



February 12<sup>th</sup>, 2019

Whitney Ficocello, RN, BSN, PHN

# Clinically-Indicated Peripheral Vascular Access Care and Maintenance:

*Addressing current standards with evidence-based practice*

# Disclosure

- Whitney Ficocello, RN, BSN, PHN
- Employed within 3M's Medical Solutions Division as an Advanced Technical Service Engineer
- Employed with Fairview Health Services

# Learning Objectives

1. Identify current clinical standards addressing peripheral vascular care
2. Discuss clinical challenges associated with peripheral catheter maintenance that can impact outcomes
3. Describe recommended practices and evidence based interventions for peripheral catheter maintenance
4. Identify potential solutions to address these challenges and clinical studies that support these solutions

A row of monarch butterfly pupae and adults hanging from a surface. The pupae are on the left, and the adults are on the right. The background is a dark, textured surface.

# Peripheral IV Removal: Times are Changing

What is your facility protocol for PIV removal?



# Peripheral Vascular Catheters<sup>4-5, 62</sup>

The number of peripheral intravenous catheters sold in the US is estimated to be greater than **330 million**

The **Peripheral Vascular Catheter** is the most common vascular access device used in healthcare

Greater than **90% of hospitalized patients** have a VAD

Average cost to insert a catheter is **\$25-35** each time

**35-50%** of peripheral vascular catheters fail before the intended dwell time is complete

PIV insertion is perceived as a simple procedure when it is, in fact, technically difficult and **INVASIVE**



# Historical Practice Standards & Guidelines<sup>2-3, 62</sup>

**Common Policy:** Short peripheral catheter sites are replaced every 72-96 hours

- Thought to reduce the risk of phlebitis and infection.
- Decrease patient discomfort related to phlebitis.
- Minimal evidence to support removing as indicated vs planned removal.

## Consequences

- Pain and discomfort with new insertion attempts
- Increased healthcare costs



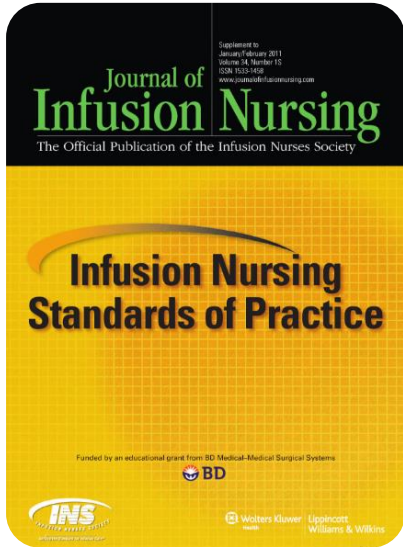
# Historical Practice Standards & Guidelines<sup>61-62</sup>

## Dwell Time Increases

**Centers for Disease  
Control and Prevention  
(2002)**

- Recommend dwell time for PIV catheters be increased from 72 to 96 hours
- No substantial evidence to maintain 72 hour removal
- Potential cost savings of \$168/day or \$61,200 per year

# Historical Practice Standards & Guidelines<sup>1-2</sup>



## Infusion Nurses Society, 2011

- Consider replacement of the PIV when clinically indicated...The decision to replace the short peripheral catheter should be based on assessment of the patient's condition.
- Do not routinely replace in pediatrics

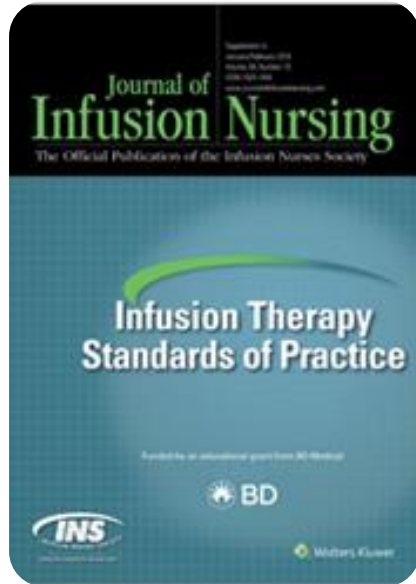
## Centers for Disease Control, 2011

- There is no need to replace peripheral catheters more frequently than every 72-96 hours to reduce risk of infection and phlebitis in adults
- Replace PIVs in children only when clinically indicated.





# Current Practice Standards & Guidelines<sup>2, 12</sup>



## Infusion Nurses Society, 2016

- Remove PIV if it is no longer included in the plan of care or has not been used for 24 hours or more.
- Remove PIV when clinically indicated, based on findings from site assessment and/or clinical signs and symptoms of systemic complications



## Centers for Disease Control, 2011

- There is no need to replace peripheral catheters more frequently than every 72-96 hours to reduce risk of infection and phlebitis in adults
- No recommendation is made regarding replacement of peripheral catheters in adults only when clinically indicated (Unresolved issue)
- Replace PIVs in children only when clinically indicated.



# Peripheral IV Catheter Failure

- Are you tracking the number of attempts for PIV insertions?
- Are you tracking PIV related complications?

# Peripheral Vascular Catheters<sup>6-8</sup>



Average cost to insert  
a short term PIV in US  
between  
**\$28 and \$35**  
(first-stick insertions)

## Costs can vary significantly

- Number of attempts
- Products used
- Supportive technologies used
  - stabilization devices
  - skin protectant
  - dressing type
  - needleless connectors type
  - tubing/extension set type
  - etc.

If not successful first time,  
then cost increases with  
removing, and reinserting.



With each failure, the risk  
of failure with each  
subsequent catheter is  
progressively increased

# Complication rates of PIVCs<sup>5</sup>

Catheter-Related  
Phlebitis

15.4 %

Catheter  
Infiltration

23.9 %

Catheter  
Occlusion/  
Mechanical  
Failure

18.8 %

Catheter  
Dislodgment

6.9 %

Catheter-Related  
BSI (up to)

0.2 %

---

Overall Mean PIVC Catheter Failure Rate = **46%**

# Phlebitis<sup>3, 5-6, 11-12</sup>

Inflammation of the vein wall

## Mechanical

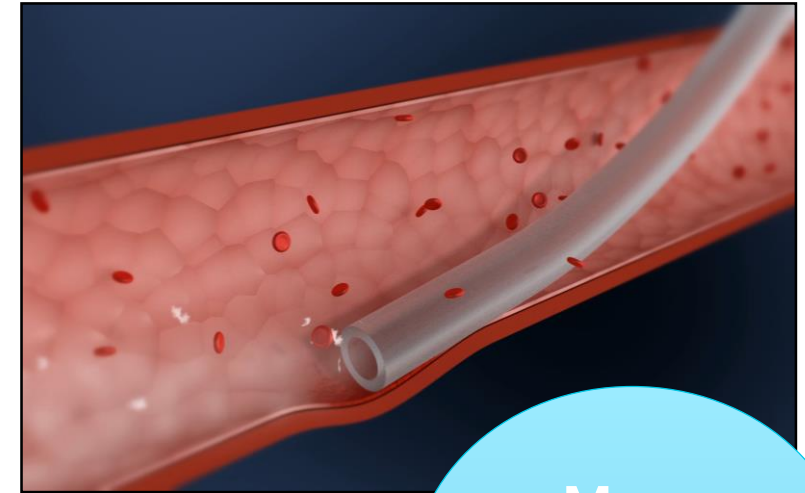
- Catheter properties or movement:  
Gauge, placement, length, securement

## Chemical

- Irritating fluids or medications

## Bacterial

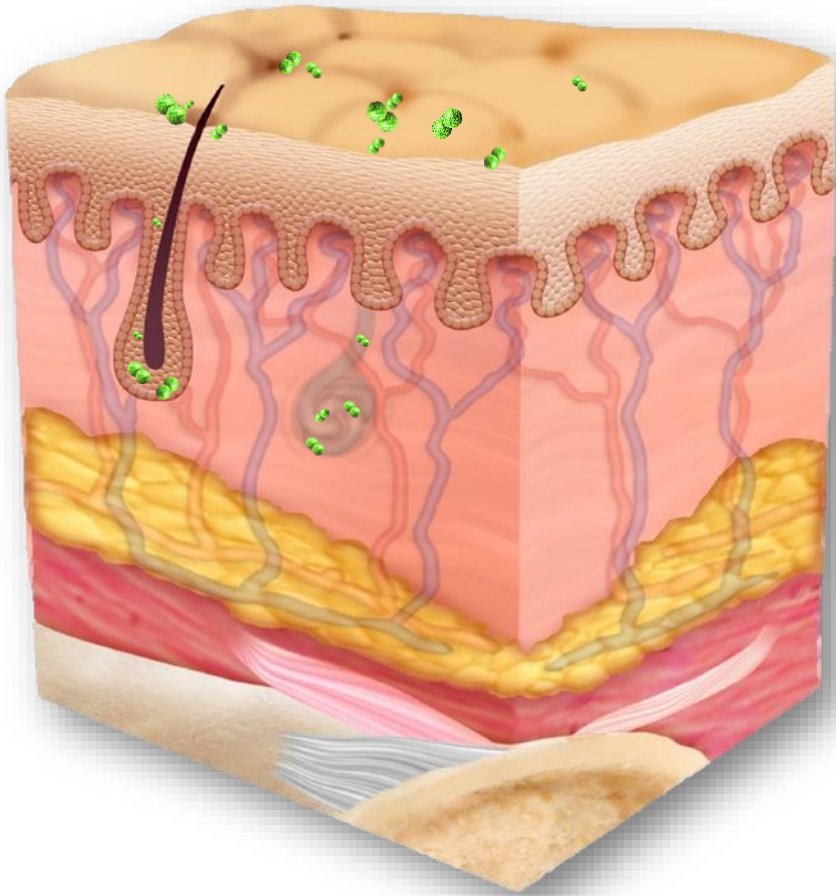
- Physical transport of bacteria into the bloodstream
- Infectious cause



Mean  
phlebitis rates  
14.7-16.1%



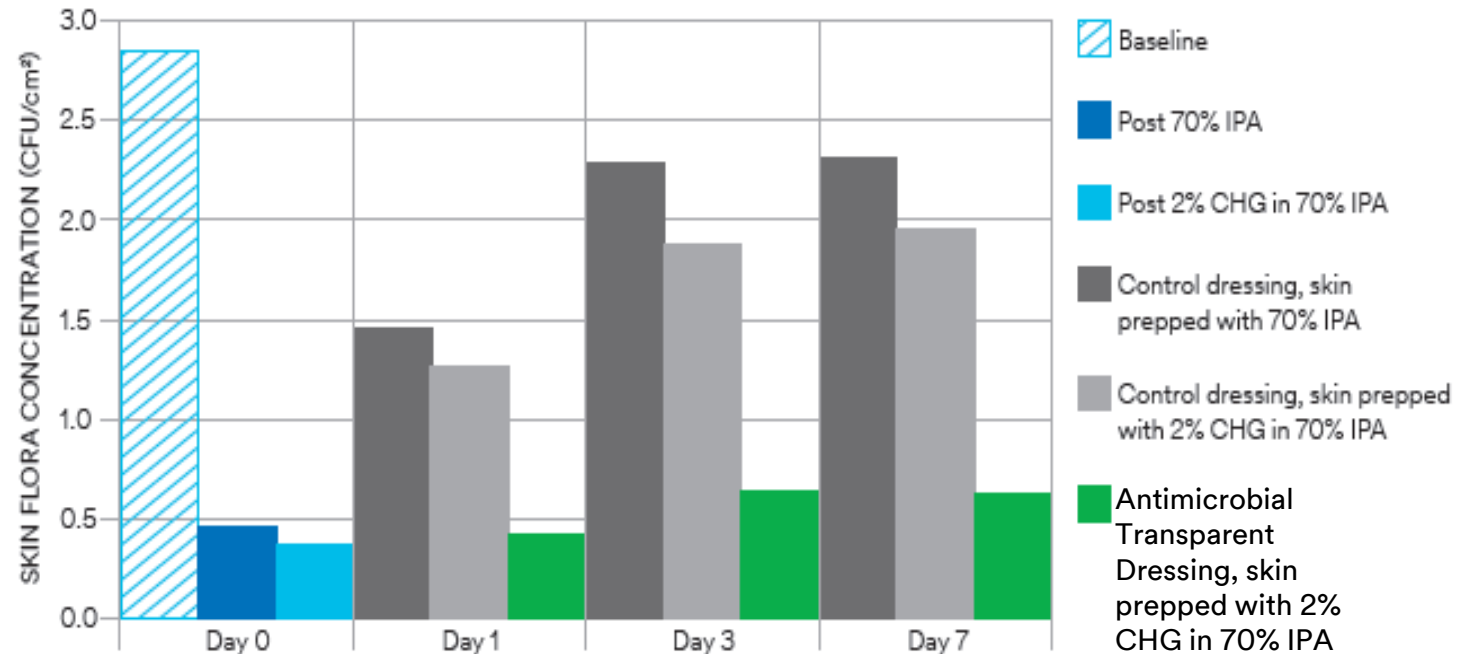
# Bacterial Phlebitis<sup>57</sup>



- Unsecured catheters may “piston” in and out of the vessel and may physically transport bacteria into the bloodstream
- The skin cannot be sterilized!
- Bacteria, or skin flora, reside on and under the skin surface
- Skin flora regrow in 24-48 hours after skin antisepsis

# Bacterial Phlebitis<sup>57, 58</sup>

- Unsecured catheters may “piston” in and out of the vessel and may physically transport bacteria into the bloodstream
- The skin cannot be sterilized!
- Bacteria, or skin flora, reside on and under the skin surface
- Skin flora regrow in 24-48 hours after skin antiseptics



# Phlebitis rate between 2.3% and 60% <sup>3, 5-6, 11-12</sup>



Incidence varies due to:

1. The spectrum of inflammatory pathology
2. Differences in definition
3. Difficulty differentiating from other catheter failure etiologies.

Incidence is determined by:

1. Interaction of the catheter
2. Catheter insertion technique
3. Care and maintenance used
4. Patient response

Pain  
Tenderness  
Warmth  
Erythema  
Swelling  
Palpable cord

Diagnosis is challenging  
Typically require two or more clinical symptoms

# Infiltration and Extravasation <sup>3, 5-6, 11-12</sup>

## PIVs sites most at risk

Hand, wrist, foot, ankle and antecubital fossa

...solution or medication into surrounding tissue; rated by a

## Assessment

Observation, palpation, flush prior to infusion to identify resistance

## Immediate treatment

Stop infusion immediately, disconnect infusion, aspirate for a blood return and remove PIV



**Mean Incidence 23.9%**

# Dislodgement<sup>12-13</sup>



**Mean  
Incidence  
6.9%**

**Infusion  
Nurses  
Society,  
2016**

- Inadequate stabilization and securement can cause unintentional dislodgement and complications requiring premature VAD removal.
- Do not rely on standard, non-bordered transparent semipermeable membrane dressings as a means of stabilization.



# Dislodgement Complications of PIVCs

Jackson, 2012 Retrospective comparative audit of two peripheral IV securement dressings.<sup>13</sup>

## Peripheral IV catheter restarts

Between a 3-month period in 2010 and the same 3 months in 2011.  
Intervention was implementation of an advanced securement dressing in 2011

## Baseline Data

Internal review of 6500 peripheral cannula outcomes - approximately 36% failed as a result of dislodgement

## Dwell Time Increase

“Statistical analysis showed that during the period of use of the [securement dressing], the number of cannula reaching 72 hours increased by a factor of 2.94...”

## Lower Restarts

“The total number of PVC restarts during the comparative audit periods was 9% lower...”

# Mechanical Failure/Occlusion<sup>2, 5, 12, 14-16</sup>

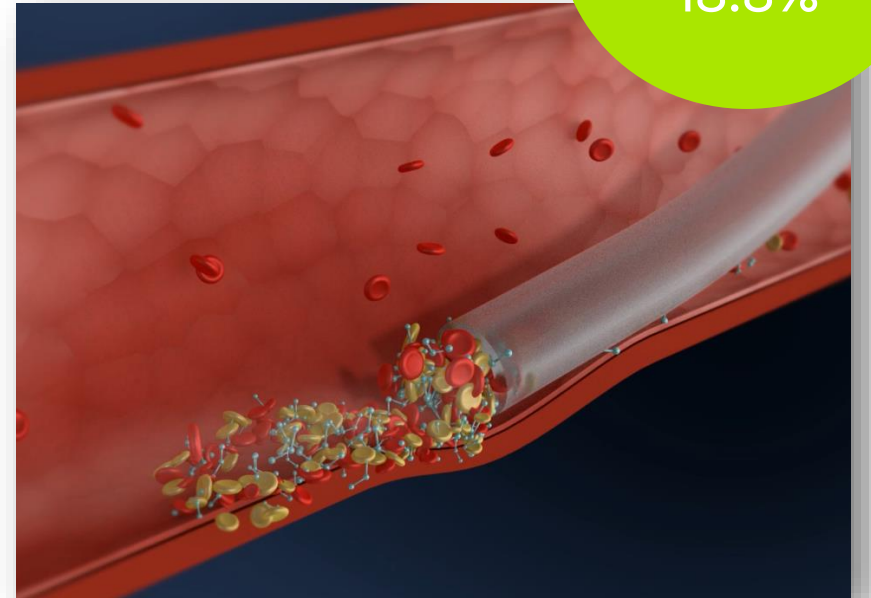
Mean  
incidence  
18.8%

## Obstruction:

- Catheter kinking or “Dead-ending” into vessel wall.

## Thrombus Formation

- Tunica Intima is composed of a single layer of cells
- Damaged can initiate inflammatory response → Thrombosis & Occlusion
- Virchow’s Triad: Thrombus formation resulting from three key areas
  1. Blood flow
  2. The vessel wall
  3. Blood components



Difficulty differentiating from other catheter failure etiologies  
leads to broad range of incidence.

# Peripheral Vascular Catheter Complications<sup>5,6</sup>

## Infection

### CR-BSI

- 0-2.2% meet CDC National Healthcare Safety Network criteria for CR-BSI

### Local infection

- 0.1-5.1% local culture tip-positive

Lower levels of localized bacterial contamination could lead to early catheter failure through inflammatory processes

“If we consider that half of the catheters sold are successfully inserted, a rate of 0.1% of these catheters producing a BSI would result in 165,000 patients becoming infected annually”



Both classes  
require  
confirmatory  
positive blood  
culture

# How many CLABSIs may be related to PIVs?<sup>9-10</sup>

BSI risk for PIVs is substantial and may sometimes be comparable to the risk for central lines; especially when the sheer number of PIVs placed is considered<sup>46</sup>

## DeVries, 2014

- 21% of hospital acquired BSIs were in patients with PIVs (6 previous years sample)
- Up to 47% of infections meeting the definition of CLABSI occurred in patients with multiple lines
  - Majority of which were PIVs

**Central lines present great risk on a per-line basis, but peripheral's represent the largest numerical risk**

## Kovacs, 2016

- 36% of primary *S. aureus* hospital-acquired bloodstream infection (HABSI) were non CLABSI (PIV or midline catheter was portal of entry)
  - 43.2% of these were MRSA (n=19)
  - 27 cases required admission to ICU
- Complicated *S. aureus* HABSI was significantly more common in the non-CLABSI group (15.9% vs 0,  $p \leq 0.001$ )
- Mortality rates in non CLABSI BSIs were similar to those with CLABSI

# Not Just an IV Line: A Global Impact<sup>63</sup>

## International Survey of Adults and Caregivers Experiencing a Peripheral IV line

712 respondents from 25 countries.

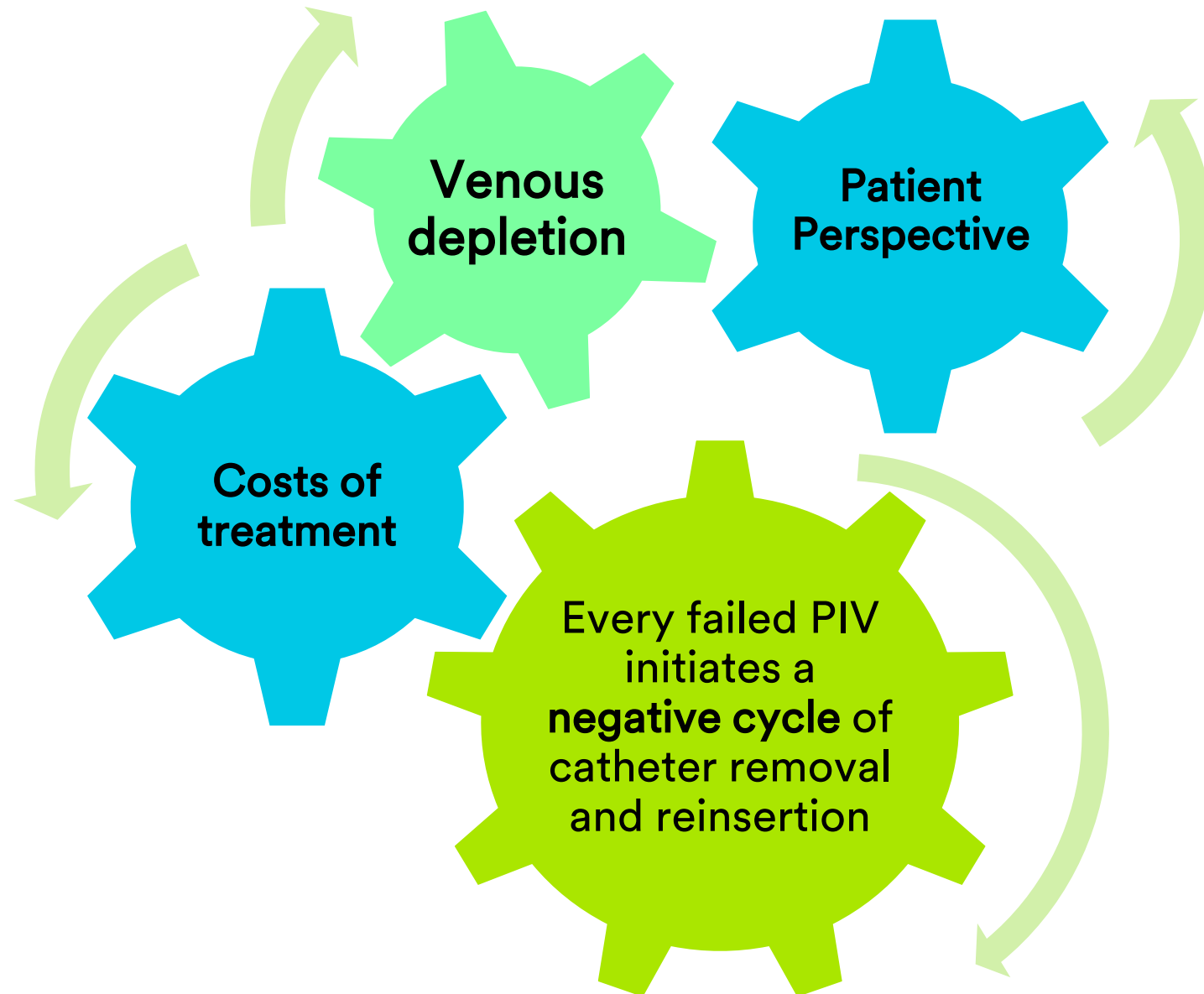
---

1. Significance of safe and consistent PIVC Care
2. Importance of staff training and competence
3. Value of communication





# Consequences of Failed Peripheral IV Catheters<sup>5, 32-33, 63</sup>





# Peripheral IV Dwell Time

A look at the evidence and guidelines

# Evidence-Based Practice: Before and After<sup>64</sup>

## Evaluation of the healthcare impact following implementation of clinically indicated PIV removal

- No significant PIV-related infections
- Monthly phlebitis rates ranged from 1.9% to 3.5%
- Peripheral IV use decreased by 14.2%
- **Estimated monthly cost savings of \$2100 and 70 hours of nursing time saved.**
  - Approx. 9000 pt discharges/2 requiring PIV (15% for > 96hr)
  - \$10/catheter and 20 minutes insertion RN time



# Evidence-Based Practice: Before and After<sup>64</sup>

**Evaluation of the healthcare impact  
following implementation of clinically  
indicated PIV removal**

**Changing to replacement when clinically indicated could:**

Prevent as many as 6 million unnecessary PIV insertions

Save \$60 million dollars in health care costs

Save 2 million hours of staff time



# Randomized Controlled Trial: Routine Versus Clinically Indicated<sup>8</sup>

Analyzed 6,000 peripheral IV catheters  
and their dwell time

Rickard (2012)	Routine Replacement	Clinically Indicated
Phlebitis Rate	114 of 1690 (7%) of patients	114 of 1593 (7%) patients

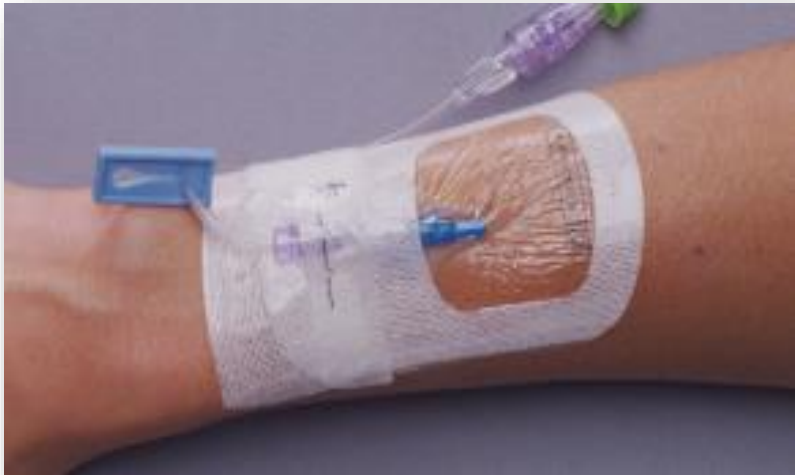


**No Difference in Phlebitis Rates**

# No Difference in Outcome<sup>7</sup>

Webster, 2013 Clinically Indicated Replacement Versus Routine Replacement of Peripheral Venous Catheters

Performed a review of seven PIV trials: Out of 4895 PIV patients, there was no evidence to support changing catheters every 72-96 hours.



## Results:

- No significant difference between CRBSI rate.
- No difference in phlebitis rates.
  - Even found decrease in rates with increased dwell time.
- Lower cannulation costs of approximately AUD 7 (\$5 USD)

**Projected 5-year savings:**

**\$300 million and 1 million health care worker hours**



# Systematic review: PIV dwell times, CRBSI, and catheter colonization<sup>34-35</sup>

Mermel, 2017 *Clinical Infectious Diseases*

- Incidence of PVC-R-BSI (0.18%)
- 23% of all hospital-acquired CRBSI were short term PVCs
  - *S. aureus* was most common pathogen
- 33% of healthcare associated *S. aureus* CR-BSI's are due to PIVs
  - *S. aureus* has been associated with highest morbidity and mortality
  - PVCs with dwell times >3-4 days have been associated with increased risk of *S. aureus* related PVC-R-BSIs

If approximately 200 million PVCs are successfully inserted into adult patients each year in the United States, there could be >160,000 PVC-R-BSIs occurring annually.

1. Obtain blood cultures when symptomatic
2. Remove non-essential PIVs
3. Replace PIVs placed under emergent conditions

# Emergently Placed PIV<sup>11</sup>, 16-17

## Stuart, 2016 - 137 *S. aureus* PVCR-BSIs

- 61% inserted by the ambulance service or ED
- 45% involved PVCs in situ beyond 4 days

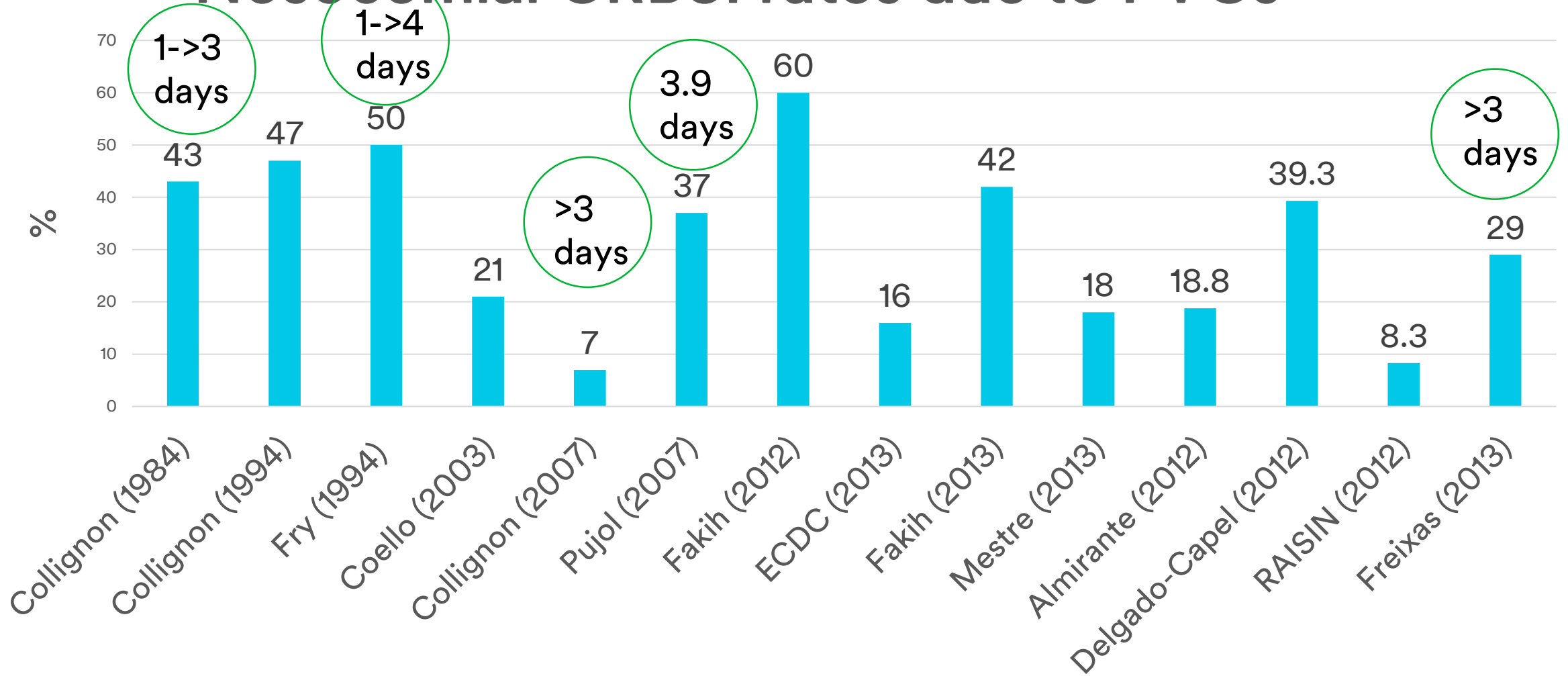
## Trihn, 2011 – Emergency Department PIVCs

- 67% increased risk PVCR *S. aureus* bacteremia

### Infusion Nurses Society (2016)

1. Consider labeling catheters inserted under suboptimal aseptic conditions in any health care setting
2. Remove and insert a new catheter as soon as possible, preferably within 24 to 48 hours.

# Nosocomial CRBSI rates due to PVCs<sup>17-31</sup>




Study, first author and year of publication

# Significant Costs Associated with PIV Failure: Why Move Toward Clinically Indicated?



Recommendation	INS 2016	Royal College 2016	Epic3 2014	CDC 2011
Remove peripheral IV catheters when clinically indicated	✓	✓	✓	Pediatrics only

# Significant Costs Associated with PIV Failure: Why Move Toward Clinically Indicated?

 <b>Recom</b> <b>Remov</b> <b>when c</b>	Rickard (2012) <sup>8</sup>	No difference in phlebitis rates
	Webster (2013) <sup>34</sup>	No evidence to support changing catheters every 72-96 hours. Significant cost savings.
	Mermel (2017) <sup>7</sup>	Catheter dwell time of >3-4 days has been associated with increased risk of S. aureus related PVCr-BSIs
	Hadaway (2012) <sup>6</sup>	165,000 PIV bloodstream infections per year
	Bergenger (1998) <sup>36</sup>	Unable to demonstrate an increased risk of complications following 3 days of catheterization.
	Literature Review <sup>17-31</sup>	PVC CRBSI at days 1, 2, 3, and >4

**When facilities move to clinically indicated peripheral IV removal the discussion of securement, stabilization, and infection control becomes even more important**



# Peripheral IV Survival

- Who is inserting the majority of your PIVs?
- Have you changed your care and maintenance policy related to clinically indicated removal?



# Peripheral IV Survival<sup>11</sup>

Infusion Nurses Society

## Selection and Placement

- Use smallest gauge possible
- Avoid areas of flexion

## Securement and Stabilization

- Consider engineered stabilization device
- Do not rely on standard, non-bordered transparent semipermeable membrane dressings as a means of stabilization.

## Care and Maintenance

- Visually inspect the entire infusion system
- Flush and aspirate with each access and as clinically indicated
- Assess the catheter site every 4 hours
- Change when loose, damp, or visibly soiled

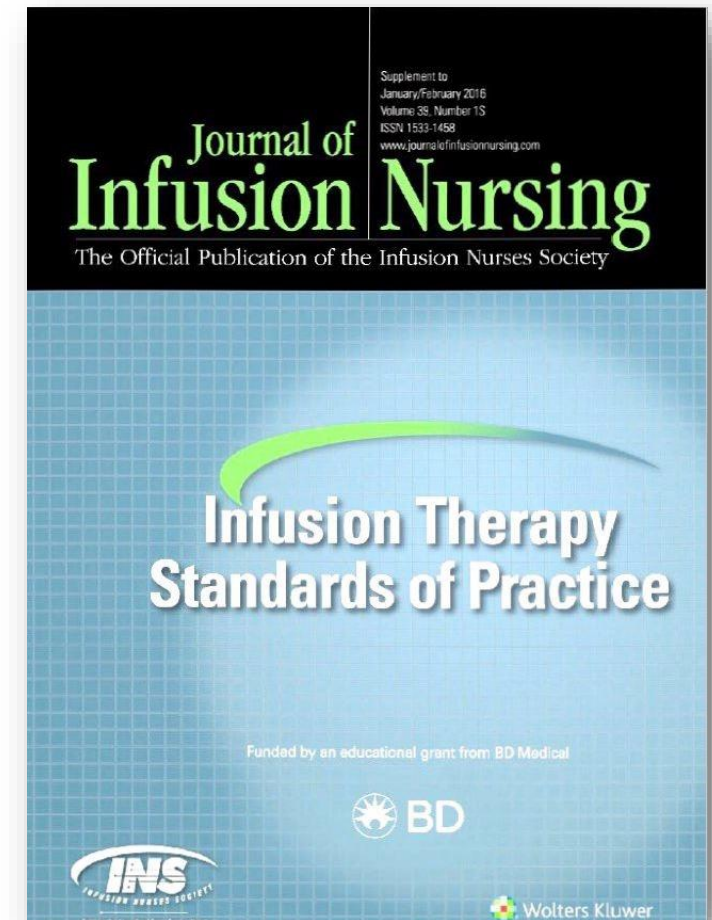
## Education and Qualification

- Use dedicated IV teams
- Promote consistent practice among all clinicians

# INS Standards of Practice<sup>11</sup>

## Peripheral Stabilization

- Do not rely on a VA device dressings (standard, non-bordered transparent semipermeable membrane (TSM) dressings, gauze and tape dressings) as a means of stabilization as there is insufficient evidence supporting their benefits as stabilization devices. (Level I)
- For PIV consider: (1) Integrated stabilization on PIV catheter hub with a bordered polyurethane securement dressing or (2) a standard round hub PIV in combination with an adhesive engineered stabilization device (ESD\*). (Level III)



# Survival of PIVs<sup>48</sup>

Wallis, 2013 Risk Factors for Peripheral Intravenous Catheter Failure

Secondary data analysis from a RCT of PIVC dwell time on 3,283 adult med/surg patients

- PIVC survival is improved by addressing modifiable risk factors



PIVCs placed by OR or Radiology suite staff had a 20% lower occlusion risk than ward insertions



# Care Bundles 48, 56



**A collection of processes combined to effectively and safely care for patients undergoing particular treatment.**

- Improves the reliability of the delivery of evidence-based healthcare processes
- Goal-oriented in nature
- Requires teamwork across specialties

**When interventions are combined, or consistently bundled together, we can significantly improve patient outcomes**

# Central Line Insertion and Maintenance Bundles<sup>12, 49-50</sup>

## Evidence-based recommendations

### Central Line Insertion Bundles

#### Hand Hygiene

Skin antisepsis using >0.5% chlorhexidine in alcohol solution

Maximal sterile barrier precautions (Mask, cap, sterile gown, large sterile drape and sterile gloves)

Avoid the femoral vein for CVC placement



### Central Line Maintenance Bundles

Perform hand hygiene before manipulation of IV system

Assess need for catheter daily

Dressing change recommendations and guidelines based on dressing type

IV tubing administration set, secondary set and add-on device change guidelines based on medication or product infused

Disinfect IV access ports with appropriate disinfectant for a period of time



# Peripheral Line Insertion Bundles<sup>48</sup>

Currently no guidelines/practice standards that focus solely on PIV insertion and maintenance

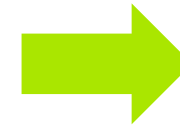
## Peripheral Line Insertion Bundle

Hand Hygiene ✓

Use of 2% alcoholic chlorhexidine for skin antisepsis ✓

Sterile barrier precautions (sterile drape and sterile gloves) ✓

Avoid areas of flexion ✓



Many concepts in the CVC maintenance bundle could be applied to PIVs



# Peripheral Vascular Catheter Care<sup>48</sup>

Currently no guidelines/practice standards that focus solely on PIV insertion and maintenance

## Peripheral Line Maintenance Bundles

Perform hand hygiene before manipulation of IV system ✓

Assess need for catheter daily ✓

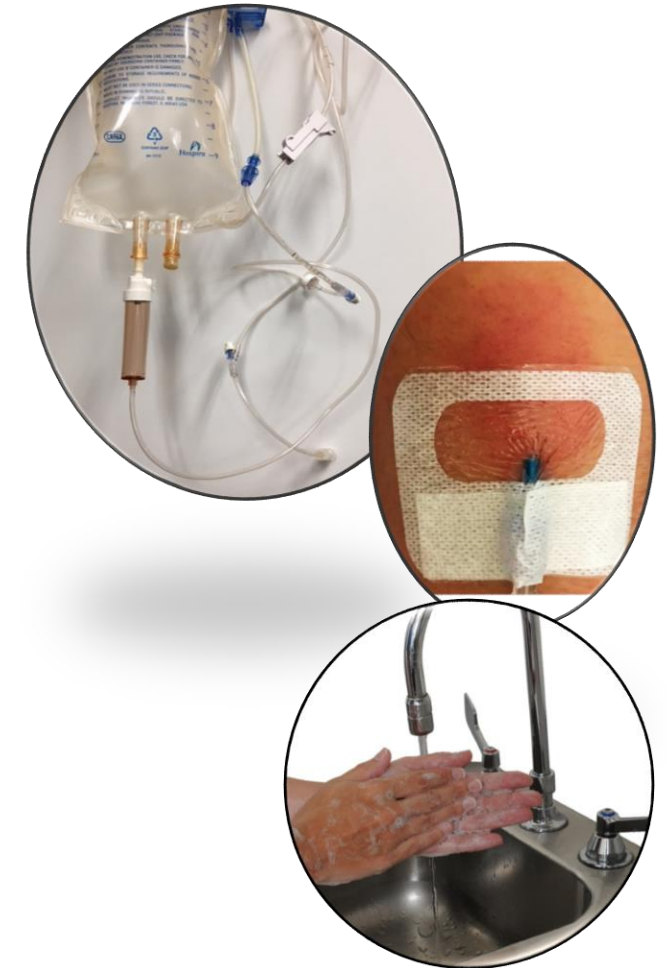
Dressing change recommendations and guidelines based on dressing type ✓

IV tubing administration set, secondary set and add-on device change guidelines based on medication or product infused ✓

Disinfect IV access ports with appropriate disinfectant for a period of time ✓

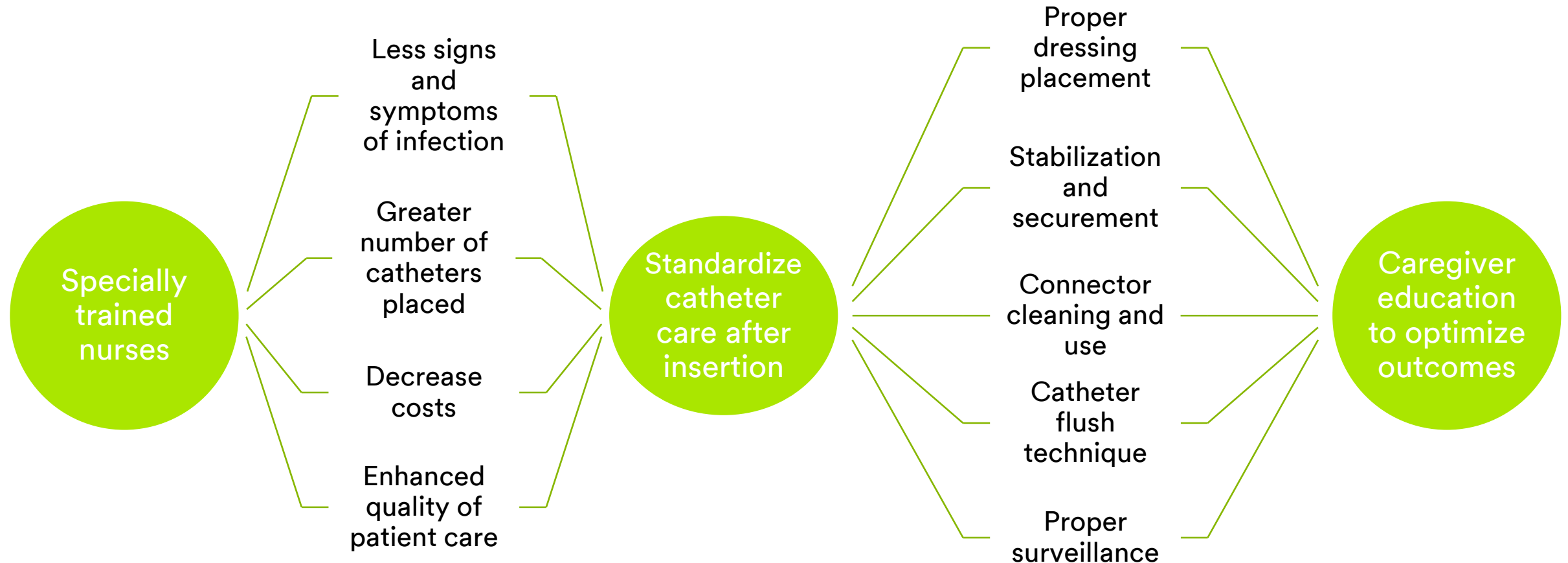
Sterile barrier precautions ✓

Proper site assessment and removal for s/s of phlebitis or infection ✓



# Peripheral IV Care Bundle<sup>3, 5, 13, 50-53</sup>

## Literature Review



# Inconsistency in Practice<sup>6, 52-53, 59</sup>

Alexandrou, 2018 Use of Short Peripheral Intravenous Catheters: Characteristics, Management, and Outcomes Worldwide

**Cross sectional study reviewed 40,620 peripheral IVs in 51 countries:**

- 66% placed in a non-recommended area
- 21% of dressings were placed incorrectly or needed replacement
- 33% of devices had no documented site assessment
- 71% of insertions by ward RNs



Hadaway, 2007

Studies show venipuncture proficiency rates of 2.18 attempts and 2.35 attempts to establish 1 catheter site.

# Organizational Support

---

Are you tracking IV care compliance rates?



# Improving Quality Within the Organization<sup>12</sup>

Infusion Nurses Society, 2016 Standards of Practice

## Focus on Fixing the System and Processes

- There are no bad people, only bad processes

## Participate in quality improvement programs

- Identify quality indicators and benchmarks
- Surveillance, data collection, analysis, reporting
- Implement changes based on data collected

## Advocate for Teamwork Interventions

- Training and education
- Work redesign
- Use of structured tools and protocols
- Minimize and eliminate barriers to change
- Empower the clinician





# Agents of Change<sup>60-61</sup>

Campbell (2008)



Change is both situational and psychological.

Ignoring either will result in **doom**:

*Always trying to implement change, without results.*

## See-Feel-Change Mindset

Create a compelling, factual, dramatic situation.

Change can create feelings of anger, false pride, and pessimism which can undermine attempts at promoting change.





# Agents of Change<sup>60-61</sup>

Campbell (2008)



## See-Feel-Change Mindset

Create a compelling, factual, dramatic situation

### Create a climate for change

- Increase urgency, build guiding teams, get the vision right

### Engage and enable the whole organization

- Communicate for buy-in, enable action, create short term wins

### Implement and sustain the change

- Don't let up, make it stick

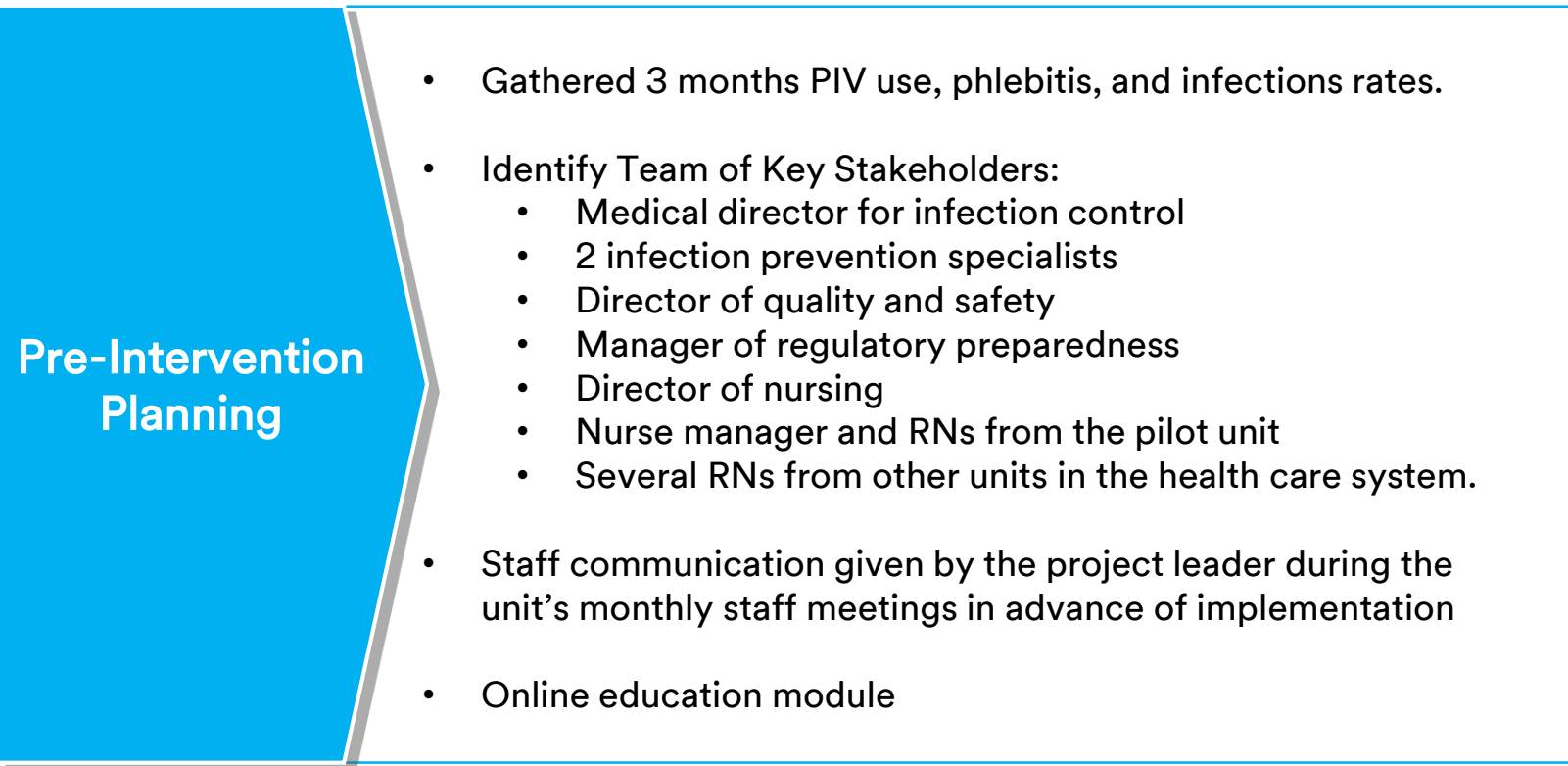
**Give accurate and timely *feedback* to improve outcomes and sustain the change**



# Evidence-Based Practice: Before and After<sup>64</sup>

## Pre-Intervention

Using Kotter's Model of Change a 144-bed hospital implemented clinically indicated PIV removal policy change from 96 hour dwell time



# Evidence-Based Practice: Before and After<sup>64</sup>

## Intervention

Using Kotter's Model of Change a 144-bed hospital implemented clinically indicated PIV removal policy change from 96 hour dwell time

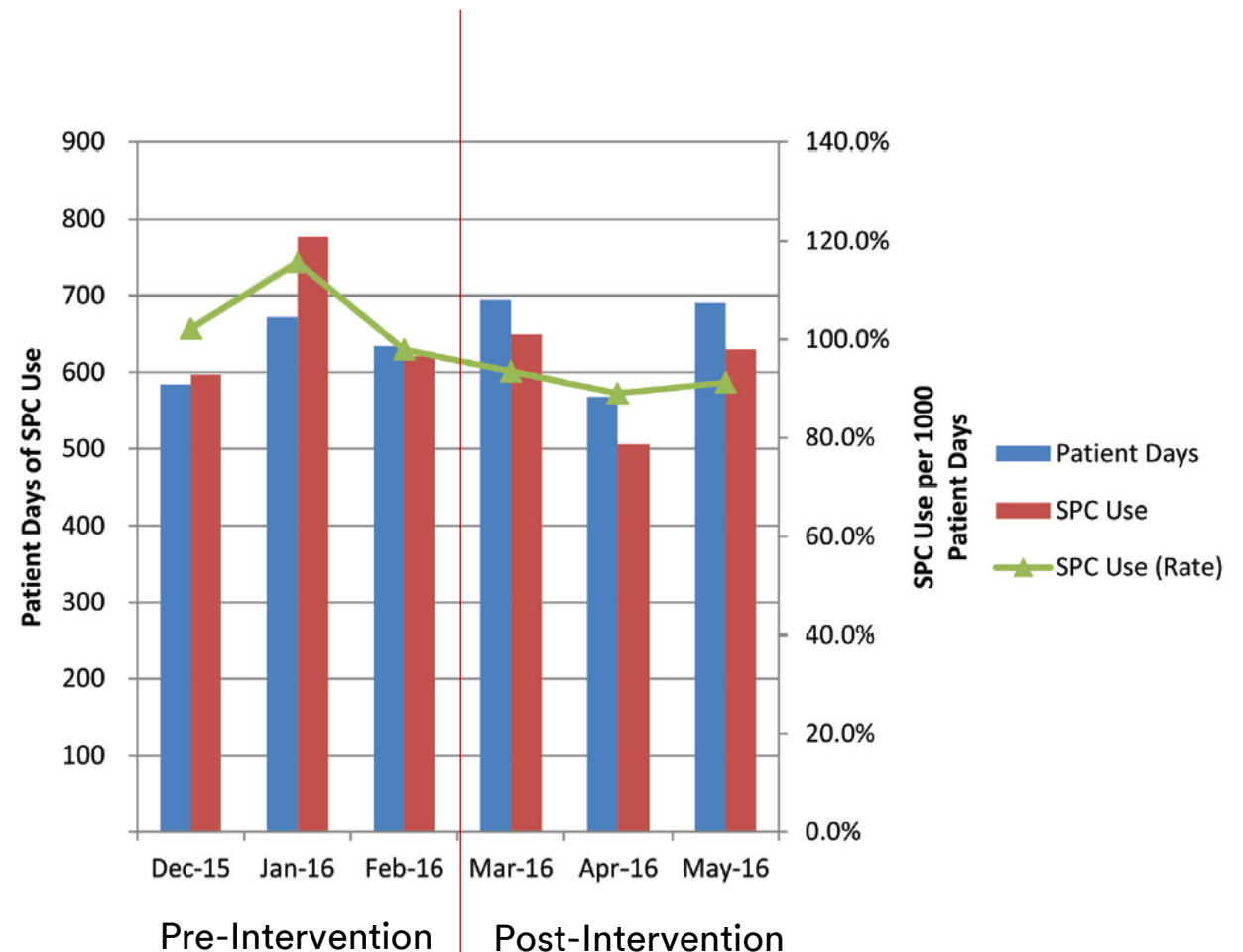
### Intervention Support

- Weekly communication with implementation team:
  - nurse manager, clinical resource leaders, infection prevention specialists, and staff RNs
- IP surveillance for three months post
- Each month after the practice change, outcome data were displayed for the staff in a high-traffic area
- Extending the policy to the other hospital units and the larger health care system.
  - Relied on nurses from the pilot to share their story of success.

# Evidence-Based Practice: Before and After<sup>64</sup>

## Post-Intervention Data

- PIV catheter use following implementation of 3 month pilot practice change decreased by 14.2%
  - *Despite an increase in patient days*
- 70 hours of RN time saved
- There were no peripheral catheter infections during the 3 months following the practice change.

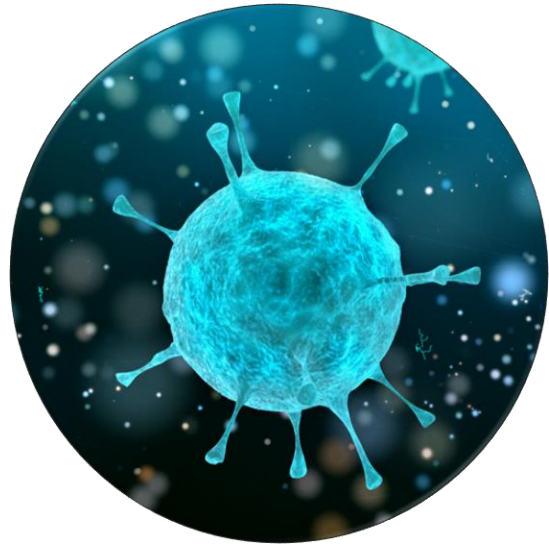
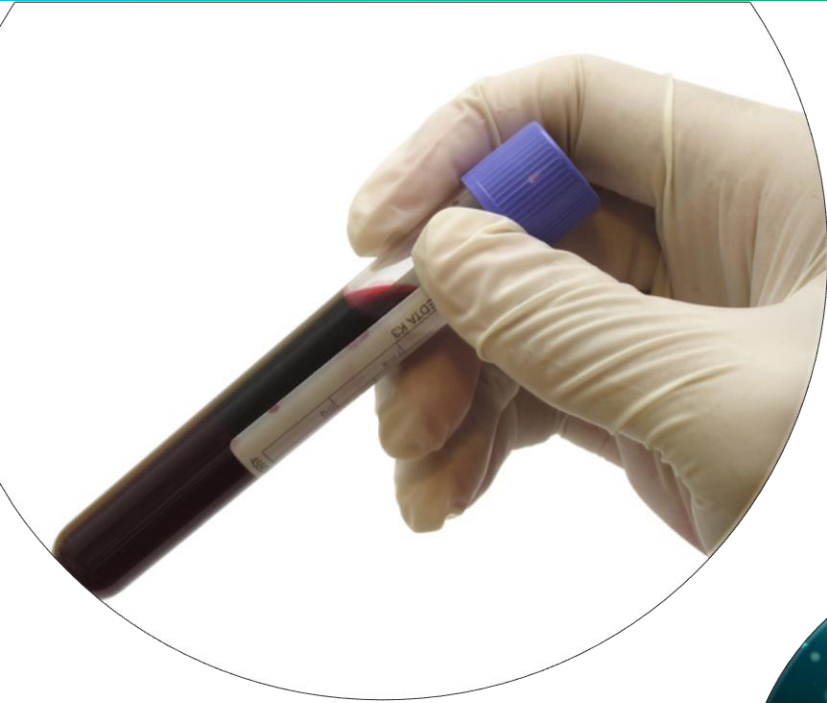


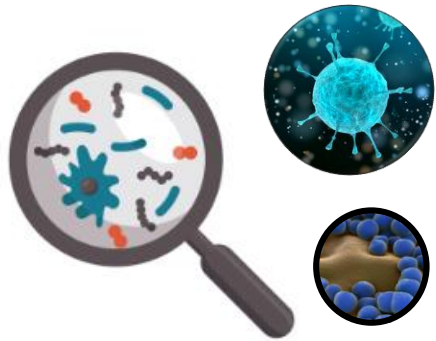
# Duncan, 2018<sup>54</sup>

A Bundled Approach to Decrease the Rate of Primary Bloodstream Infections Related to Peripheral Intravenous Catheters

Despite central line initiatives, continued primary BSI occurrences, even in patients without a central line.

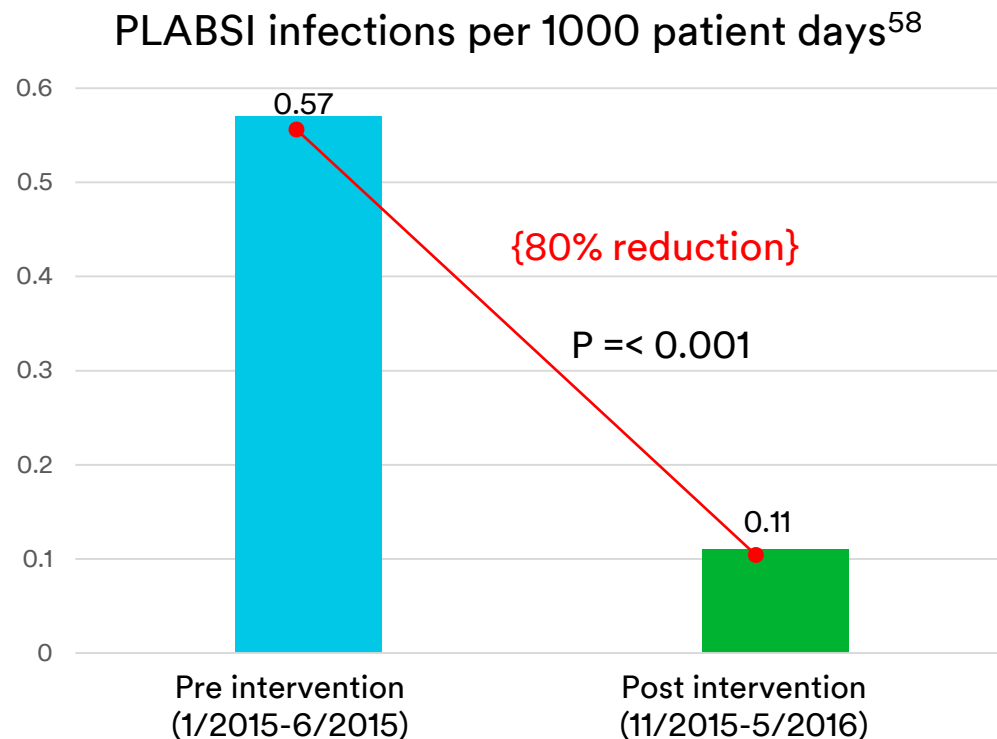
- Point prevalence audit conducted on IV tubing management
- Large variation in practice
  - disconnecting for convenience
  - looping back onto another port
  - not capping the male luer
- PIV bundle and education initiated





# Duncan, 2018<sup>54</sup>

A Bundled Approach to Decrease the Rate of Primary Bloodstream Infections Related to Peripheral Intravenous Catheters



- Engaged and educated nurses over a 1 month period
- Weekly audits measured compliance and aided in providing immediate corrective feedback
- PLABSI bundle decreased primary bloodstream infections from 0.57 to 0.11 per 1000 patient days
- Increased compliance rate from 36% to 90%



# The Road to Quality Improvement<sup>48</sup>

Significant improvement in PVC management using a care bundle approach

**Multidisciplinary team in Scotland developed PVC bundle:**

- 10% Occurrence of PVCA Staph. aureus

**Goal: Introduce the bundle tool to improve the management of PVCs**

- Audit compliance over the 25-week period
- Real-time feedback
- Assess the sustainability of the quality improvement measure.

**Team Leaders**

- Active engagement



# The Road to Quality Improvement<sup>48</sup>

Significant improvement in PVC management using a care bundle approach



Monthly PDSA cycles (Plan, Do, Study, Act)



## Weekly auditing

- Documentation (date, location, indication, assessment, necessity)
- Maintenance (daily review of necessity, site assessment, timely removal)



Displayed results in real time



# The Road to Quality Improvement<sup>48</sup>

Significant improvement in PVC management using a care bundle approach

**28%**  
**compliance**  
**increase**

- Increased compliance 1.11% each week up to 82% by study completion.
- Improvement in documentation of location (54%), date (6%), and indication (28%)
- Improvement in site assessment documentation (27%) and daily review of necessity (33%)

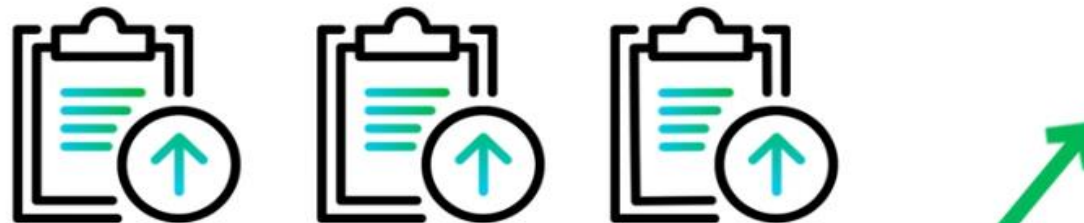


# The Road to Quality Improvement<sup>48</sup>

Significant improvement in PVC management using a care bundle approach

**Success**

- Multidisciplinary teamwork
  - Open communication
  - Shared decision-making
  - Collaboration
- Commitment of team leaders
- Providing consistent feedback
- Displaying performance feedback in real time

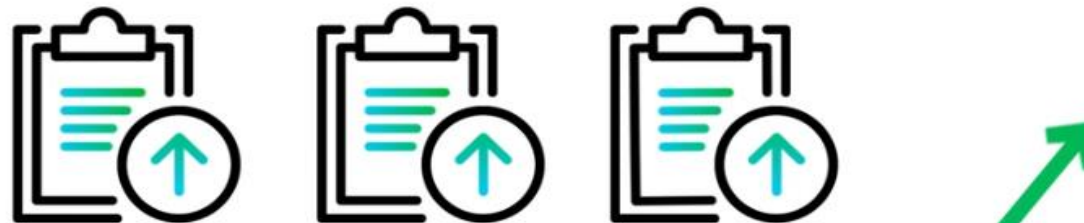


# The Road to Quality Improvement<sup>48</sup>

Significant improvement in PVC management using a care bundle approach

**Success**

*This process inspired, motivated, and empowered front-line staff to aim to improve patient outcomes in real time*



# Auditing and Feedback<sup>55</sup>

Ivers, 2012 Audit and feedback: effects on professional practice and healthcare outcomes

---



Audit and feedback leads to important improvements in professional practice.



Performance is measured and then compared to professional standards or targets.



Behavior change theories suggest that feedback works by changing recipients awareness and beliefs about current practice

---



# Auditing and Feedback<sup>55</sup>

Ivers, 2012 Audit and feedback: effects on professional practice and healthcare outcomes



Make auditing and feedback effective:

1. Communicate clear goals and action plan
2. Auditor is a supervisor or colleague (charge RN, Nurse Manager, IP, experienced RN)
3. Feedback can be verbal and/or written
4. Ongoing audits and feedback

# Cultivate knowledge<sup>25-26</sup>

Education and feedback lead to marked improvements

## Care outside of the ICU

Evaluate the effect of education and feedback on process measures to improve PVC care maintenance and infectious complications

### Group A = Intervention

- Formal nursing education, educational materials, direct feedback on performance, bi-weekly audits, manager reports

### Group B = Control

- Data collection with no intervention

## Care in the Emergency Department

### Poor compliance with care of the PVC

- ED represents 50% of admissions

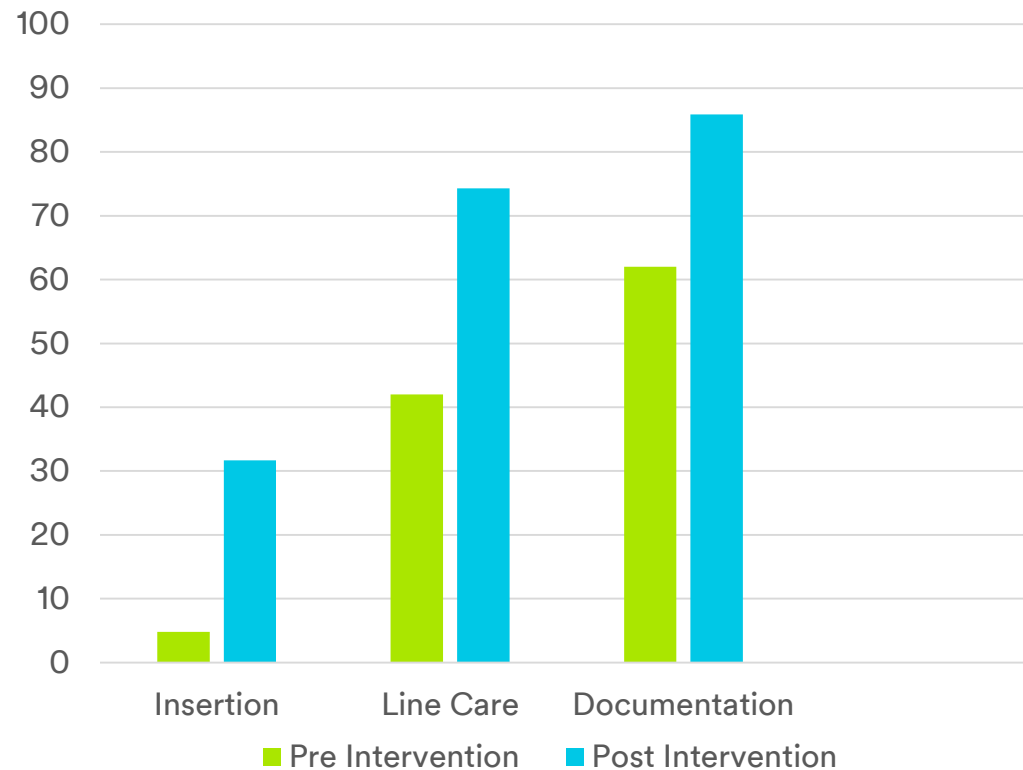
### Infectious Disease Society of America (IDSA)

- Educate health care workers (HCW)
- Assess HCWs knowledge
- Assess HCWs adherence to guidelines

### Sustainability, staff support, and education

# Cultivate knowledge<sup>25-26</sup>

Education and feedback lead to marked improvements

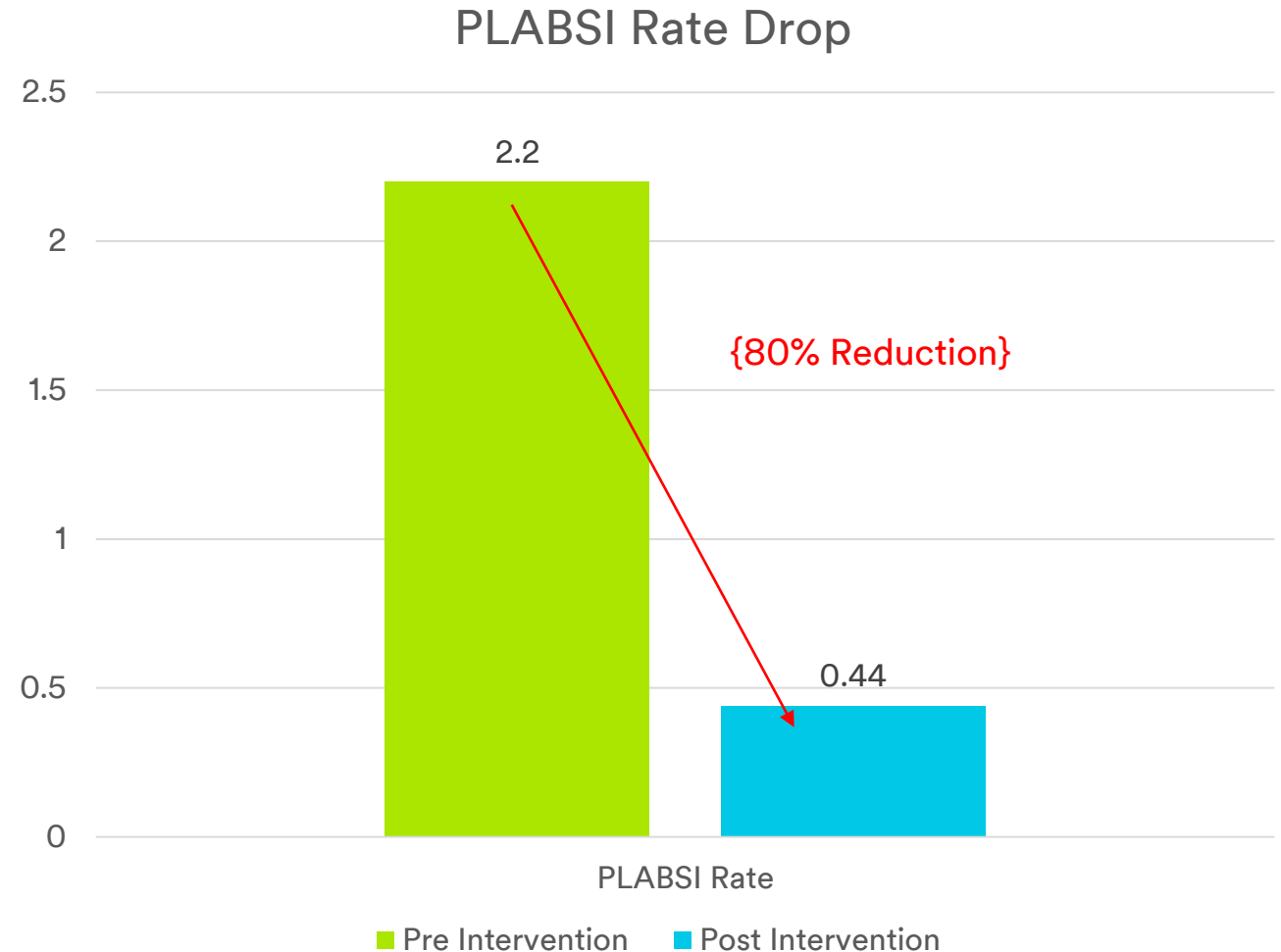


- PVC insertion procedure compliance **improved** from 4.8% to 31.7% (ED)
- Line care **improved** from 42% compliance to 74.3% (non-ICU)
- PVC documentation **improved** from 62% to 85.9% (ED)

# Cultivate knowledge<sup>25-26</sup>

Education and feedback lead to marked improvements

- Intact dressings improved from 88.5% to 93.7% (non-ICU)
- Appropriate duration of dwell time, 2.5% improvement (non-ICU)
- PLABSI rates dropped from 2.2/1000 patient days to 0.44/1000 patient days (non-ICU)
  - 75% of those patients PVCs were placed in the ED



# Cultivate knowledge<sup>25-26</sup>

Education and feedback lead to marked improvements

## RN Response

- 93.2% felt their practice improved
- 92% saw a change in the overall approach to line care on the unit
- 97.7% considered themselves responsible for patient outcomes
- 87% felt more involvement by their manager vs 55% in control group



# Cultivate knowledge



**Education and real-time feedback to nurses increases and sustains compliance with processes to reduce catheter complications.**

Quality Output Demands Quality Input





# Putting it all together.

- Peripheral IVs are the most common vascular access device, yet it is perceived as a simple procedure.
- Peripheral IVs are, in fact, an invasive procedure with significant complications.
- Evidence and standards reveal it may be advantageous to move to a clinically-indicated peripheral IV removal.
- Longer peripheral IV dwell times may exacerbate infectious complications.
- Regardless of decision, care and maintenance should be standardized with peripheral IV bundles, and consider more stringent insertion techniques.
- Change management must be considered.
- Use of PIV bundles, education on catheter care and maintenance, auditing and feedback can enhance patient outcomes.



**Thank you**

# References

1. Infusion Nurses Society. (2011). *Infusion Nursing Standards of Practice (2011)* (Vol. 34).
2. O'Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis*. 2011; 52(9): e162-e193.
3. Webster, J., Osborne, S., Rickard, C. M., & New, K. (2013). Clinically-indicated replacement versus routine replacement of peripheral venous catheters. *Cochrane Database of Systematic Reviews*, 2013(4), CD0077981-1.
4. Vizcarra C, Cassutt C, Corbitt N, et al. Recommendations for improving safety practices with short peripheral catheters. *J Infus Nurs*. 2014;37:121-124.
5. Helm RE, Klausner JD, Klemperer JD, Flint LM, Huang E. Accepted but unacceptable: Peripheral IV catheter failure. *J Infus Nurs*. 2015; 38(3): 189-203.
6. Hadaway L. Infiltration and extravasation. *Am J Nurs*. 2007; 107(8): 64-72.
7. Webster, J., Osborne, S., Rickard, C. M., & New, K. (2013). Clinically-indicated replacement versus routine replacement of peripheral venous catheters. *Cochrane Database of Systematic Reviews*, 2013(4), CD0077981-1.
8. Rickard CM, Webster J, Wallis MC. Routine versus clinically indicated replacement of peripheral intravenous catheters: a randomized controlled equivalence trial. *Lancet*. 2013;380(9847):1066-1074.
9. DeVries M, Mancos P, Valentine MJ. Reducing bloodstream infection risk in central and peripheral intravenous lines: Initial data on passive intravenous connector disinfection. *J Assoc Vasc Access*. 2014; 19(2): 87-93.
10. Kovacs CS, Fatica C, Butler R, Gordon SM, Fraser TG. Hospital-acquired Staphylococcus aureus primary bloodstream infection: A comparison of events that do and do not meet the central line-associated bloodstream infection definition. *Am J Infect Control*. 2016; 44: 1252-1255. Bashir MH, Olson LK, Walters SA. Suppression of regrowth of normal skin flora under chlorhexidine gluconate dressings applied to chlorhexidine gluconate-prepped skin. *Am J Infect Control*. 2012; 40(4): 344-348.
11. Gorski L, Hadaway L, Hagle ME, McGoldrick M, Orr M, Doellman D. Infusion Therapy Standards of Practice. *J Infus Nurs*. 2016; 39(suppl 1): S1-S59
12. Jackson A. Retrospective comparative audit of two peripheral IV securement dressings. *British J of Nurs*. 2012; 21. 10-5
13. Yacopetti N. Central venous catheter-related thrombosis: a systematic review. *J Infus Nurs*. 2008; 31(4): 241-248.
14. Amy Leung, Clare Heal, Jennifer Banks, Breanna Abraham, Gian Capati, and Casper Pretorius, "The Incidence of Peripheral Catheter-Related Thrombosis in Surgical Patients," *Thrombosis*, vol. 2016, Article ID 6043427, 6 pages, 2016. doi:10.1155/2016/6043427
15. Zingg W, Pittet D. Peripheral venous catheters: an under-evaluated problem. *Int J Antimicrob Agents*. 2009;34(4)(suppl):S38-S42.
16. Trinh TT, Chan PA, Edwards O, et al. Peripheral venous catheter-related Staphylococcus aureus bacteremia. *Infect Control Hosp Epidemiol*. 2011;32(6):579.
17. Stuart RL, Cameron DR, Scott C, et al. Peripheral intravenous catheter-associated Staphylococcus aureus bacteraemia: more than 5 years of prospective data from two tertiary health services. *Med J Aust*. 2013; 198:551-3.
18. Collignon PJ, Munro R, Sorrell TC. Systemic sepsis and intravenous devices. A prospective survey. *Med J Aust*. 1984; 141:345-8.
19. Collignon PJ. Intravascular catheter associated sepsis: a common problem. The Australian Study on Intravascular Catheter Associated Sepsis. *Med J Aust*. 1994; 161:747-8.

# References cont.

20. Collignon PJ. Intravascular catheter associated sepsis: a common problem. The Australian Study on Intravascular Catheter Associated Sepsis. *Med J Aust.* 1994; 161:374–8.
21. Collignon PJ, Dreimanis DE, Beckingham WD, et al. Intravascular catheter bloodstream infections: an effective and sustained hospital-wide prevention program over 8 years. *Med J Aust.* 2007; 187:551–4.
22. Freixas N, Bella F, Limón E, et al. Impact of a multimodal intervention to reduce bloodstream infections related to vascular catheters in non-ICU wards: a multicentre study. *Clin Microbiol Infect.* 2013; 19:838–44.
23. Fry DE, Borzotta AP. Nosocomial blood-borne infection secondary to intravascular devices. *Am J Surg.* 1994; 167:268–72.
24. Pujol M, Hornero A, Saballs M, et al. Clinical epidemiology and outcomes of peripheral venous catheter-related bloodstream infections at a university-affiliated hospital. *J Hosp Infect.* 2007; 67:22–9.
25. Fakh MG, Jones K, Rey JE, et al. Sustained improvements in peripheral venous catheter care in non-intensive care units: a quasi-experimental controlled study of education and feedback. *Infect Control Hosp Epidemiol.* 2012; 33:449–55.
26. Fakh MG, Jones K, Rey JE, et al. Peripheral venous catheter care in the emergency department: education and feedback lead to marked improvements. *Am J Infect Control.* 2013; 41:531–46.
27. Mestre G, Berbel C, Tortajada P, et al. Successful multifaceted intervention aimed to reduce short peripheral venous catheter-related adverse events: a quasiexperimental cohort study. *Am J Infect Control.* 2013; 41:520–6.
28. European Centre for Disease Prevention and Control. Point prevalence survey of healthcare associated infections and antimicrobial use in European acute care hospitals. Stockholm, Sweden: ECDC; 2013.
29. Coello R, Charlett A, Ward V, et al. Device-related sources of bacteraemia in English hospitals—opportunities for the prevention of hospital-acquired bacteraemia. *J Hosp Infect.* 2003; 53:46–57.
30. Almirante B, Limón E, Freixas N, Gudiol F; VINCat Program. Laboratory-based surveillance of hospital-acquired catheter-related bloodstream infections in Catalonia. Results of the VINCat Program (2007–2010)., *Enferm Infecc Microbiol Clin.* 2012; 30(suppl 3): 13–9.
31. Delgado-Capel M, Gabillo A, Elías L, et al. Características de la bacteriemia relacionada con catéter venoso periférico en un hospital general. *Rev Esp Quimioter.* 2012; 25:129–133.
32. Hawes ML. A proactive approach to combating venous depletion in the hospital setting. *J infus Nurs.* 2007;30(1):33-44
33. Zhang L, Keogh S, Rickard CM. Reducing the risk of infection associated with vascular access devices through nanotechnology: a perspective. *Int J Nanomedicine.* 2013;8:4453-4466
34. Mermel L. Short-tern Peripheral Venous Catheter-Related Bloodstream Infections: A Systematic Review. *Clinical Infectious Diseases.* 2017;65(10):1757-1762
35. Chopra V, Flanders SA, Saint S, et al. The Michigan appropriateness guide for intravenous catheters (MAGIC): results from a multispecialty panel using the RAND/UCLA appropriateness method. *Ann Intern Med.* 2015;163(suppl 6):S1-S39.
36. Bregenzer T, Conen D, Sakmann P, et al. Is routine replacement of peripheral intravenous catheters necessary? *Arch Intern Med.* 1998; 158:151–6.

# References Cont.

37. Kok J, O'Sullivan MV, Gilbert GL. Feedback to clinicians on preventable factors can reduce hospital onset Staphylococcus aureus bacteraemia rates. *J Hosp Infect.* 2011; 79:108–14.
38. Rhodes D, Cheng AC, McLellan S, et al. Reducing Staphylococcus aureus bloodstream infections associated with peripheral intravenous cannulae: successful implementation of a care bundle at a large Australian health service. *J Hosp Infect.* 2016; 94:86–91.
39. Lolom I, Deblangy C, Capelle A, et al. Impact d'un programme prolongé d'amélioration continue de la qualité sur le risque infectieux lié aux cathéters veineux périphériques. *Presse Med.* 2009; 38:34–42.
40. Maki DG, Ringer M. Evaluation of dressing regimens for prevention of infection with peripheral intravenous catheters. Gauze, a transparent polyurethane dressing, and an iodophor-transparent dressing. *JAMA.* 1987; 258:2396–403.
41. Barbut F, Pistone T, Guiguet M, et al. Complications liées au cathétérisme veineux périphérique: etude prospective. *Presse Med.* 2003; 32:450–6.
42. Safdar N, McKinley LM, Davidson B, et al. Recommendations to replace peripheral venous catheters every 72-96 hours: is a single reference enough? *J Hosp Infect.* 2011; 79:172–3.
43. Freixas N, Bella F, Limón E, et al. Impact of a multimodal intervention to reduce bloodstream infections related to vascular catheters in non-ICU wards: a multicentre study. *Clin Microbiol Infect.* 2013; 19:838–44.
44. Bruno M, Brennan D, Redpath MB, et al. Peripheral venous catheter-related Staphylococcus aureus bacteraemia: a multi-factorial approach to reducing incidence. *J Hosp Infect.* 2011; 79:173–4.
45. Bregenzer T, Conen D, Sakmann P, et al. Is routine replacement of peripheral intravenous catheters necessary? *Arch Intern Med.* 1998; 158:151–6.
46. Loveday H, Wilson J, Pratta R, et al. epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England. *Journal of Hospital Infection.* 86S1 (2014) S1–S70
47. Denton A, Bodenham A, Conquest A, et al. Standards for Infusion Therapy, 4<sup>th</sup> Edition. *Royal College of Nursing*, 2016.
48. Boyd S, Aggarwal I, Davey P, Logan M, Nathwani D. Peripheral intravenous catheters: the road to quality improvement and safer patient care. *J Hosp Infect.* 2011;77(1):37-41.
49. The Joint Commission. *Preventing central line-associated bloodstream infections: A global challenge, a global perspective.* Oak Brook, IL: Joint Commission Resources; Mar 12, 2012. [https://www.jointcommission.org/assets/1/18/CLABSI\\_Monograph.pdf](https://www.jointcommission.org/assets/1/18/CLABSI_Monograph.pdf)
50. Marschall J, Mermel LA, Fakih M, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals: 2014 update. *Infect Control Hosp Epidemiol.* 2014; 35(7): 753-771.
51. Maki DG. Improving the safety of peripheral intravenous catheters. *BMJ.* 2008;337:122-123
52. Soifer, N. E., Borzak, S., Edlin, B. R., & Weinstein, R. A. (1998). Prevention of peripheral venous catheter complications with an intravenous therapy team: a randomized controlled trial. *Archives of Internal Medicine*, 158(5), 473-477.



# References Cont.

53. Alexandrou, E., Ray-Barruel, G., Carr, P. J., Frost, S. A., Inwood, S., Higgins, N., ... & Rickard, C. M. (2018). Use of Short Peripheral Intravenous Catheters: Characteristics, Management, and Outcomes Worldwide. *Journal of hospital medicine*, 13(5).
54. Duncan M, Warden P, Bernatchez S, Morse D. A bundled approach to decrease primary bloodstream infections related to peripheral intravenous catheters. *J Assoc Vasc Access*. 2018; 23(1): 15-22.
55. Ivers, N., Jamtvedt, G., Flottorp, S., Young, J. M., Odgaard-Jensen, J., French, S. D., ... & Oxman, A. D. (2012). Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev*, 6(6).
56. Resar, R., Pronovost, P., Haraden, C., Simmonds, T., Rainey, T., & Nolan, T. (2005). Using a bundle approach to improve ventilator care processes and reduce ventilator-associated pneumonia. *The Joint Commission Journal on Quality and Patient Safety*, 31(5), 243-248.
57. Bashir MH, Olson LK, Walters SA. Suppression of regrowth of normal skin flora under chlorhexidine gluconate dressings applied to chlorhexidine gluconate-prepped skin. *Am J Infect Control*. 2012; 40(4): 344-348.
58. 3M data on file
59. Austin, E. D., Sullivan, S. B., Whittier, S., Lowy, F. D., & Uhlemann, A. C. (2016, April). *Peripheral intravenous catheter placement is an underrecognized source of Staphylococcus aureus bloodstream infection*. In *Open forum infectious diseases (Vol. 3, No. 2, p. ofw072)*. Oxford University Press.
60. Bertoglio, S., van Boxtel, T., Goossens, G. A., Dougherty, L., Furtwangler, R., Lennan, E., ... & Stas, M. (2017). Improving outcomes of short peripheral vascular access in oncology and chemotherapy administration.
61. Lai KK. Safety of prolonging peripheral cannula and i.v. tubing use from 72 hours to 96 hours. *Am J Infect Control* 1998; 26:66–70.
62. Keleekai, N. L., Schuster, C. A., Murray, C. L., King, M. A., Stahl, B. R., Labrozzi, L. J., ... & Glover, K. R. (2016). Improving nurses' peripheral intravenous catheter insertion knowledge, confidence, and skills using a simulation-based blended learning program: a randomized trial. *Simulation in Healthcare*, 11(6), 376.
63. Cooke M, Ullman AJ, Ray-Barruel G, Wallis M, Corley A, Rickard CM (2018) Not "just" an intravenous line: Consumer perspectives on peripheral intravenous cannulation (PIVC). An international cross-sectional survey of 25 countries. *PLoS ONE* 13(2): e0193436. <https://doi.org/10.1371/journal.pone.0193436>
64. Stevens, C., Milner, K. A., & Trudeau, J. (2018). Routine Versus Clinically Indicated Short Peripheral Catheter Replacement: An Evidence-based Practice Project. *Journal of Infusion Nursing*, 41(3), 198-204.