Central Line Associated Bloodstream Infection Prevention

Last updated 2017

Basics of Infection Prevention
Healthcare-Associated Infections Program
Center for Health Care Quality
California Department of Public Health

Objectives

- Describe the etiology and epidemiology of central line associated bloodstream infections (CLABSI)
- Identify patients at risk for CLABSI
- Review evidence-based CLABSI prevention care practices
- Discuss adherence monitoring and feedback

CLABSI Prevention Objectives

- National 2020 Target Goal: Reduce CLABSI by 50% from 2015 baseline
  - Recommended for adoption in California hospitals by the CDPH HAI Advisory Committee
- Centers for Medicare and Medicaid Services (CMS) Value-Based Purchasing
  - Reduce payments for hospitals ranking among the lowest-performing 25 percent

National Action Plan for Prevention of HAI, 2013:
https://health.gov/hcq/prevent-hai.asp

CMS Hospital Value-Based Purchasing:
https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier2&cid=1228772039937

CLABSI Prevention – What works?

Best sources for **evidence-based CLABSI prevention practice** recommendations

- **CDC Guidelines** for the Prevention of Intravascular Catheter-Related Infections, **2011**
- CDC **Checklist** for CLABSI Prevention of CLABSI
- **SHEA/IDSA** Strategies to Prevent Central Line-Associated BSI Acute Care Hospitals, **2014**

Central Line

- Intravascular catheter that terminates at or close to the heart or one of the great vessels
- Used for infusion, withdrawal of blood or hemodynamic monitoring
- Multiple types
  - Nontunneled (subclavian, jugular)
  - Peripherally inserted central catheters (PICCs)
  - Tunneled (Broviac, Hickman, Groshong)
  - Dialysis catheter (Quinton)
  - Implanted ports (Permacath)

  (Midline catheters are not central lines)

NHSN Patient Safety Module: Chapter 4

CLABSI Pathogenesis

Common mechanisms

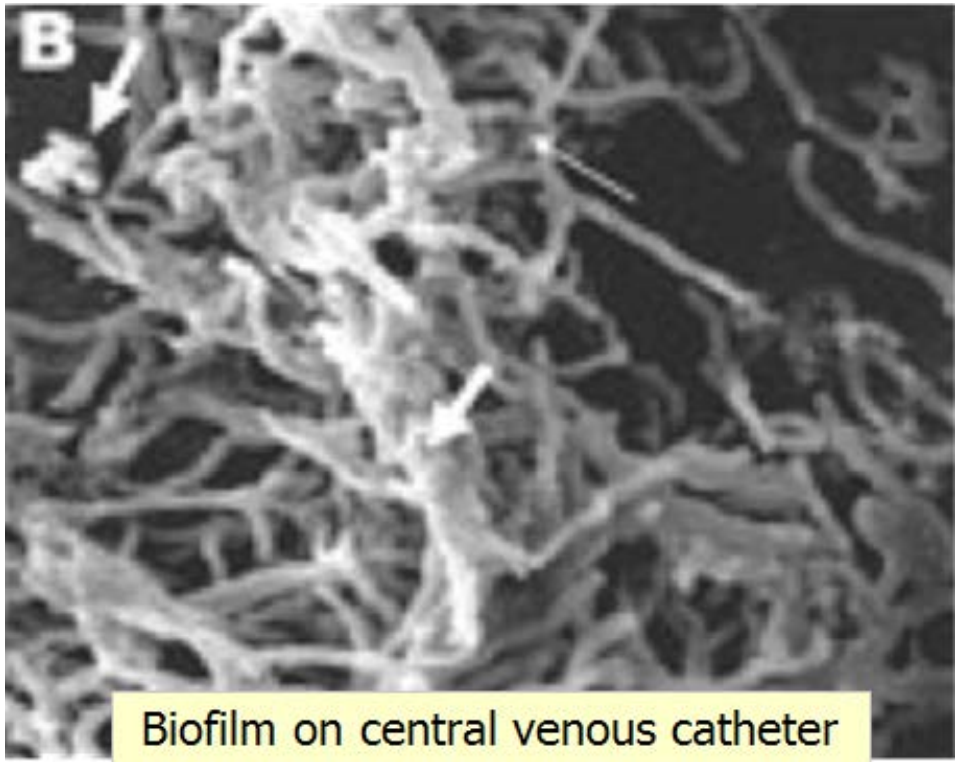
- Extraluminal contamination
  - Pathogens migrate on external surface of catheter
  - CLABSI in early period following insertion, < 7 days
- Intraluminal contamination
  - Pathogens migrate along internal surface
  - CLABSI more common >7 days
  - Access port contamination

Less common mechanisms

- Hematogenous seeding from another source
- Contaminated infusates

Biofilms

- Complex aggregation of microorganisms growing on a solid substrate
- Form on catheter surfaces
- Contribute to CLABSI risk



Biofilm on central venous catheter

Common CLABSI Pathogens

• Coagulase-negative Staphylococci	16%
• *Staphylococcus aureus*	13%
• *Klebsiella (pneumoniae/oxytoca)*	8%
• *Enterococcus faecalis*	8%
• *Enterococcus faecium*	7%
• *Candida albicans*	6%

Distribution of Pathogens Reported to NHSN by HAI Type, 2015:
https://www.cdc.gov/nhsn/xls/reportdatatables/2014-appendix-pathogens.xlsx

CLABSI Risk Factors

- Multiple catheters
- Catheters with multiple lumens
- Emergency insertion
- Prolonged duration
- Prolonged hospital stay prior to line insertion
- Excessive line manipulation
- Neutropenia
- Prematurity
- Total parenteral nutrition
- **Hemodialysis**

Hemodialysis

- Catheters (specifically, central lines) are the most common cause of BSI in dialysis patients
  - 7X higher CLABSI risk than arteriovenous fistulas or grafts

Vascular Access Type	Rate (per 100 patient-months)
AV fistula	0.26
AV graft	0.39
Other vascular access type	0.67
Central venous catheter	2.16

- Include hemodialysis providers **and contractors** in CLABSI prevention education and competency programs

Can You Modify CLABSI Risk?

Modifiable Risk Factors	Higher CLABSI Risk	Lower CLABSI Risk
Insertion circumstances	Emergency insertion	Elective insertion
Skill of inserter	General clinician	Specialized (e.g., PICC team)
Insertion site	Femoral	Subclavian
Skin antisepsis	Alcohol (and povidone iodine)	Chlorhexidine (lowest risk)
Catheter lumens	Multilumen	Single lumen
Duration of use	Temporary (non-tunneled) catheters (including PICC) left in place long-term	Dialysis fistula (lowest risk) or permanent (tunneled) catheter when long-term use expected
Barriers for insertion	Anything less than maximal	Maximal

CDC / HICPAC Guidelines for the Prevention of Intravascular Catheter Infections, 2011: https://www.cdc.gov/hai/pdfs/bsi-guidelines-2011.pdf

HAI Prevention Practice Terms

Core / Basic Care Practices

- **Standard of practice**
- Based on higher levels of scientific evidence
- Demonstrated feasibility
- **Effectiveness depends on consistency**

Special Approaches

- Used **in addition to Core/Basic** care practices when HAI rates remain high or during outbreaks
- Based on some scientific evidence
- May not be feasible in all settings

CLABSI Prevention – What Works?

- Proper line insertion practices (CLIP)
- Proper line maintenance
- Competency education of clinical staff
- Adherence monitoring and feedback of prevention care practices

Prevention "Bundle"

- A group of practices with high-level clinical evidence of effectiveness
- When applied together, improvements are synergistically greater
- Benefits of bundle adoption
  - Minimize practice variation among health care providers
  - Adherence to a set of recommendations is enhanced
  - Able to measure adherence

The whole is greater than the sum of its parts!

Central Line Insertion Practices (CLIP) Bundle

Prepare

1. All-inclusive catheter cart/kit
2. Optimal catheter site selection – avoid femoral

Insert

1. Hand hygiene
2. Maximal barrier precautions
3. Chlorhexidine skin antisepsis
4. Daily review of line necessity

Empower all providers to stop the insertion if improper insertion practice observed

Institute of Healthcare Improvement CLABSI Bundle, 2009: http://app.ihi.org/imap/tool/processpdf.aspx?processGUID=e876565d-fd43-42ce-8340-8643b7e675c7

CLIP – Hand Hygiene

For central line insertion, perform hand hygiene

- Before and after palpating catheter insertion sites
  - Do not palpate insertion site after applying antiseptic unless aseptic technique maintained
- Before and after inserting, replacing, accessing, repairing, or dressing a catheter
- When hands obviously soiled or contamination suspected
- Before and after invasive procedures
- Between patients
- Before donning and after removing gloves

CLIP - Maximum Barrier Precautions

- Cap, mask, sterile gown and gloves worn by the line inserter and assistant
- Patient covered from head to toe with sterile drape with small opening for insertion site

CLIP – Chlorhexidine Skin Antisepsis

- Perform skin antisepsis just prior to line insertion using a skin antisepsis containing chlorhexidine
- Allow time to dry completely before puncturing site

CLIP – Optimal Catheter Site Selection

- Select lower risk insertion site if possible
- Subclavian vein preferred for non-tunneled catheters in adults

CLIP – Daily Review of Line Necessity

- Perform daily review of central line necessity (and document in patient record)
  - Appropriate use examples include chemotherapy, extended antibiotic course, hemodialysis, total parenteral nutrition
- Promptly remove unnecessary lines
  - Risk of infection increases with duration of line

Central Line Care and Maintenance

- Adopt a central line maintenance bundle
- Perform hand hygiene when replacing, accessing, repairing, or dressing a catheter
- Disinfect hub and access port before each use
  - Only use sterile devices to access catheters
- Monitor adherence to
  - Daily review of line necessity
  - Prompt removal of central lines
  - Accessing the line using “scrub-the-hub” practices
  - Catheter site care and dressing practices

CLABSI Prevention Special Approaches

If CLABSI rates high or have not decreased to established goals despite consistent use of core practices

- Perform daily chlorhexidine bathing (2% solution) in select populations, e.g., ICU
- Consider using antimicrobial-impregnated catheter If line is expected to be in >5 days
- Cover insertion site with chlorhexidine-impregnated dressings
  - Shown to decrease CLABSI rates in some studies, not in others

Measuring Prevention

Requires monitoring for

Adherence with practices known to reduce infections

- **Process** measure

Changes in CLABSI incidence

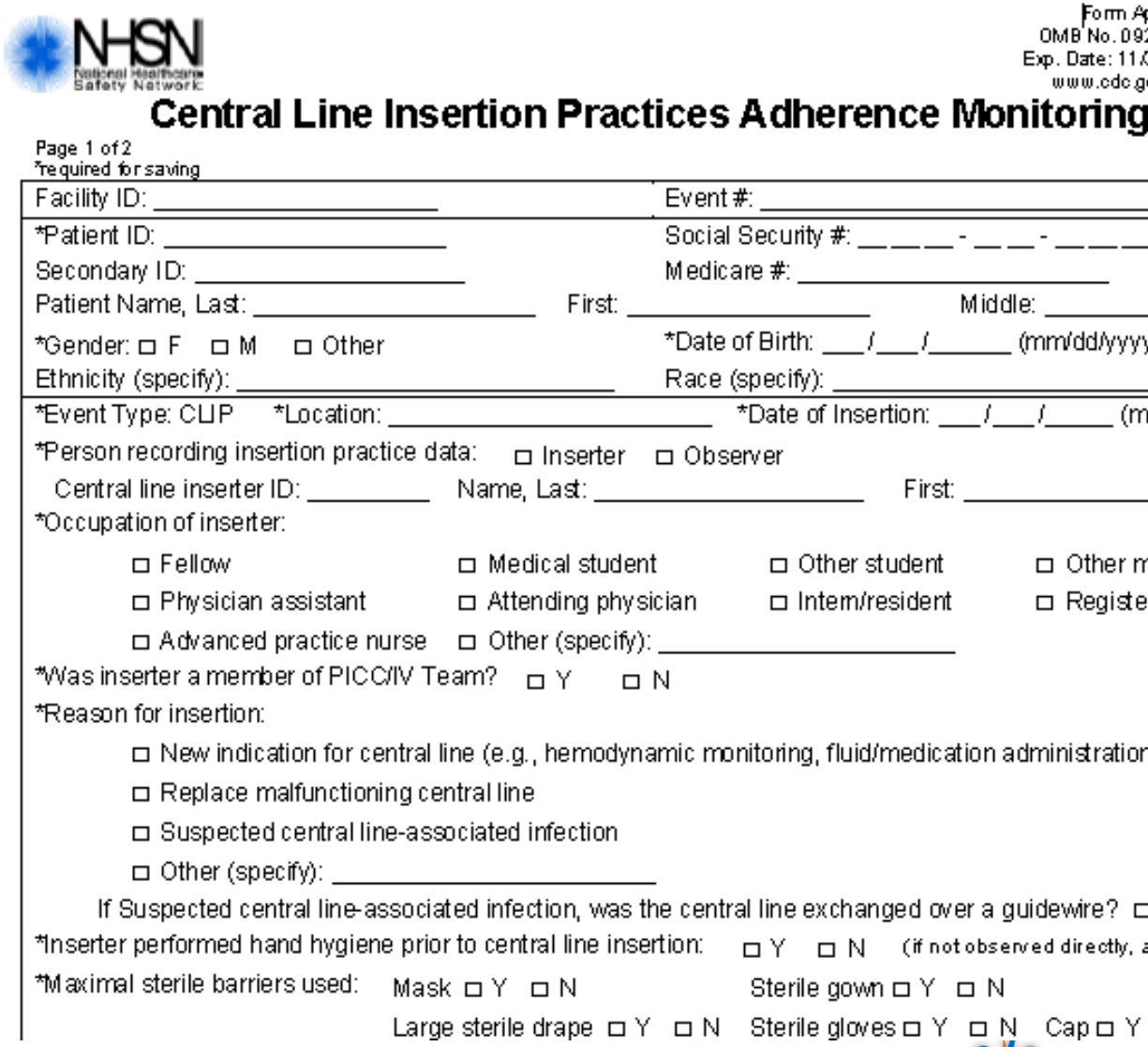
- **Outcome** measure

Facility Role in CLABSI Prevention

- Ensure policies and practices reflect current evidence based recommendations
  - CDC and SHEA/IDSA guidelines
- Ensure staff competency upon hire and at least annually
  - New hire orientation
  - Annual skills fair
  - Return demonstration to ensure competency
- Perform surveillance and adherence monitoring of care practices
  - Use tools to measure adherence
- Provide feedback to frontline staff and leaders
  - Present adherence results with CLABSI incidence to each unit

Monitoring Central Line Insertion

- If patient develops CLABSI, especially within 7 days after insertion, assess CLIP adherence
- If high CLABSI, monitor CLIP in all locations where lines are inserted, including OR and interventional radiology



NHSN National Healthcare Safety Network

Form A
OMB No. 09
Exp. Date: 11/
www.cdc.g

Central Line Insertion Practices Adherence Monitoring

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Facility ID: _____ Event #: _____

*Patient ID: _____ Social Security #: ___-___-____

Secondary ID: _____ Medicare #: _____

Patient Name, Last: _____ First: _____ Middle: _____

*Gender: ☐ F ☐ M ☐ Other *Date of Birth: ___/___/_____ (mm/dd/yyyy

Ethnicity (specify): _____ Race (specify): _____

*Event Type: CLIP *Location: _____ *Date of Insertion: ___/___/_____ (m

*Person recording insertion practice data: ☐ Inserter ☐ Observer

Central line inserter ID: _____ Name, Last: _____ First: _____

*Occupation of inserter:

☐ Fellow ☐ Medical student ☐ Other student ☐ Other m
☐ Physician assistant ☐ Attending physician ☐ Intern/resident ☐ Registe
☐ Advanced practice nurse ☐ Other (specify): _____

*Was inserter a member of PICC/IV Team? ☐ Y ☐ N

*Reason for insertion:

☐ New indication for central line (e.g., hemodynamic monitoring, fluid/medication administration
☐ Replace malfunctioning central line
☐ Suspected central line-associated infection
☐ Other (specify): _____

If Suspected central line-associated infection, was the central line exchanged over a guidewire? ☐

*Inserter performed hand hygiene prior to central line insertion: ☐ Y ☐ N (if not observed directly, a

*Maximal sterile barriers used: Mask ☐ Y ☐ N Sterile gown ☐ Y ☐ N

Large sterile drape ☐ Y ☐ N Sterile gloves ☐ Y ☐ N Cap ☐ Y

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Monitoring Central Line Access Maintenance

Observation	Patient 1		Patient 2		Adherence by Task # Yes	Adherence by Task # Obs
Supply kit is used for central line dressing changes.	(Yes)	No	(Yes)	No	2	2
Hand hygiene performed before **and** after manipulating the catheter (regardless of glove use).	Yes	(No)	Yes	(No)	0	2
Wet, soiled, or dislodged dressings are changed promptly.	(Yes)	No	(Yes)	No	2	2
Need for line assessed daily by a practitioner, with prompt removal of unnecessary lines.	(Yes)	No	Yes	(No)	1	2
Scrubbing method is used during dressing change when applying CHG to the insertion site.	(Yes)	No	Yes	No	1	1
Dressing is changed with aseptic technique, using clean gloves to remove the old dressing and sterile gloves when applying the new dressing.	(Yes)	No	Yes	No	1	1
The access port or hub is scrubbed immediately prior to each use with the appropriate antiseptic.	Yes	No	(Yes)	No	1	1
Antiseptic-containing protector caps are utilized for all line connectors if it is facility policy.	Yes	No	Yes	No	Not Policy	
The catheter is accessed with only sterile devices.	Yes	No	(Yes)	No	1	1
Daily bathing with a 2% CHG solution is done if facility policy.	(Yes)	No	(Yes)	No	2	2

Total # Yes 11 Total # Observations 14 #Yes/#observations x 100= 79% Adherence

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Monitoring Central Line Dressing Maintenance

Central Line Maintenance Practices	Patient 1		Patient 2		Adherence by Task	
					# Yes	# Observed
Central line insertion date is documented.	Yes	No	Yes	No	2	2
Dressings wet, soiled, or dislodged are changed promptly.	Yes	No	Yes	No	2	2
Need for the line assessed daily by a practitioner, with prompt removal of unnecessary lines	Yes	No	Yes	No	0	2
Optimal site selected, avoid femoral site in adult patients.	Yes	No	Yes	No	2	2
Sterile gauze, sterile transparent or sterile semi-permeable dressing used to cover the catheter site is in place for ≤ 7 days (Mark "No" if no date on the dressing.)	Yes	No	Yes	No	0	2
Antiseptic-containing protector caps are utilized for all line connectors if facility policy.	Yes	No	Yes	No	2	2
A CHG-impregnated sponge applied at insertion site	Yes	No	Yes	No	2	2
Tubing and administration set have been in place for ≤ 7 days. (Mark "No" if no date on dressing.)	Yes	No	Yes	No	0	2
TPN/Lipids: tubing dated to ensure change every 24 hours.	Yes	No	Yes	No	None	Today
Daily bathing with a 2% CHG solution is done if facility policy.	Yes	No	Yes	No	1	2
Total # Yes 11	Total # Observations 18		#Yes/#observations x 100= 61 % Adherence			

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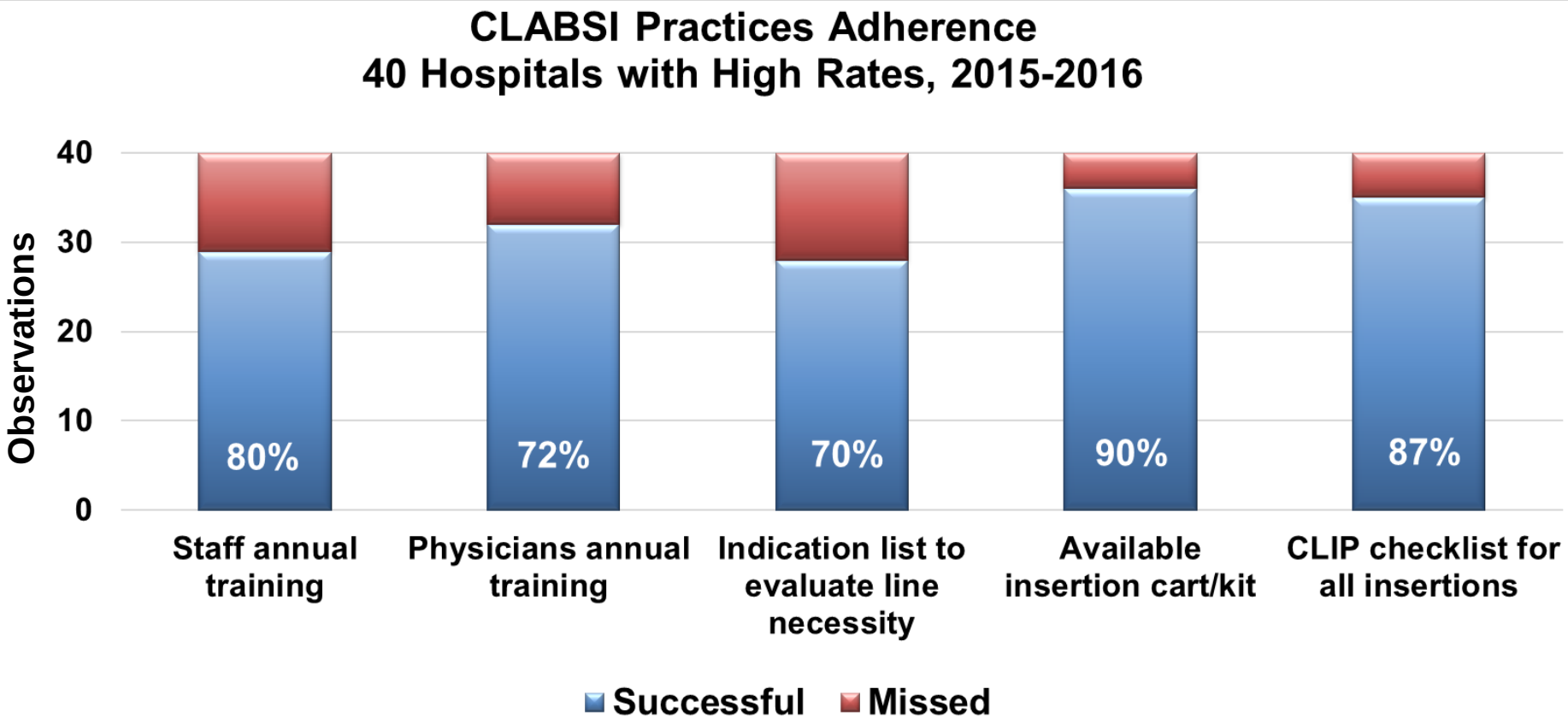
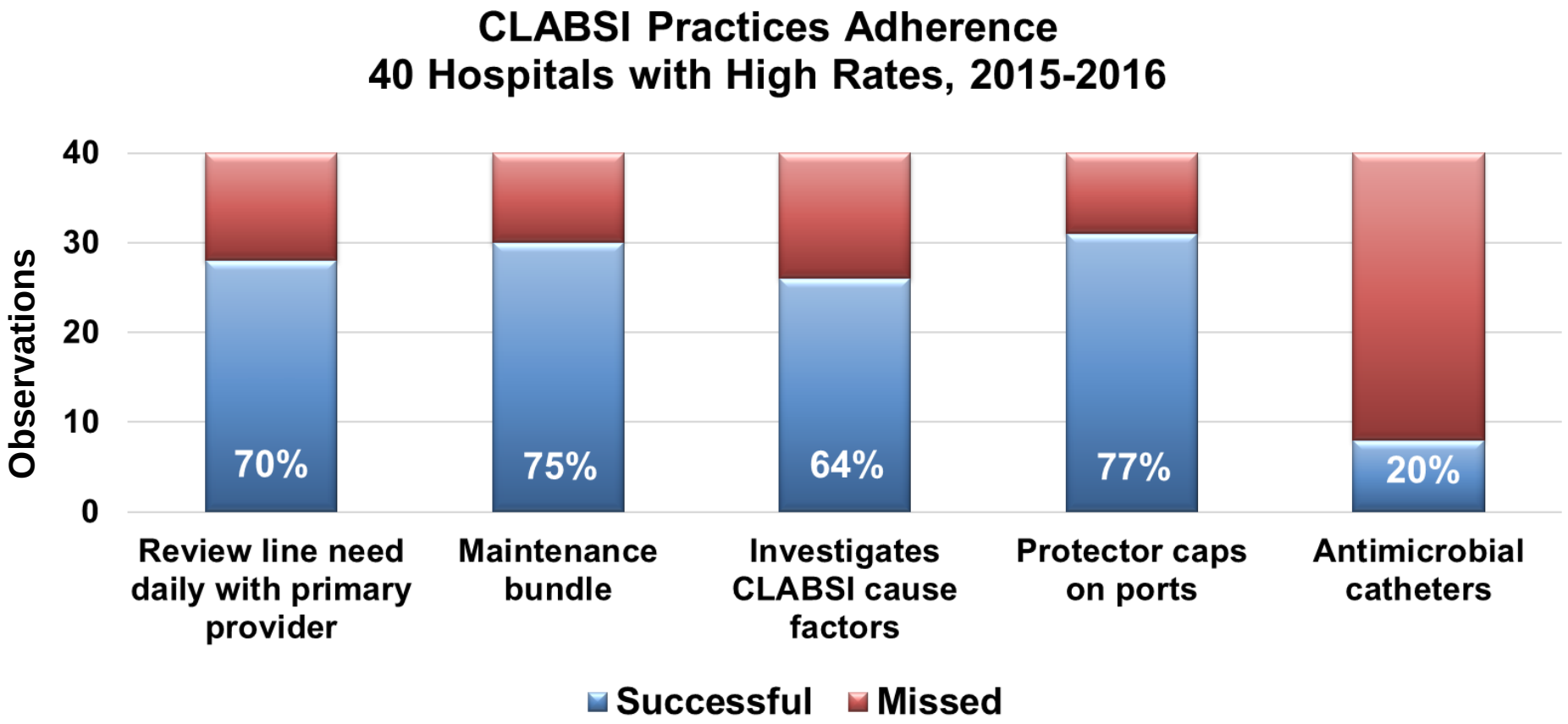

CLABSI Practices Adherence
40 Hospitals with High Rates, 2015-2016
Observations
40
30
20
10
0
80%
72%
70%
90%
87%
Staff annual training
Physicians annual training
Indication list to evaluate line necessity
Available insertion cart/kit
CLIP checklist for all insertions
Successful
Missed


CLABSI Practices Adherence
40 Hospitals with High Rates, 2015-2016
Observations
40
30
20
10
0
70%
75%
64%
77%
20%
Review line need daily with primary provider
Maintenance bundle
Investigates CLABSI cause factors
Protector caps on ports
Antimicrobial catheters
Successful
Missed

CLABSI Practice Observations
40 Hospitals with High Rates, 2015-2016

	# Observations	Adherence
Line insertion	**8**	**93%**
Line maintenance	**206**	
Insertion date documented		**81%**
Hand hygiene before/after even if gloves worn		**70%**
Clean, dry, intact dressing		**93%**
Daily line assessment, prompt removal		**99%**
Avoid femoral site		**95%**
CHG sponge at insertion site		**96%**
Daily CHG bath if hospital policy		**55%**

Preventing CLABSI: The MOST Important Things

Prevent Early- and Late-Onset CLABSI

- ❑ **Provide list of indications** for central line
- ❑ **Education** of HCP inserting or caring for central line
- ❑ **Bathe** ICU patients with CHG daily
- ❑ **Adhere** to infection prevention practices at insertion (CLIP)
- ❑ **Use all-inclusive** catheter cart/kit
- ❑ **Use Ultrasound** guidance for insertion
- ❑ Use **alcoholic CHG skin prep**
- ❑ **Disinfect hub** before accessing central line
- ❑ **Remove** nonessential catheters
- ❑ **Change** transparent dressings and site care with CHG every 5-7 days or if soiled
- ❑ **Replace** administration sets not used for blood product or lipids no longer than every 4 days (96 hours)
- ❑ **Use antimicrobial ointment** for hemodialysis catheter insertion sites
- ❑ **Perform CLABSI surveillance**

Questions?

For more information,
please contact any
HAI Liaison IP Team member

Or email
HAIProgram@cdph.ca.gov