Real-Time Identification and Removal of Unnecessary Vascular Access Devices to Reduce Bloodstream Infections

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Objectives

1. Introduce pSIR and VADD as metrics that go beyond SIR and SUR to better capture total bloodstream infection risk
2. Discuss utilization of the DRIP criteria to prevent insertion of unnecessary PIVs
3. Summarize the design and implementation of Mission Control CABSI: an intervention which helps to identify and remove unnecessary vascular access devices in real-time
4. Interpret Mission Control CABSI data and share lessons learned

The SIR and Its Limitations

Both hospitals look identical, but they're not.

	CLABSI Rate	Central Line Days	SIR	Absolute Infections
Hospital A (Large Academic Medical Center)	2 per 1,000 line days	3,000 (1.5 SUR)	1.0	**6 infections**
Hospital B (Same Census and Pt Population as A)	2 per 1,000 line days	500 (0.25 SUR)	1.0	1 infection

⚠ Hospital A had 5 MORE CLABSIs than Hospital B, despite identical SIRs. Same census, same rate, vastly different infection burden.

Why the SIR alone is insufficient:

- Does not account for device utilization, facilities that proactively remove lines are penalized
- Does not differentiate which line caused the infection
- Large academic centers are compared to each other, but patient acuity differs significantly

Who will look WORSE under Hospital Onset Bacteremia reporting?

Hospital A - more patients harmed, more HOB events, higher mortality exposure.

The SIR alone does not capture the full risk.

NHSN. SIR Guide (Based on 2015 National Baseline). CDC, 2024.
NHSN. SUR Guide. CDC, 2024.

pSIR & VADD: Metrics That Better Capture Bloodstream Infection Risk

Population SIR (pSIR)

pSIR = SIR × SUR

- Accounts for BOTH infection rate AND device utilization
- Reduces unfairly elevated SIRs for facilities that proactively remove lines
- Better reflects the impact of line reduction efforts on overall infection risk
- Especially useful when interventions drive substantial reductions in device use
- UCSD FY25 CLABSI SIR: 0.42

Vascular Access Device Density (VADD)

VADD = (CL + PIV days) ÷ Patient days

- Captures ALL lines, central AND peripheral, not just central lines
- Average number of lines per patient per day
- Higher VADD is associated with higher infection burden
- Outside the ICU, PIV-BSI rate per 1,000 line-days approaches that of CLABSI
- Enables comparison of vascular access burden across units and facilities

Together, pSIR and VADD give infection preventionists a complete, actionable picture of line burden and infection risk.

Fakih M, et al. Introducing the Population SIR. Open Forum Infect Dis. 2018;5(Suppl 1):S636.
Nickel B, et al. Infusion Therapy Standards of Practice, 9th Ed. J Infusion Nursing. 2024;47(1S):S1–S285.

PIV Dwell Time & Infection Risk (Maintenance or Insertion Issue?)

13×
BSI risk increase after Day 3

80%
of PIV-BSIs occurred after Day 4

371K
PIVCs studied at Geneva University (2016–2020)

61
PIV-BSI events 20% due to S. aureus

Key Evidence

Zanella et al., JAMA Network Open 2025

- 371,061 PIVCs at Geneva University Hospitals
- BSI risk low in first 2 days; increases rapidly after Day 3
- 13× risk increase after Day 3
- 10 of 49 late BSIs (20%) caused by S. aureus

Charles et al., Cochrane 2026

- 14 RCTs, 11,428 participants
- No clear difference in CRBSI between clinically-indicated vs. routine removal
- Supports need-based removal over fixed-schedule removal
- Cost savings associated with clinically-indicated removal

Zanella MC, et al. Dwell time and risk of BSI with PIVCs. JAMA Netw Open. 2025;8(4):e257202.
Charles KR, et al. Clinically indicated vs. routine removal of PVCs. Cochrane Database Syst Rev. 2026;1:CD007798.

The DRIP Criteria: Is Every PIV Justified?

Only ONE criterion is needed to justify PIV insertion.

D

Deterioration

Is the patient deteriorating or at risk of sudden deterioration?

I

IV Medications

Does the patient require intravenous medications?

R

Rehydration

Does the patient require IV fluids?

P

Procedures

Are procedures requiring IV access planned or likely?

10.1% of PIV insertion requests were NOT clinically indicated

3,103 unnecessary PIV insertions avoided over 15 months using DRIP criteria (Idle PIV rate: 8.3% → 1.8%)

May N, Gillman L. The DRIP Criteria. Joint Commission J Quality & Patient Safety. 2025;51:666–672.

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CHG: Treatment, Not Just a Bath

CHG bathing significantly reduces hospital-acquired bloodstream infections in both ICU and non-ICU settings.

Why CHG Matters

- Reduces skin colonization and catheter-associated BSI across all vascular access devices
- PIV-BSIs are more likely to involve S. aureus, a more lethal organism than CoNS in CLABSIs
- Decolonization interrupts the extraluminal pathway, the likely route for PIV-BSI
- AVA recommendation – consider CHG use for PIVs

CHG in Practice at UCSD

- CHG for PIV dressings in use at UCSD since 2016
- Switched from foam disk to CHG gel dressing in 2025
- Foam disk positioning is challenging with short peripheral catheters, gel dressing easier to place well consistently
- Currently transitioning to CHG gel dressings for central lines

Nurse acceptance rates for CHG treatment range from 5% to 96%. Framing matters enormously. Calling it ***"treatment"*** rather than a bath, and sharing outcome data with nursing managers, drives meaningful increases in compliance.

Shannon D, et al. Preventing CABSI in Adults. APIC, 2025.
Thompson J, et al. Standards of care for PIVCs: Evidence-based expert consensus. JAVA. 2024.
Timsit JF, et al. Dressing disruption is a major risk factor for catheter-related infections. Crit Care Med. 2012;40(6):1707–1714.

The MIC Framework: A Practical Pathway to Safer Vascular Access

Three pillars for building a sustainable VAD stewardship program — each one enables the others.

M — Materials

The Right Equipment

- RNs competent in Ultrasound-Guided PIV Insertion (USGPIV) - improves first-attempt success, especially for DIVA patients
- Aseptic Non-Touch Technique (ANTT) - distinct from standard clean technique
- Protection of the VAD insertion site with CHG
- Passive disinfection caps
- Standardized dressing change kits

I — Informatics

The Data Infrastructure

- Track vascular access device utilization across the entire organization.
- Identify unused or unnecessary PIVs before complications occur
- Monitor dwell time, line usage frequency, and BSI rates by unit and device type
- Build a line list for PIV-only surveillance and apply NHSN CLABSI criteria to PIV-BSI calculation
- Share inserter-level data with physician leadership

C — Culture

Organizational Change

- Device rounds: ask 'What is the indication?' for every line - reference INS 2024 Standards
- Multidisciplinary approach: IP, nurses in quality, front-line nursing CLABSI champions, physician support, patient safety committee
- Empower bedside nurses: 'Have we used this PIV in 24 hours?' - not just 'Does the patient need it?'

Thompson J, et al. Standards of care for PIVCs: Evidence-based expert consensus. JAVA. 2024.
Nickel B, et al. Infusion Therapy Standards of Practice, 9th Ed. J Infusion Nursing. 2024;47(1S):S1–S285.

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UCSD Mission Control CABSI est. July 2025

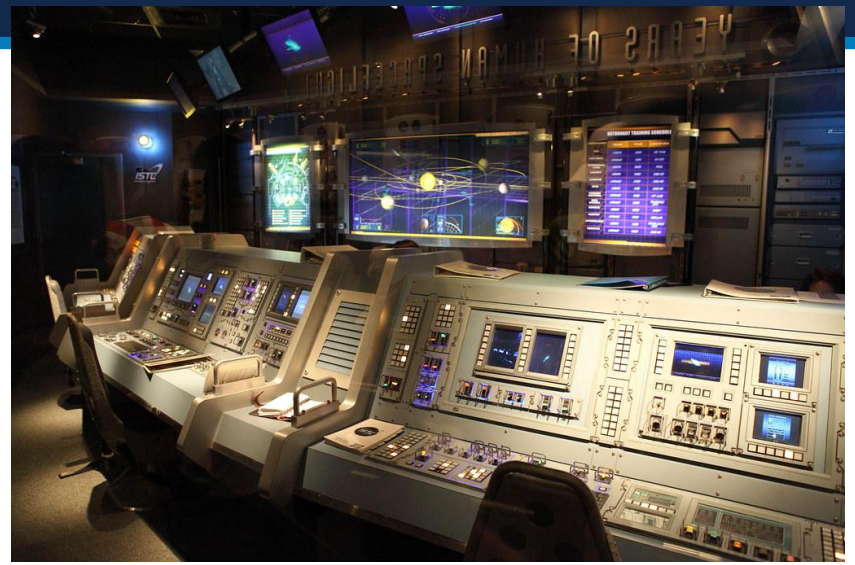
1. **Central Line Not Infusing**: Good Afternoon Provider/RN, Our Mission Control group is working with primary teams to reduce catheter-associated bloodstream infections. This patient's *(insert name of central line),* as indicated by the LDA summary flowsheet, has not been used for infusion in the last 48 hours. Please review the clinical indication for this central line and place an order for removal if it is no longer indicated. Thank you.

2. **Central Line + 2 or more PIVs:** Good Afternoon Provider/RN, Our Mission Control group is working with primary teams to reduce catheter-associated bloodstream infections. This patient currently has 2 PIVs and a central line which is considered a significant line burden, also known as vascular access device density (VADD). Higher VADD is associated with an increased risk of bloodstream infection. Please review the indication of each of these vascular access devices and order removal of those that are no longer clinically indicated. Thank you.

3. **Central Line Not Meeting Necessity:** Good Afternoon Provider/RN**,** Our Mission Control group is working with primary teams to reduce catheter-associated bloodstream infections. This morning, the documented line indication on the LDA summary flowsheet for this patient's *(insert name of central line*) was "No longer indicated, will request order from provider to discontinue". If the central line is no longer indicated, please place an order for removal. Thank you.

4. **3+ PIVs:** Good Afternoon Provider/RN, Our Mission Control group is working with primary teams to reduce catheter-associated bloodstream infections. This patient currently has *insert # PIVs* which is considered a significant line burden also known as Vascular Access Device Density (VADD). Higher VADD is associated with an increased risk of bloodstream infection. Please review the indication for each of these lines and remove those that are no longer needed. Thank you.

5. **Field-Inserted PIVs**: Good Afternoon RN, Our Mission Control group is working with primary teams to reduce catheter-associated bloodstream infections. This patient's *(insert PIV gauge and anatomic location)* is documented to have been inserted in the field, where aseptic conditions are suboptimal. Please remove this PIV in accordance with UCSDHP 394.1 which states that PIVs inserted in the field should be removed within 24 hours of admission. Thank you.



Why Mission Control?

- 340 HOB events identified in a single year at UCSD, 18 of 21 device-associated HOB events were attributable to PIVs (Jung et al., 2026)
- Extend BSI surveillance to include PIVs
- Enables real-time, system-wide identification of idle and unnecessary lines before harm occurs
- Provides an education opportunity for RNs and providers

Jung SHP, et al. System-wide surveillance of hospital-onset bacteremia and fungemia. Open Forum Infect Dis. 2026;13(Suppl 1):ofaf695.047.
Rhee C, et al. Is hospital-onset bacteraemia an actionable quality measure? BMJ Quality & Safety. 2024;33(8):479–482.

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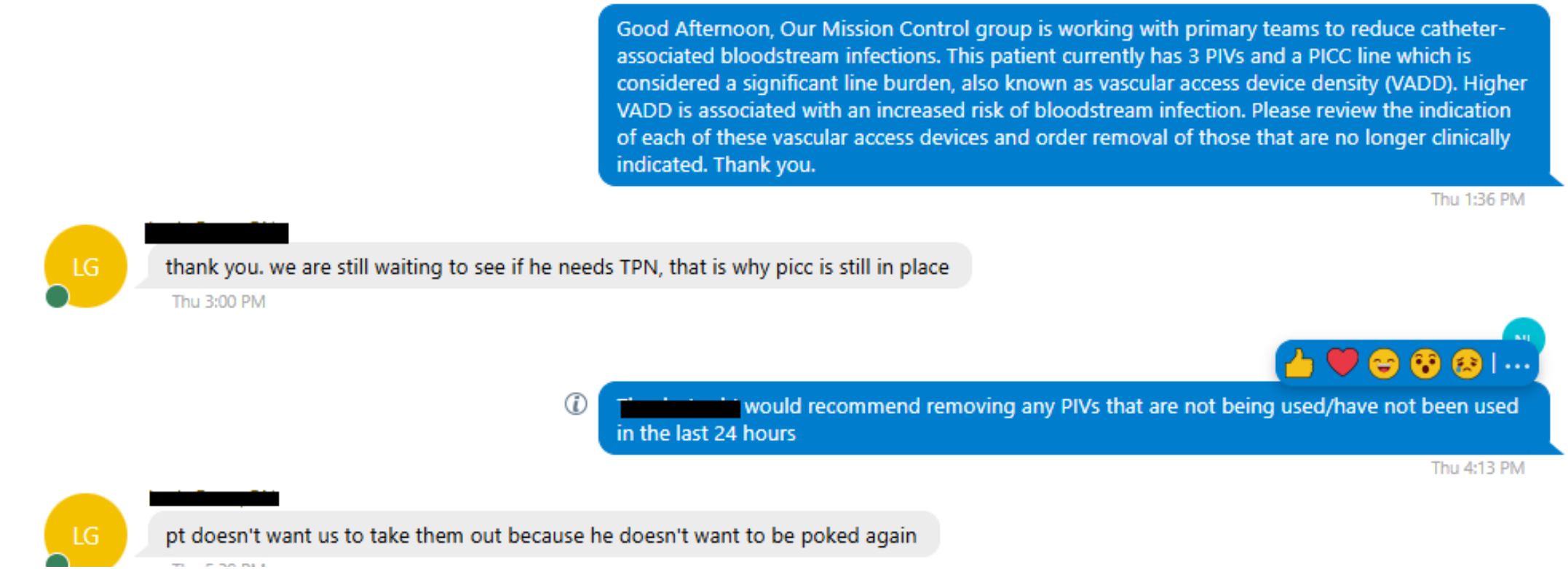
The Infamous “just in case” PIV….



The Infamous “just in case” PIV….

Good Afternoon, Our Mission Control group is working with primary teams to reduce catheter-associated bloodstream infections. This patient currently has 3 PIVs which is considered a significant line burden also known as Vascular Access Device Density (VADD). Higher VADD is associated with an increased risk of bloodstream infection. Please review the indication for each of these lines and remove those that are no longer needed. Thank you.

Oct 20, 3:21 PM

[redacted]

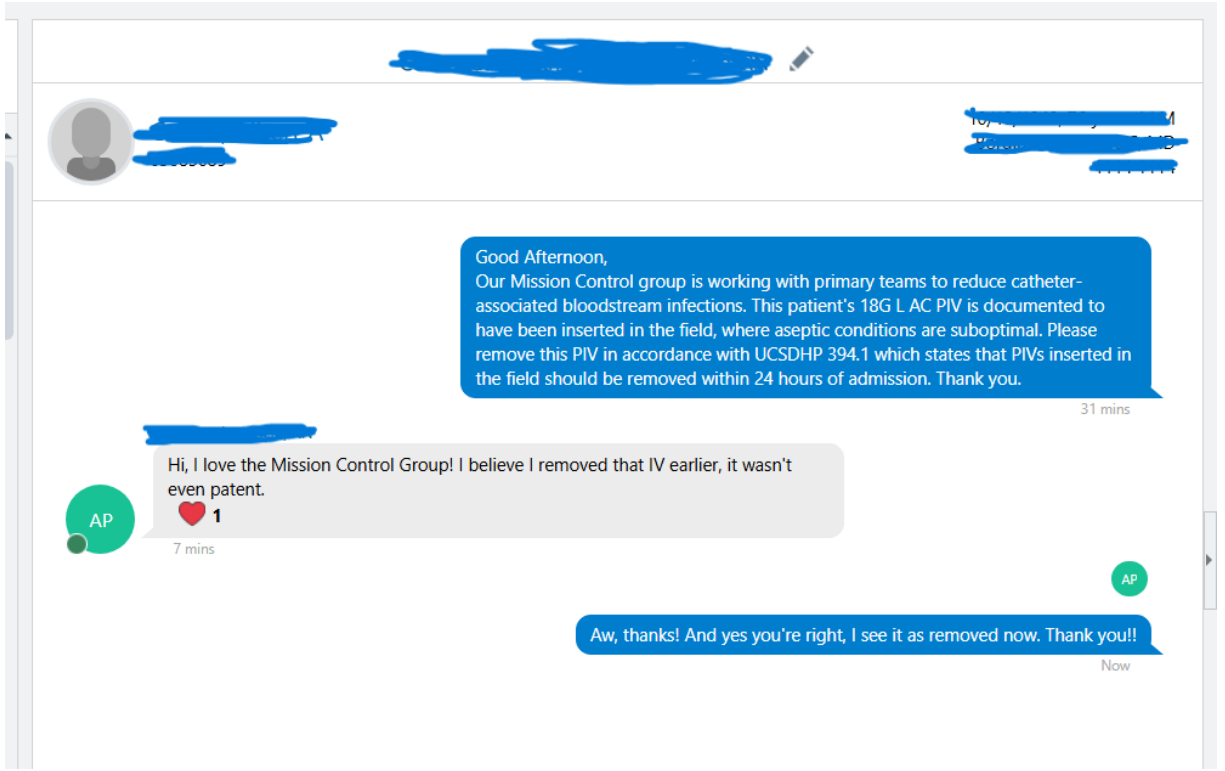
Hi there, one is dedicated line for the heparin gtt. One runs his PRN zofran, and the other is back up in case one of those fails.

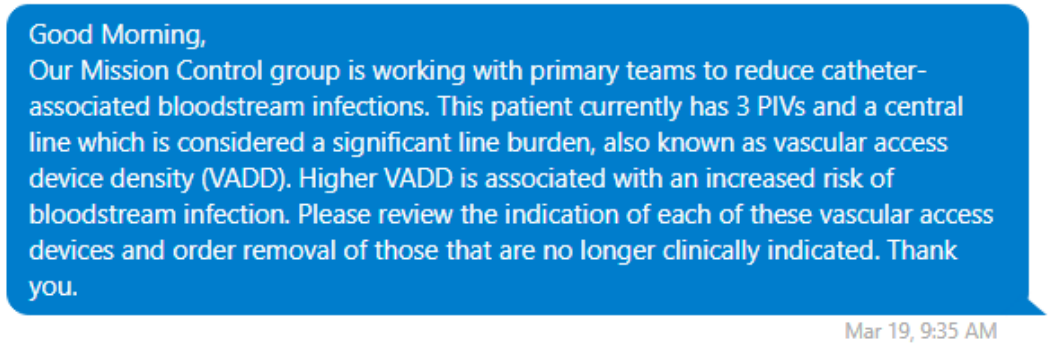
Would you like me to remove one?

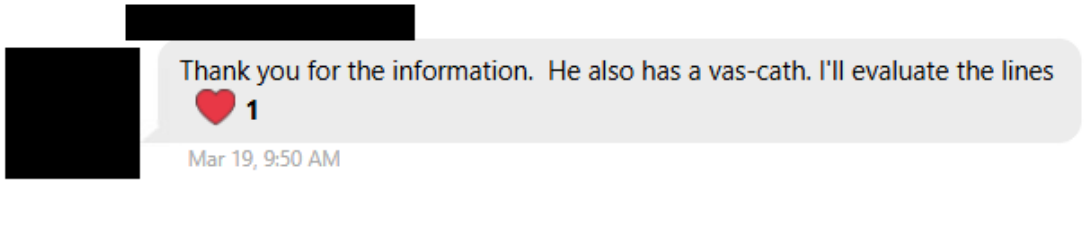
Oct 20, 3:28 PM

I would recommend removing the just in case PIV. Infusion Nurses Society (INS) recommends removing PIVs that have not been used in 24 hours or more, thank you.

Messages are *generally* well-received…







Lots of PIVs getting removed!

Good Afternoon,
Our Mission Control group is working with primary teams to reduce catheter-associated bloodstream infections. This patient currently has insert 4 PIVs which is considered a significant line burden also known as Vascular Access Device Density (VADD). Higher VADD is associated with an increased risk of bloodstream infection. Please review the indication for each of these lines and remove those that are no longer needed. Thank you.

👍 2

Nov 3, 12:00 PM

[redacted]

NR penny, can you remove any PIVs that are no longer necessary please?

Nov 3, 5:30 PM

[redacted]

PH will do ❤️ 1

Nov 3, 5:30 PM

NR PH

good morning - just wanted to follow up on the message from yesterday.

Oct 28, 9:50 AM

[redacted]

Oct 28, 9:52 AM

[redacted]

VW Hi Aryeh. We considered taking out her PIVs recently, however, she's had 2 STEMI scares and 1 (negative) stroke code within the past 4 days, so we were holding onto every line. She is also hemophiliac w/extensive bruising, getting a line was a nightmare for past Rns. It seems now that she is quite stable, so, primary RN Jolyn is hoping to take out the PIVs. Pt may refuse to have them D/C'd, in this case, I'll defer to the primary to document accordingly.

Oct 28, 9:56 AM

ok, sounds good. thank you for explaining.

Oct 28, 9:59 AM

[redacted]

SK Yea I think it would be best to keep the central line in for now

Oct 28, 10:27 AM

[redacted]

I'll talk to her about at least removing the peripheral IVs!
👍 **3**

Oct 28, 10:28 AM

JT Peripheral IVs removed!
👍 1 ❤️ **1**

Oct 28, 1:23 PM

JT VW SK

Mission Control CABSI

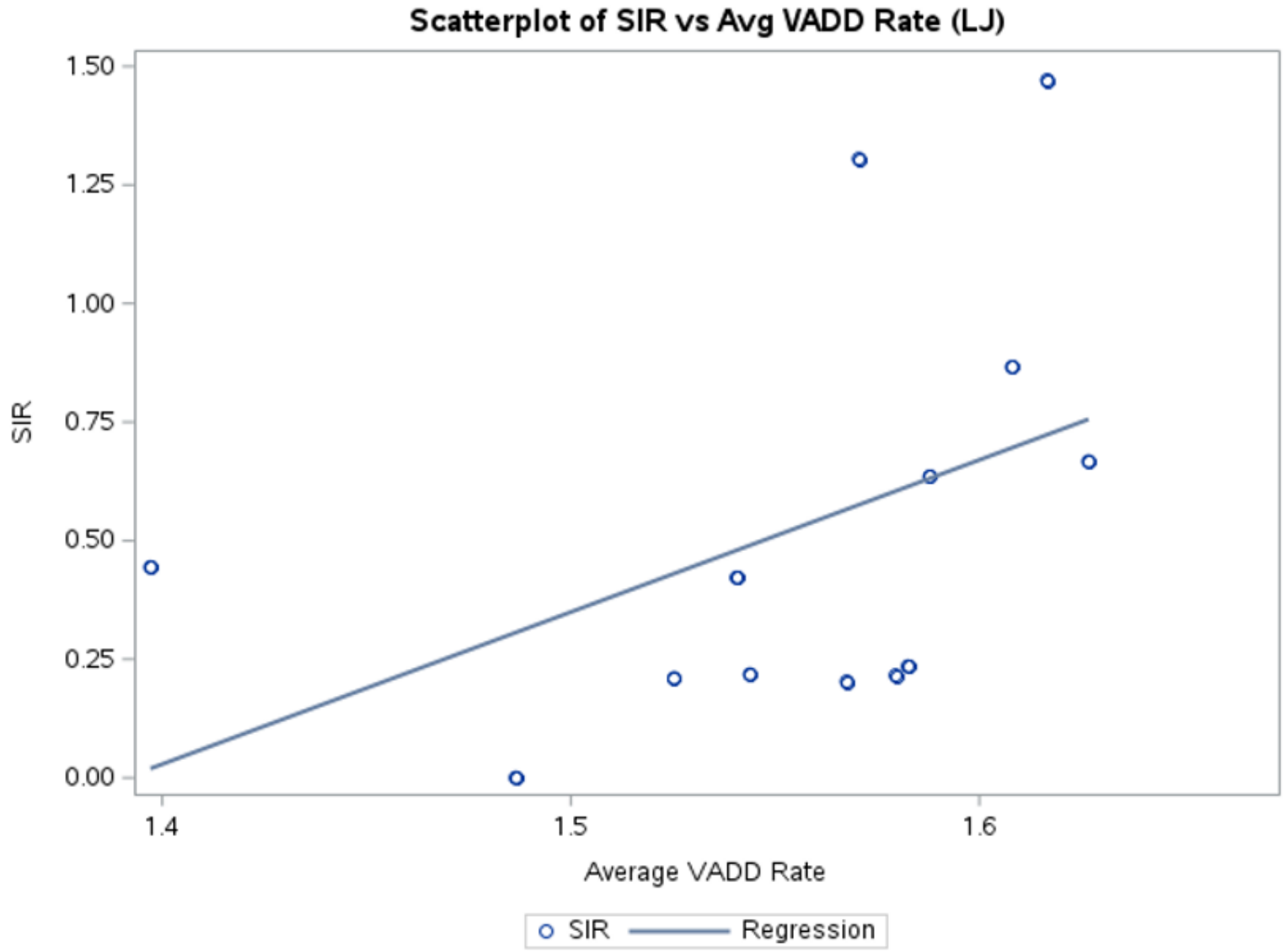
326
total
messages sent

75.2%
Removal rate
Field-PIVs >24 hrs

60%
Removal rate
>3 PIVs in place

Message Type	Total Messages Sent	Lines Removed	Removal Percentage	Key Insight
Field-inserted PIVs in place >24 hrs	145	109	**75.2%**	Should be 100% because it's in UCSDH PIV Policy
>3 PIVs in place simultaneously	50	30	**60%**	Lots of unnecessary PIVs floatin' around…
Total Combined	**195**	**139**	**68% avg**	

Early identification and prompt removal of unnecessary lines reduces vascular access device density (VADD). Higher VADD is associated with an increased risk of bloodstream infection.


Scatterplot of SIR vs Avg VADD Rate (LJ)
SIR
1.50
1.25
1.00
0.75
0.50
0.25
0.00
1.4
1.5
1.6
Average VADD Rate
SIR
Regression

Why Do We Care So Much About Removing PIVs? PIV BSI isn't reportable (yet)

If a central line is present, it will get blamed every time but what if the PIV is the problem…

Kreide et al., Annual Public Health Research Day University of California San Diego May 2026

- Patients with PIVs in addition to their central line have a higher risk of CLABSI
- Reduction of unnecessary PIVs may be a way to decrease CLABSI rates in the ICU settting

Feldheim et al., JAVA. 2023

- Outside of the ICU, the CLABSI and PIV BSI rate per 1,000 line days is not significantly different
- 5/12 PIV-BSI cases due to Staphylococcus aureus

Zhang et al., Journal of Infection Prevention 2016

- PIV BSI rate is lower than that of CLABSI
- Greater number of PIVs in use means absolute infection rates for PIV BSI approach that of CLABSI

Mission Control CABSI

326
total
messages sent

20.6%
Central line + 2 PIVs

11.7%
Central line not meeting necessity

Message Type	Total Messages Sent	Lines Removed	Removal Percentage	Key Insight
Central line + 2 PIVs	67	32	**47.8%**	Assess line indication on a daily basis
Central line not meeting necessity	38	8	**21.1%**	Usually cleans up erroneous documentation
Total Combined	**105**	**40**	**35% avg**	

Early identification and prompt removal of unnecessary lines reduces dascular dccess device density(VADD). Higher VADD is associated with an increased risk of bloodstream infection.

Lessons Learned and Next Steps

Sustainable VAD stewardship requires infrastructure, data, and a culture shift.

Other Initiatives at UCSD

- UCSD PIV Lines Report unit-level visibility into PIV utilization and dwell time trends
- Mission Control CABSI continuing to expand message categories and analyze removal outcome data
- CHG gel dressing transition for central lines building on established PIV CHG program
- Emails sent to central line inserters notifying them of outlier dressing failure rates (both high and low performing)
- MPH Students to Help With Projects (ie. "Have we improved our PIV BSI rate since switching from CHG foam disk to CHG gel dressing for PIVs?")
- PIV BSI Surveillance (coming soon in the next 6 months)

What are the questions we should all be asking?

"Have we used this PIV in the last 24 hours?"

"What is the indication for this line?"

"That was yesterday's indication. What is today's indication?"

- Multidisciplinary rounding: IP + quality nurse + CNS + bedside nurse + physician
- Share unit-level data with managers and frontline nurses — transparency drives accountability

Dear Dr. XXX,

Infection Prevention and Clinical Epidemiology has recently completed an analysis of all internal jugular central lines inserted at UC San Diego Health for calendar year 2024. It was noted that lines inserted by you, had significantly ($p<=0.05$) less unplanned dressing changes than your peers at UC San Diego Health. We would like to thank you for being a champion, as dressing failures are strongly correlated with increased rates of central line associated blood stream infections. The line insertion technique most frequently associated with dressing failures with internal jugular central lines is that the line has been inserted too high. Gravity then pulls the line down towards the chest, and this action detaches the dressing causing an unplanned dressing failure. The latter is particularly true when these lines have several access infusion ports and accessories (e.g. manifolds and/or Stopcocks). Again, thank you for your efforts on behalf of our patients.

Nickel B, et al. Infusion Therapy Standards of Practice, 9th Ed. J Infusion Nursing. 2024;47(1S):S1–S285.

References

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17. Zhang L, et al., Infection risks associated with peripheral vascular catheters Journal of Infection Prevention 2016;17(5): 207-213