation-focused**
- Collaborative effort involving experts in infection prevention and control

SHEA The Society for Healthcare Epidemiology of America · IDSA · CDC · APIC

- Written in partnership with implementation-focused organizations

Pediatric Infectious Diseases Society · NQF National Quality Forum · Society of Critical Care Medicine · The Joint Commission · American Hospital Association · Institute for Healthcare Improvement

HCA

Infect Control Hosp Epidemiol 2014; 35: S1-S178 Infection Prevention and Epidemiology

Recommended strategies

- Two levels of recommendations based on balancing of potential benefits and risks
  - ✓ ***Basic Practices:*** Recommended for all acute care hospitals
  - ✓ ***Special Approaches:*** Strategies to consider if basic practices are in place but there's still a problem based on risk assessment or surveillance data

HCA

Infection Prevention and Epidemiology

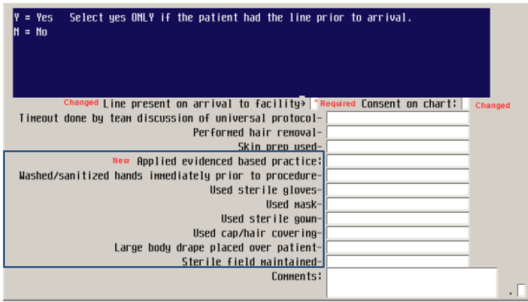
CLABSI

CLABSI Bundle

- Hand washing
- Use maximum sterile barrier precautions during CVP insertion
- Use CHG/alcohol for skin preparation in patients over 2 months of age
- Remove unnecessary lines
- Site selection

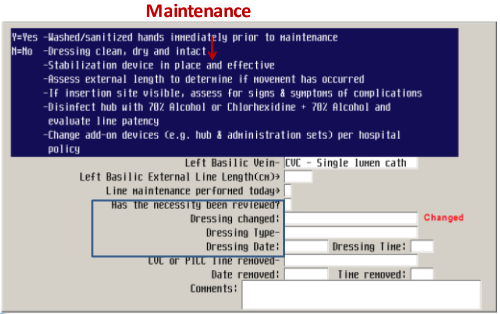
Maintenance BSI Bundle

- Hand washing
- Physician documentation of necessity – prompt removal of unnecessary lines
- Audit tubing, connector, and dressing changes per best practice
- Line site labeled with insertion date and time
- Use CHG/alcohol for site care
- Swabbing port(scrub the hub) with alcohol prior to use


Y = Yes   Select yes ONLY if the patient had the line prior to arrival.
N = No
Changed Line present on arrival to facility› *Required Consent on chart: Changed
Timeout done by team discussion of universal protocol-
Performed hair removal-
Skin prep used-
New Applied evidenced based practice:
Washed/sanitized hands immediately prior to procedure-
Used sterile gloves-
Used mask-
Used sterile gown-
Used cap/hair covering-
Large body drape placed over patient-
Sterile field maintained-
Comments:

HCA

Maintenance

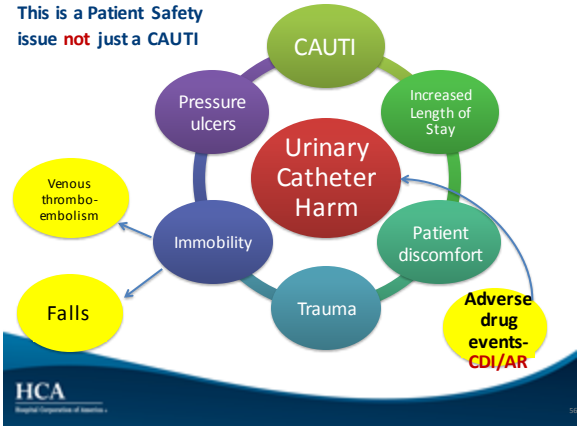

Y=Yes -Washed/sanitized hands immediately prior to maintenance
N=No -Dressing clean, dry and intact
-Stabilization device in place and effective
-Assess external length to determine if movement has occurred
-If insertion site visible, assess for signs & symptoms of complications
-Disinfect hub with 70% Alcohol or Chlorhexidine + 70% Alcohol and evaluate line patency
-Change add-on devices (e.g. hub & administration sets) per hospital policy
Left Basilic Vein- CVC - Single lumen cath
Left Basilic External Line Length(cm)›
Line maintenance performed today›
Has the necessity been reviewed?
Dressing changed: Changed
Dressing Type-
Dressing Date: Dressing Time:
CVC or PICC line removed-
Date removed: Time removed:
Comments:

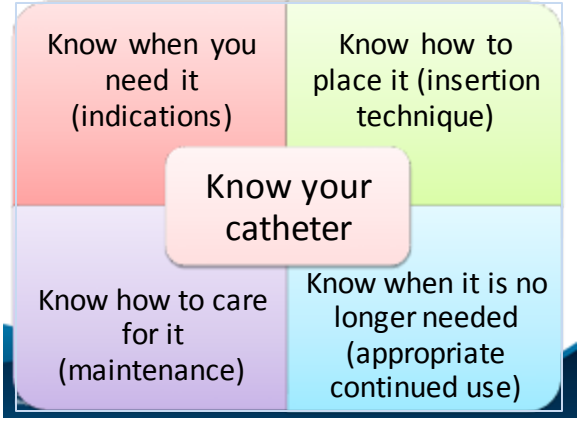
HCA

Bath ICU patients > 2 months of age with CHG on a daily basis quality of evidence I
The role of chlorhexidine bathing in non-ICU patients remains to be determined[1]

HCA

1. Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals: 2014 Update *Infect Control Hosp Epidemiology* 2014; 35:753-771


This is a Patient Safety issue not just a CAUTI
CAUTI
Pressure ulcers
Increased Length of Stay
Urinary Catheter Harm
Venous thrombo-embolism
Immobility
Patient discomfort
Falls
Trauma
Adverse drug events-CDI/AR
HCA


Know when you need it (indications)
Know how to place it (insertion technique)
Know your catheter
Know how to care for it (maintenance)
Know when it is no longer needed (appropriate continued use)

CAUTI Insertion Bundle

- Validate need prior to insertion
  - Hourly assessment of urine output in patients in an ICU.
  - Management of acute urinary retention and urinary obstruction.
  - Perioperative use for selected surgical procedures
  - Assistance in healing of open pressure ulcers or skin grafts for selected patients with urinary incontinence.
  - As an exception, at patient request to improve comfort (e.g., end-of-life care)."
- Consider other methods for bladder management
- Insert urinary catheter using aseptic technique
  - HCW should be educated about appropriate indications for urinary catheterization and procedures for insertion
  - Assure HCW professional competency for insertion and maintenance
  - Hand hygiene
  - Insertion kit with sterile gloves, drape, clean supplies, and sterile catheter
- Do not use antimicrobial/antiseptic-impregnated catheters

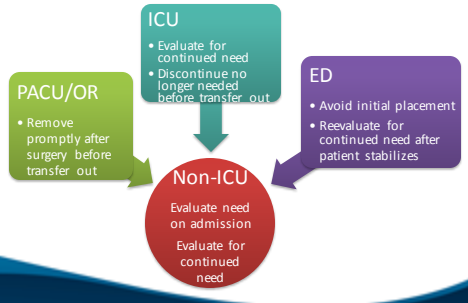
HCA

CAUTI Maintenance Bundle

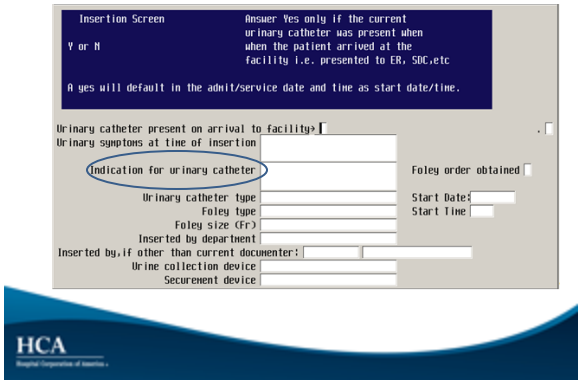
- Daily assessment of need
  - Develop urinary catheter reminders and nurse-driven protocols
- Catheter securement in –place
- Hand hygiene for patient contact
- Daily meatal hygiene with soap and water only
- Drainage bag emptied using a clean container not shared with other patients
- Maintain closed unobstructed flow with drainage bag below bladder and not on floor
- Do not treat asymptomatic bacteriuria in catheterized patients

HCA

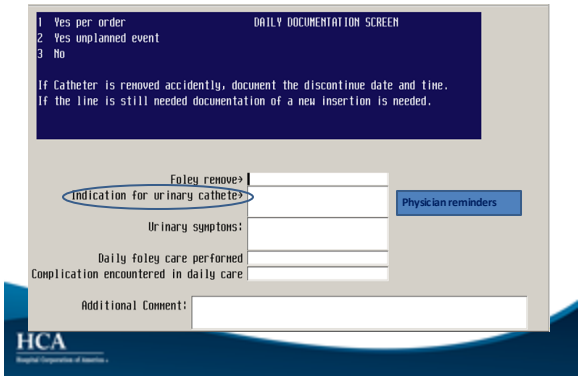
Best Approach is Multidepartmental-Multidisciplinary



HCA



Maintenance



Know when it is no longer needed

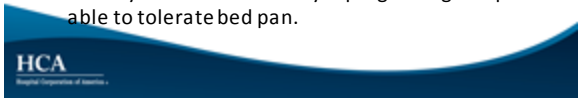
- Nurse-driven removal of no longer needed catheters
  - Pilot study: 45% reduction in unnecessary catheter utilization *Infect Control Hosp Epidemiol* 2008; 29: 815-9
  - Michigan collaborative: 25% reduction in use for 163 units *Arch Intern Med* 2012;172:255-260
  - Computer reminders to physicians plus nurse-driven protocols reduce CAUTIs by 73% *Am J Med Qual.* 2005; 20:121-126
- Most of the units involved were non-intensive care

Physician Reminders

- **Discontinuation Criteria:**
  - If the patient no longer meets criteria for indwelling urinary catheter and no existing urology order to continue catheter exists, then the catheter will be discontinued per the standing protocol.
  - Remove indwelling catheter if the following criteria is/are met:

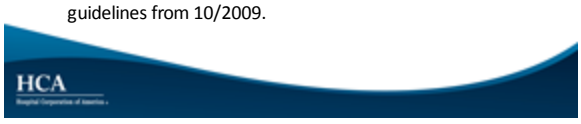
Removal criteria

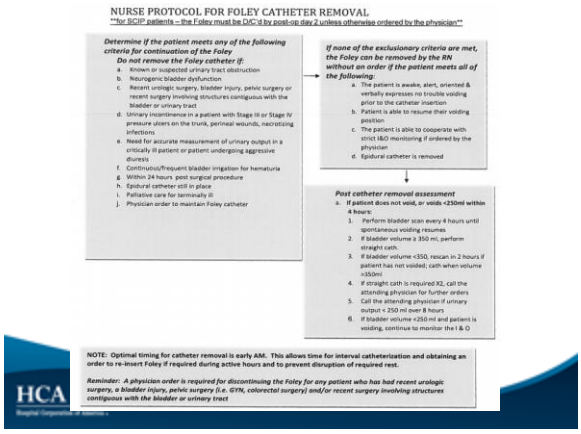
- Repaired hip fracture - within 48 hours post-op.
- Pelvic fracture - patient tolerating bedpan or prior to starting physical therapy.
- Critically ill/Hemodynamically unstable - IV diuretics are changed to PO and patient can tolerate bedpan or change in level of acuity and patient stable for transfer out of ICU/CCU.
- Urinary retention -urinary retention has resolved.
- Dyspnea issues – able to tolerate bed pan.
- Activity Tolerance – activity is progressing and patient able to tolerate bed pan.



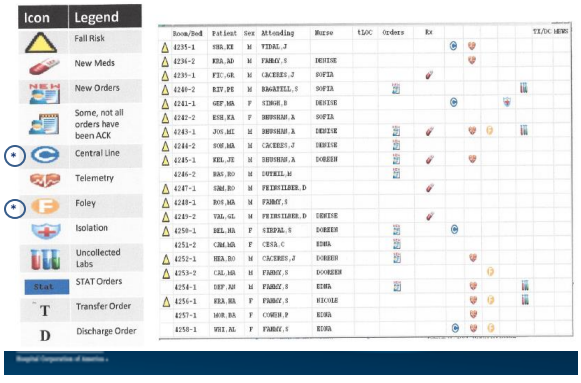
Removal Criteria continues

- Renal/Urology - discontinue as directed by urologist, if anuric discontinue urinary catheter.
- Maternity -24 hours post C-section, unless otherwise instructed by MD.
- Discharge - Evaluate daily for need of urinary catheter. Discontinue 24 hours prior to discharge and evaluate for issues with ability to void so interventions can be instituted prior to discharge.
- Surgical Patients excluding urology, nephrology, colorectal and gynecology – remove on or before post-op day 2 per SCIP guidelines from 10/2009.





Nursing Station Main Tracker



VII's Key Strategies for Success

- Clinical care and patient safety are the health care organization's core competencies and an unrelenting commitment to continuous improvement should be championed and nurtured by Executive Leadership across the continuum of care.
- Patient Safety is everyone's responsibility
- Implementation of evidenced-based recommendations-do not over rely on technology
- Improvement of the safety and teamwork culture in healthcare is critical

HCA

VII's Key to Success continued

- Collaboration and teamwork between all levels of the organization and across the continuum of care (generate light not heat)-shared learning-horizontal integration
- Small tests and adapt change over time-celebrate success
- Use of reliable data to assess impact and provide feedback to clinicians . Success cannot be demonstrated unless we define it, measure it, and reward it.

HCA

- **People change because of love for something- a deep emotional involvement**
- **The best incentive for our employees is being the best**
- **The burning platform is always *inside* people**
- **Motivation to improve comes from knowledge and inspiration, not orders**

Goran Henriks
chief learning and innovation
Jonkoping, Sweden

HCA

Infection Prevention Team

From left: Ed Septimus, Julia Moody, Chris Bushe Sara Bienvenu Jason Hickok

HCA