



# Le retrait systématique des cathéters veineux périphériques

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# CONTENT

- Introduction
- Literature update: routine replacement *versus* clinically indicated replacement
- Large «*before-after-before*» study conducted in Geneva
- New data on dwell time
- Conclusions

# INTRODUCTION

- A global audit across 13 countries:
  - almost 60% of inpatients had at least one peripheral venous catheter (PVC) in place
- In Switzerland, 48.6% of patients in acute care have a PVC in place every single day
- Approximately 330 million PVCs were sold annually in the US
- PVC-related complications:
  - Hematoma
  - Phlebitis
  - Extravasation
  - Bruising
- Little is known about the bloodstream infection (BSI) risk associated with PVCs

# INTRODUCTION

## PVCs and BSI risk

- Short-term PVCs accounted for:
  - a mean of 6.3% of nosocomial BSIs
  - 23% of nosocomial catheter-related BSIs
- Relative risk of CVC-BSI compared to PVC-BSI varied from **1.5** to 64
- Proportion of *S. aureus* PVC-BSI among CRBSI is high

**Table 2. Risk of *Staphylococcus aureus* Bloodstream Infections due to Infected Peripheral Vascular Catheters**

Study, First Author [Ref]	<b>CRBSI</b>	
	<i>Staphylococcus aureus</i> CR-BSIs due to PVCs	<i>Staphylococcus aureus</i> BSIs due to PVCs
Mylotte [50]	50% of 28 CR-BSIs	18% of 79 BSIs
Thomas <sup>a</sup> [51]	50% of 305 CR-BSIs	
Kok [52]	41% of 75 CR-BSIs	25% of 123 BSIs
Bruno [55]		35% of 31 BSIs <sup>b</sup>
Trinh [53]	12% of 196 CR-BSIs <sup>c</sup>	
Mestre [46]	64% of 14 CR-BSIs	28% of 32 BSIs
Stuart [56]		24% of 583 BSIs
Morris [54]	44% of 121 CR-BSIs	20% of 261 BSIs
Rhodes [57]		24% of 151 BSIs <sup>d</sup>
Austin <sup>a</sup> [49]		76% of 445 BSIs

- Prolonged dwell time and catheter insertion under emergent conditions increased risk of PVC-BSI...

# INTRODUCTION

## PVCs and BSI risk – dwell time

- No correlation between the number of catheter days per site for patients with a peripheral IV device, and hospital-acquired bacteraemia

- The mean PVC dwell time in PVC-BSI cases was 3.9 days ( $\pm 2.1$  days)
- One study found that 54% of PVC-BSI occurred in PVC in place for  $\geq 3$  days
- One study found that 61% of PVC-BSIs occurred in PVC in place for  $\geq 3$  days
- Other study found that 1, 32% of PVC-BSIs occurred in PVC in place for  $\geq 3$  days
- 30 of 45 PVC-BSIs occurred in PVCs with a dwell time of  $\geq 4$  days

**Moreover... Several studies  $\rightarrow$  reductions in risk of *S. aureus* BSI after instituting infection prevention initiatives involving limits in PVC dwell time to 3 days or doing so along with other interventions**

# INTRODUCTION

## Several prevention measures – one of them...

- Whether to replace PVCs routinely or when clinically indicated was categorized as an unresolved question by the US CDC:

### Replacement of Peripheral and Midline Catheters Recommendations

1. There is no need to replace peripheral catheters more frequently than every 72-96 hours to reduce risk of infection and phlebitis in adults [36, 140, 141]. *Category IB*
2. No recommendation is made regarding replacement of peripheral catheters in adults only when clinically indicated [142-144]. *Unresolved issue*
3. Replace peripheral catheters in children only when clinically indicated [32, 33]. *Category IB*
4. Replace midline catheters only when there is a specific indication. *Category II*

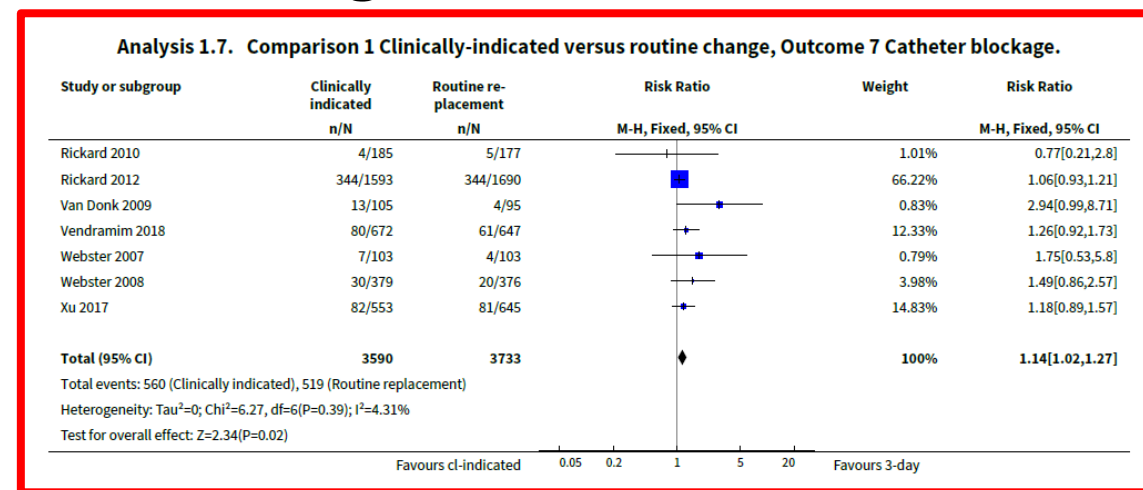
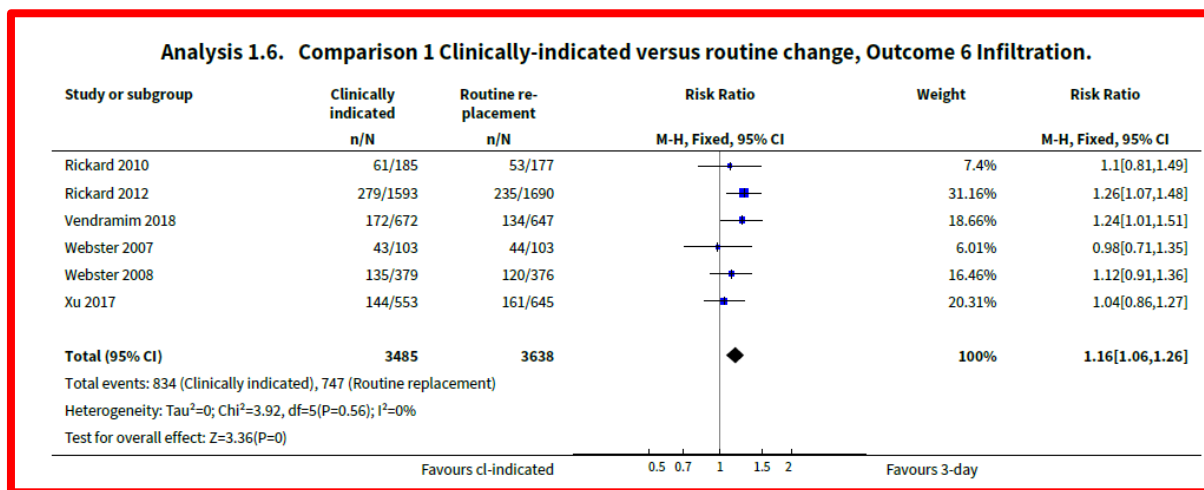
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# LITERATURE UPDATE

## Recent systematic review and meta-analysis

- 7,412 catheters (from RCTs) included
- Routine replacement:
  - ↓ **infiltration** of fluid into surrounding tissues
  - ↓ rates of catheter failure due to **blockage**



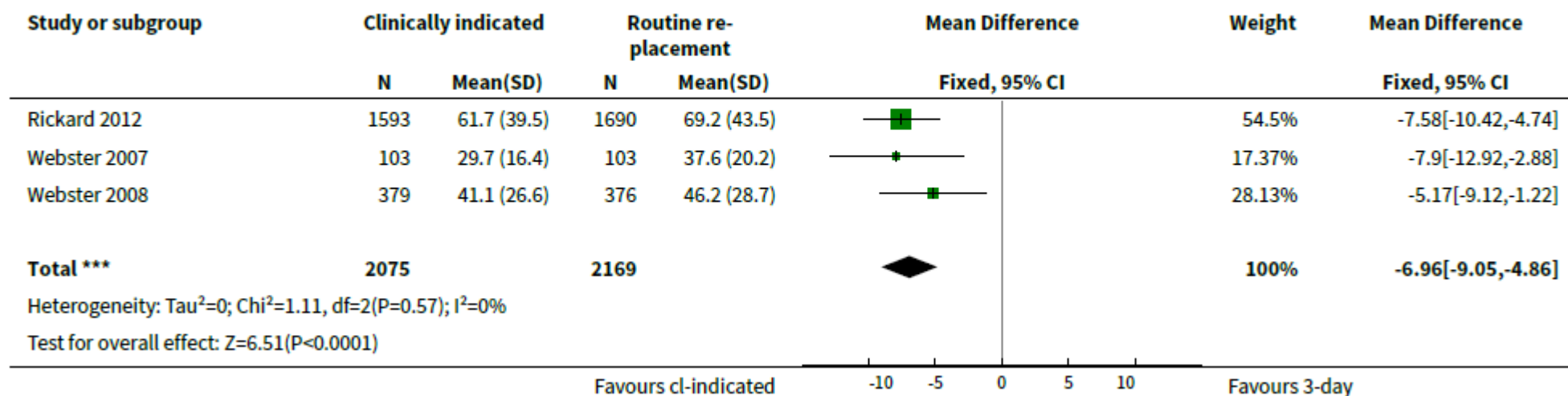


# LITERATURE UPDATE

## Recent systematic review and meta-analysis

- 7,412 catheters (from RCTs) included
- Clinically indicated removal:
  - ↓ device-related costs

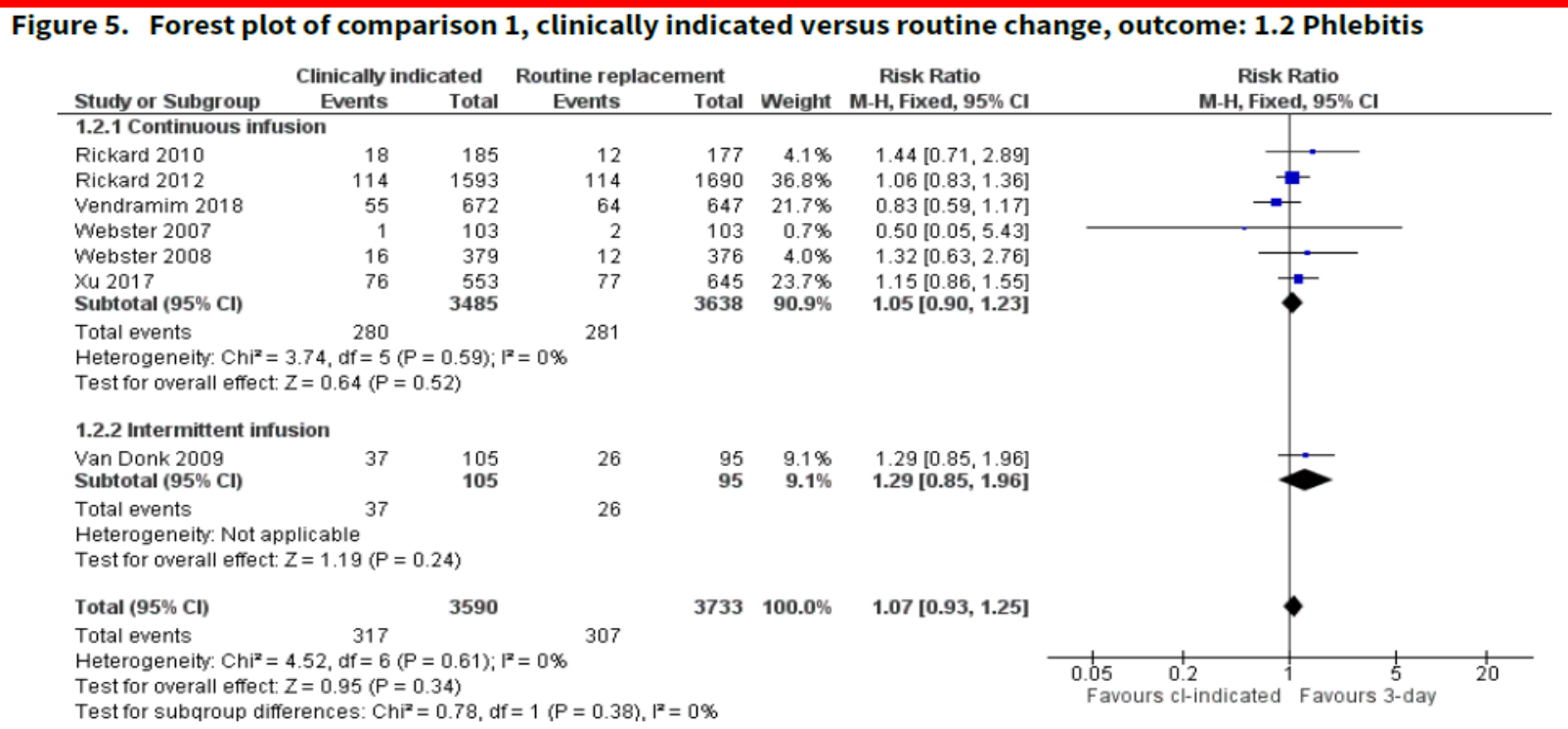
**Analysis 1.5. Comparison 1 Clinically-indicated versus routine change, Outcome 5 Cost.**



# LITERATURE UPDATE

## Recent systematic review and meta-analysis

- 7,412 catheters (from RCTs) included
- No clear difference in the incidence of **thrombophlebitis**

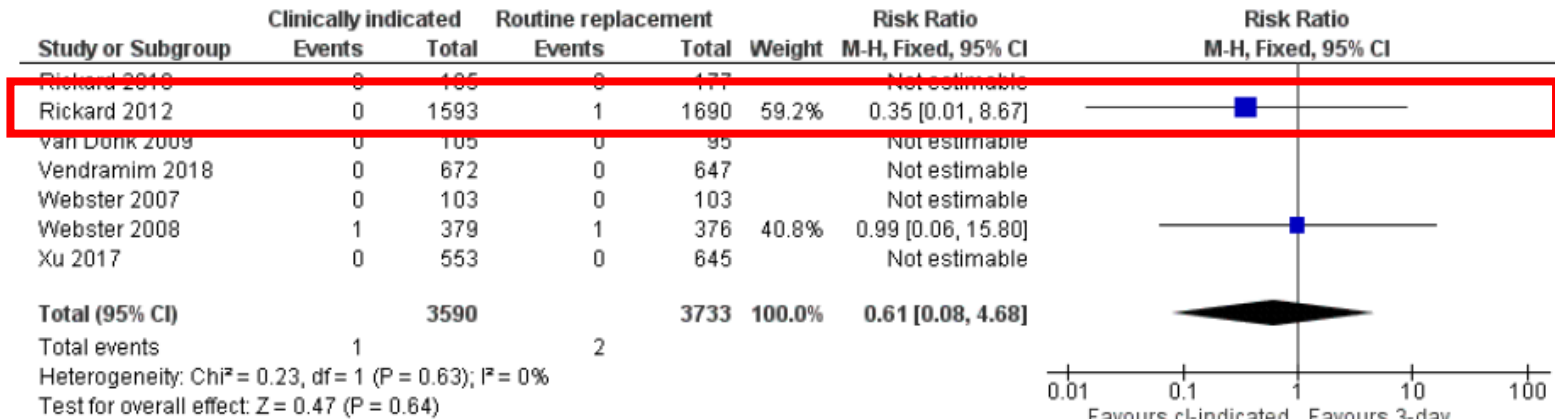


# LITERATURE UPDATE

## Recent systematic review and meta-analysis (BSI):

- Similar incidences of **CRBSI**

**Figure 4. Forest plot of comparison 1, clinically indicated versus routine change, outcome: 1.1 Catheter-related bloodstream infection**

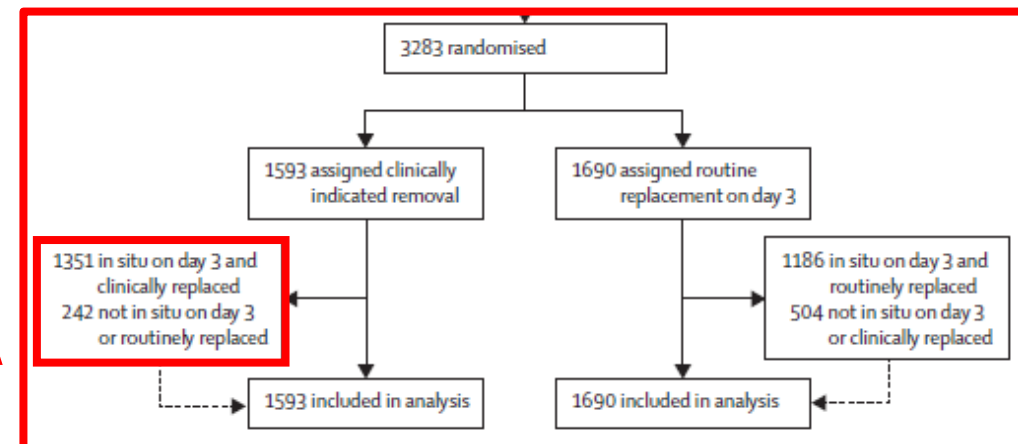


**...3 CRBSI in total...**

# LITERATURE UPDATE

## Largest RCT 2012

- Exclusion criteria:
  - Bloodstream infection, planned removal of intravenous catheter within 24h, or intravenous catheter already in situ for more than 72 h.
  - PVCs inserted in an emergency were not eligible
- Other methodological problems:
  - Not blinded
  - Phlebitis assessed by research nurses



# LITERATURE UPDATE

## Largest RCT 2012

	Clinically indicated (n=1593)	Routine replacement (n=1690)	Risk (95%CI)	p value
<b>Primary outcome, intention-to-treat analysis</b>				
Phlebitis per patient, n (%)	114 (7%)	114 (7%)	RR 1.06 (0.83 to 1.36); ARD 0.41% (-1.33 to 2.15)	0.64
Phlebitis/1000 intravenous catheter days (95% CI)	13.08 (10.68-15.48)	13.11 (10.71-15.52)	HR 0.94 (0.73 to 1.23)	0.67
<b>Primary outcome, per-protocol analysis*</b>				
Phlebitis per patient	63/1351 (5%)	47/1186 (4%)	RR 1.18 (0.81 to 1.70); ARD 0.70% (-0.88 to 2.28)	0.39
Phlebitis/1000 intravenous catheter days (95% CI)	11.4 (8.6-14.2)	13.8 (9.9-17.8)	IRR 0.83 (0.56 to 1.23)	0.32
<b>Secondary outcomes, n (n per 1000 intravenous catheter days)</b>				
Any infusion failure†	670 (76.9)	636 (73.2)	HR 0.99 (0.89 to 1.11)	0.87
Infiltration	279 (32.0)	235 (27.0)	HR 1.06 (0.89 to 1.27)	0.51
Occlusion	344 (39.5)	344 (39.6)	HR 0.92 (0.79 to 1.07)	0.92
Accidental removal	166 (19.0)	159 (18.3)	HR 0.98 (0.79 to 1.23)	0.88
CRBSI‡	0 (0)	1 (0.11)	..	..
All BSI	4 (0.46)	9 (1.03)	HR 0.46 (0.14 to 1.48)	0.19
Venous (local) infection‡	0	0	..	..
Mortality, n (%)§	4 (<1%)	4 (<1%)	RR 1.06 (0.27 to 4.23)	0.93

ARD=absolute risk difference. BSI=bloodstream infection. CRBSI=catheter-related bloodstream infection. HR=hazard ratio. IRR=incident rate ratio. RR=relative risk. \*First catheter per patient only. †Combined endpoint of phlebitis, infiltration, occlusion, accidental removal, and CRBSI. ‡Risk and p value inestimable because of 0 incidence in one or both groups. §In all cases, mortality was unrelated to intravenous catheter treatment.

Table 3: Study outcomes by treatment group (per-patient analysis)

### External validity:

- <1% mortality
- CR-BSI 1/3283 (0.03%) patients (1/5907 PVCs)
- Data only from Australia...

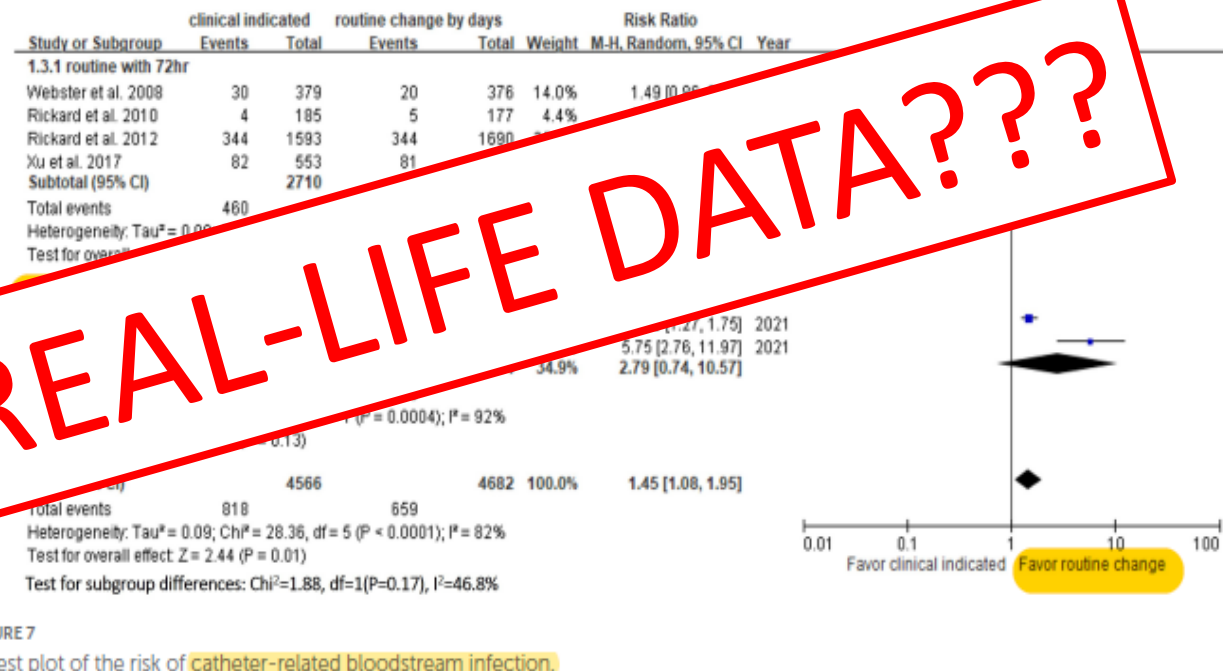
# LITERATURE UPDATE

## New meta-analysis

- Two new studies from China

TABLE 3 Study outcomes by treatment group

	Clinically indicated (n=1556)	Routine replacement (n=1494)	Risk (95%CI)	p-value
<b>Primary outcome, intention-to-treat analysis</b>				
Phlebitis per patient, n (%)	179 (11.5%)	150 (10%)	RR 1.083 (0.957 to 1.226)	.193
			ARD 15.3% (12.0% to 19.2%)	
Phlebitis/1000 intravenous catheter days (95% CI)	28.4 (24.4–32.8)	32.3 (27.4–37.8)	HR: 0.69% (0.552, 0.877)	.002
<b>Primary outcome, per-protocol analysis<sup>a</sup></b>				
Phlebitis per patient	171/1489 (11.5%)	141/1365 (10.3%)	RR 1.065 (0.937 to 1.212)	.323
			ARD 11.9% (8.7% to 15.9%)	
Phlebitis/1000 intravenous catheter days (95% CI)	27.4 (23.5–31.8)	35.0 (29.6–41.2)	HR 0.525 (0.407, 0.677)	
<b>Secondary outcomes, n (%)</b>				
Any infusion failure	721 (46.3%)	475 (31.8%)		
Infiltration	217 (13.9%)			
Occlusion	312 (20.1%)			
Dislodgement				
<b>CRBSI</b>				
All BSI				.270
Venous (local) infection			0.86 (0.05, 3.14)	.367
Mortality, n (%)			HR 0.97 (0.20, 4.82)	.973



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Research

JAMA Internal Medicine | [Original Investigation](#)

# Comparison of Routine Replacement With Clinically Indicated Replacement of Peripheral Intravenous Catheters

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Stephan Harbarth, MD, MSc; Walter Zingg, MD



# MATERIAL & METHODS

## Setting, patients and PVCs:

- Observational study: prospectively collected data at the University of Geneva Hospitals (**ten sites**)
- Included patients and PVCs: 1 January 2016 and 29 February 2020
- Hospital-wide **prospective surveillance** of all healthcare-associated bloodstream infections including PVC-BSI (IPC team)
- Individual-level data on PVC: electronic health record

**BSI**

**PVC**

# MATERIAL & METHODS

## Definitions:

- PVC-BSI:

- BSI occurring from day of insertion until 48h after catheter removal and positive culture with the same microorganism of:
  - either a quantitative PVC tip culture  $\geq 10^3$  CFU/ml **or**
  - positive superficial culture with the same microorganism from pus from insertion site

**Catheter-related**

## OR

- A BSI was associated with a catheter if occurring from day of insertion until 48h after catheter removal, the resolution of symptoms in 48h after catheter removal and the absence of any other infectious focus.

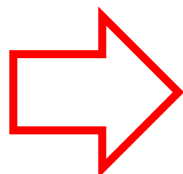
**Catheter-associated**

# MATERIAL & METHODS

## Intervention

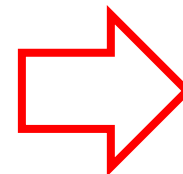
1<sup>st</sup> January 2016-  
31<sup>st</sup> March 2018:  
**Routine**  
replacement of  
PVCs every 96h.

**BASELINE**



1<sup>st</sup> April 2018-14<sup>th</sup>  
October 2019:  
Replace PVCs  
when **clinically**  
**indicated** only.

**INTERVENTION**



15<sup>th</sup> October 2019-  
29<sup>th</sup> February  
2020: **Routine**  
replacement of  
PVCs every 96h.

**REVERSION**

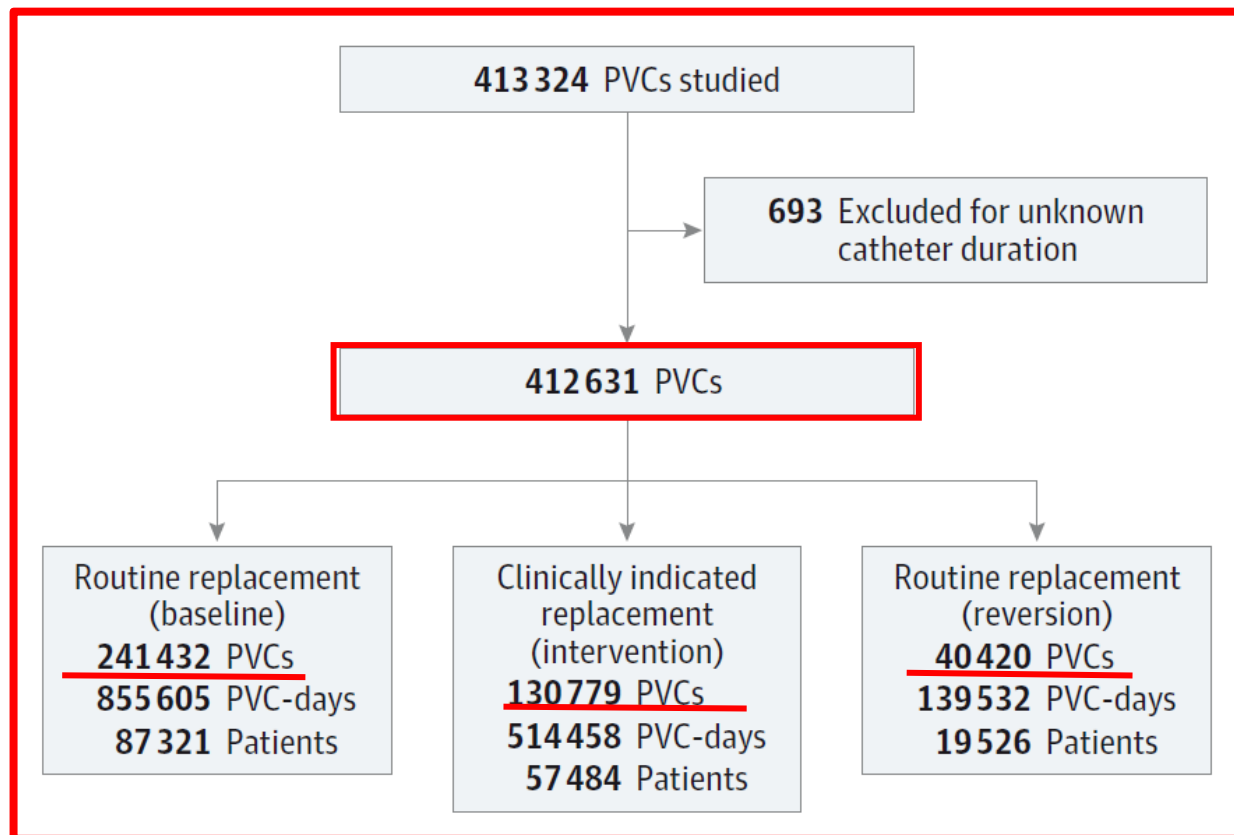
# MATERIAL & METHODS

## Statistics:

- Monthly aggregated data on PVCs and PVC-days were **graphically summarized** (2016 – 2020)
- **Incidence rate ratios [IRR]** were calculated for the intervention and reversion periods [baseline period as a reference] → segmented Poisson regression models on aggregated monthly data
  - Three sensitivity analyses:
    - Excluding catheters inserted during the year 2016
    - Excluding children
    - Excluding PVCs inserted in the ICU

# RESULTS

## Flow-chart:



# RESULTS

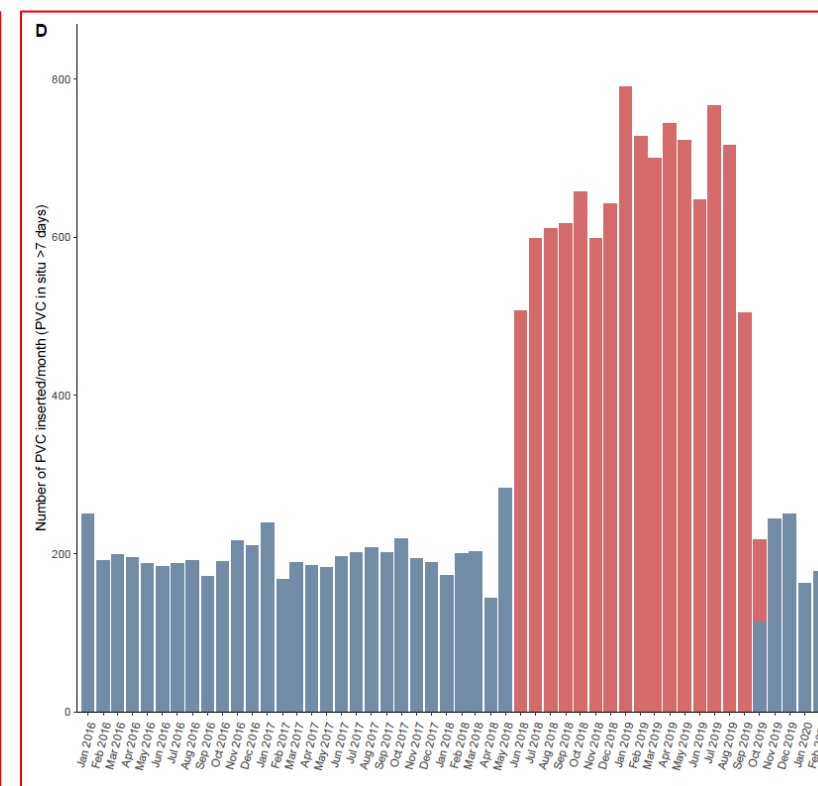
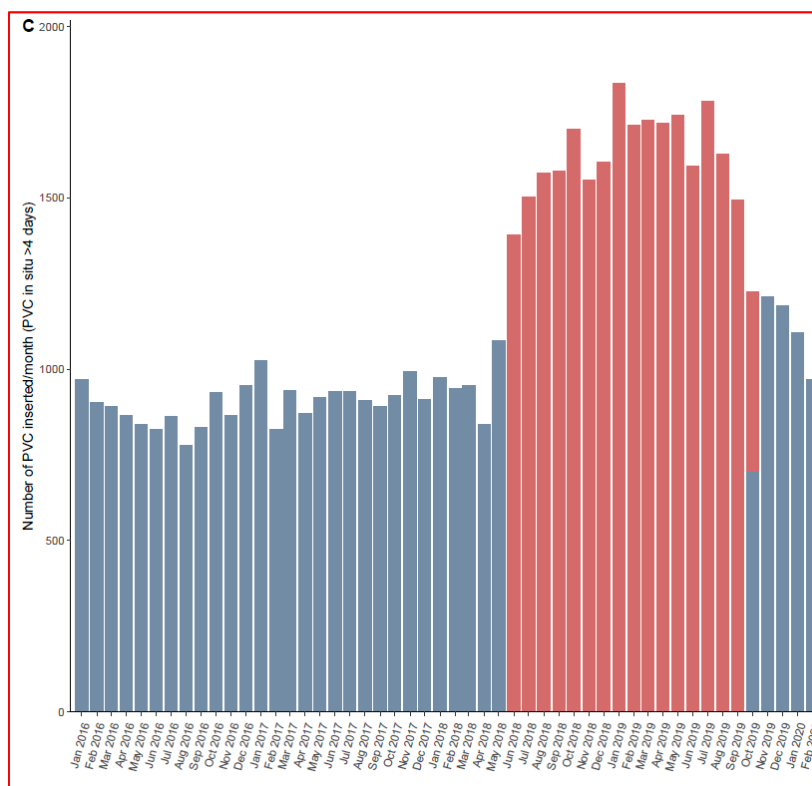
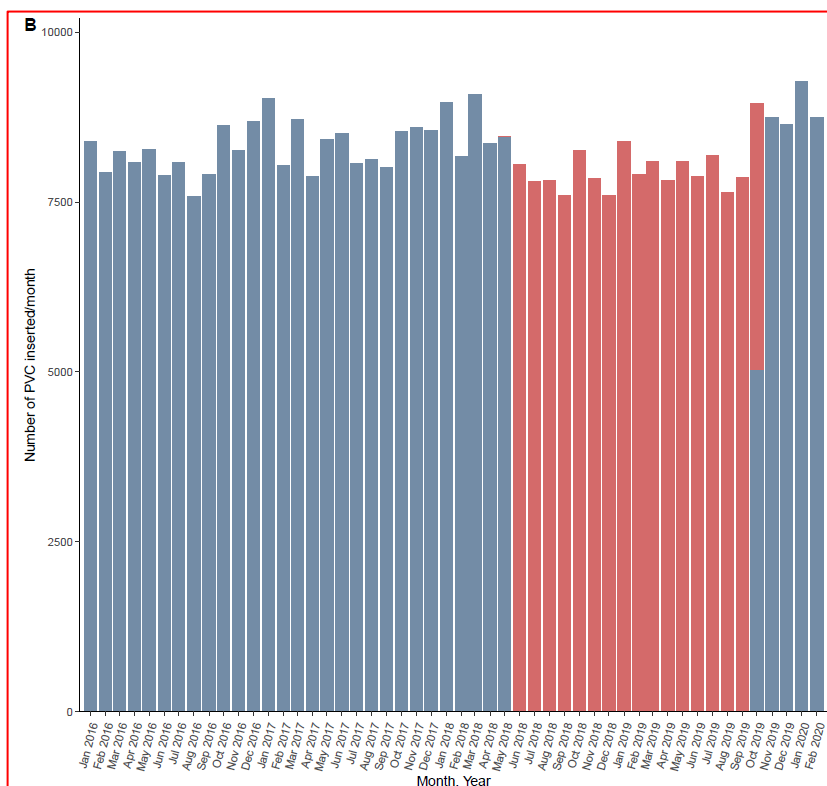
## Description of the study population by study period

Table. Characteristics of the Study Population by Study Period<sup>a</sup>

Characteristic	Baseline	Intervention	Reversion	P value
<b>Sex<sup>b</sup></b>				
Female	47 114 (54.0)	31 259 (54.4)	10 555 (54.1)	.28
Male	40 207 (46.0)	26 225 (45.6)	8971 (45.9)	
Age, median (IQR) <sup>b</sup>	51 (33-71)	52 (33-72)	55 (35-74)	<.001
ICU admission	7120 (2.9)	2782 (2.1)	732 (1.8)	<.001
No. of catheters per patient, median (IQR) <sup>c</sup>	1 (1-2)	1 (1-2)	1 (1-2)	<.001
<b>Dwell time, d</b>				
>4	26 372 (10.9)	26 656 (20.4)	5170 (12.8)	<.001
>7	5745 (2.4)	10656 (8.1)	947 (2.3)	<.001
<b>Insertion site</b>				
Forearm	130 877 (54.2)	50 584 (38.7)	15 276 (37.8)	<.001
Arm	6930 (2.9)	2105 (1.6)	675 (1.7)	
Elbow	12 247 (5.1)	21 508 (16.4)	7530 (18.6)	
Hand	69 615 (28.8)	30 930 (23.7)	9141 (22.6)	
Other	6018 (2.5)	2636 (2.0)	771 (1.9)	
Wrist	15 745 (6.5)	23 016 (17.6)	7027 (17.4)	
<b>Operator</b>				
Out-of-hospital	18 909 (7.8)	10 573 (8.1)	2786 (6.9)	<.001
In-hospital	222 523 (92.2)	120 206 (91.9)	37 634 (93.1)	
PVC-BSI	11 (<0.1)	46 (<0.1)	4 (<0.1)	<.001

# RESULTS

## Number of PVCs stratified by catheter duration during the three study periods.



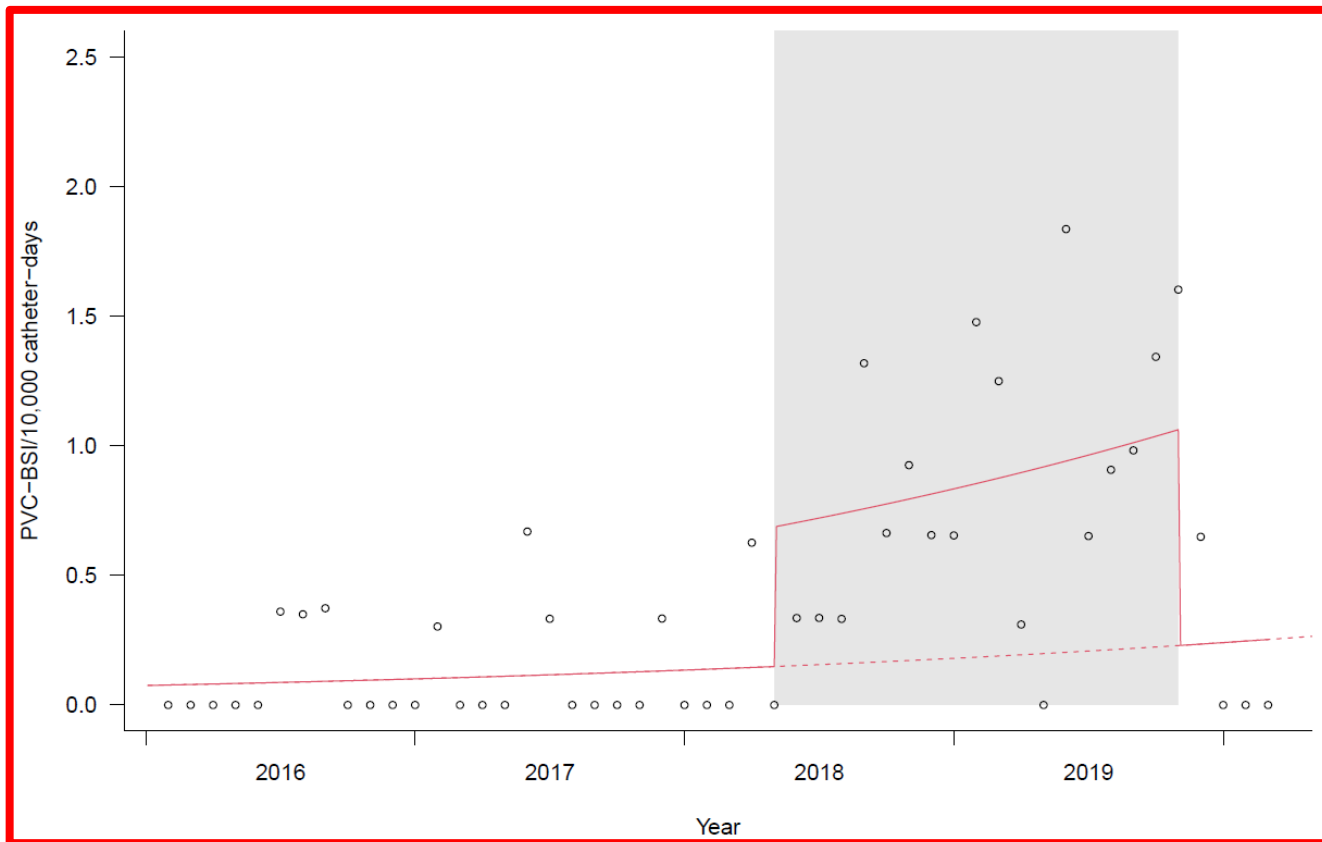
Number of PVC inserted/month

Number of PVC inserted/month (PVC in situ >4 days)

Number of PVC inserted/month (PVC in situ >7 days)

# RESULTS

## Monthly incidence of PVC-BSIs during the three study periods.

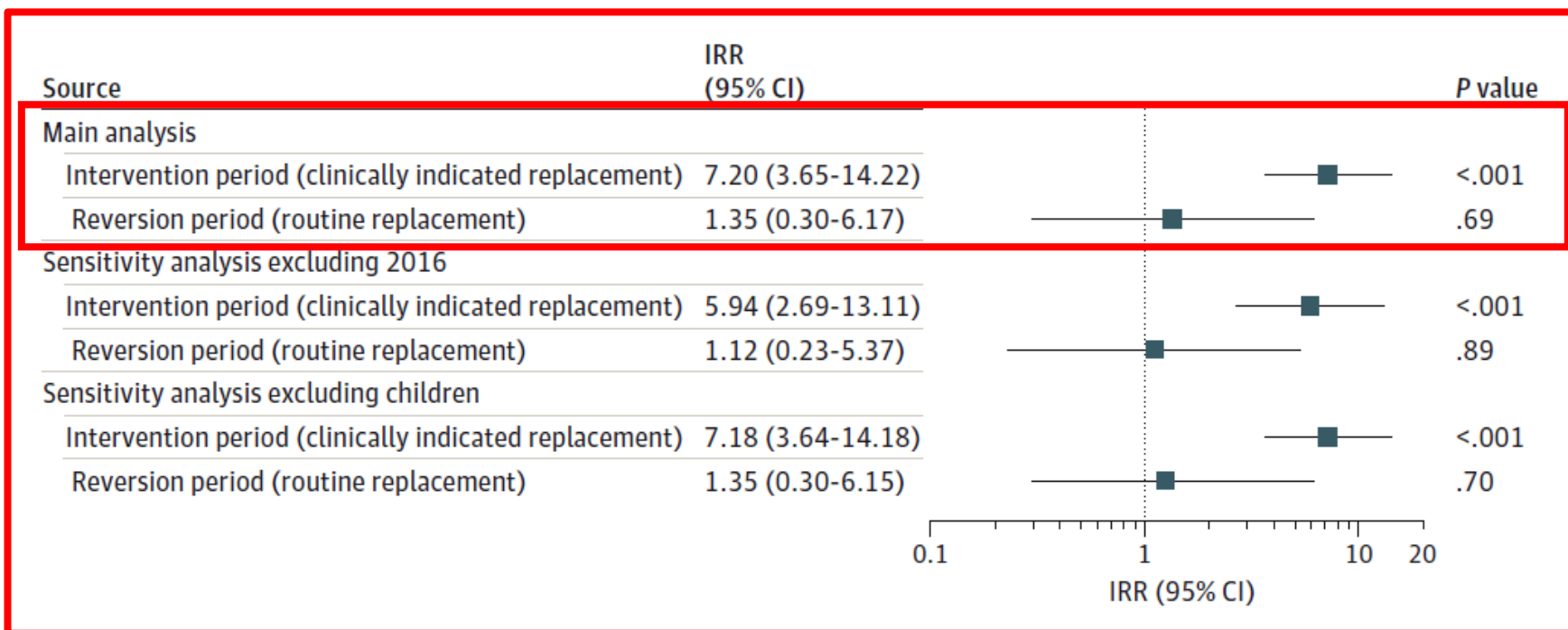


The incidence rate of PVC-BSI during the intervention period was 0.9 per 10'000 catheter-days, compared to 0.13 per 10'000 catheter-days during the baseline period.



# RESULTS

## IRRs of PVC-BSI during intervention and reversion periods



Reference:  
baseline  
period

Without ICU:

- Intervention: IRR 6.81, 95% CI 3.53-13.13,  $p < .001$
- Reversion: IRR 1.26, 95% CI 0.28-5.68,  $p = 0.76$

# RESULTS

## Microbiological etiology of PVC-BSI, stratified by routine and clinically indicated replacement periods

	Routine replacement <sup>o</sup>	Clinically indicated replacement	p-value*
<b>Achromobacter, n (%)</b>	0 (0)	1 (2.2)	0.64
<b>CoNS or other skin commensals, n (%)</b>	9 (60)	23 (50)	
<b>Enterobacter spp, n (%)</b>	1 (6.7)	3 (6.5)	
<b>Fungi, n (%)</b>	1 (6.7)	1 (2.2)	
<b>Klebsiella spp, n (%)</b>	1 (6.7)	3 (6.5)	
<b>MRSA, n (%)</b>	0 (0)	3 (6.5)	
<b>MSSA, n (%)</b>	1 (6.7)	7 (15.2)	
<b>Pseudomonas aeruginosa, n (%)</b>	0 (0)	3 (6.5)	
<b>Serratia marcescens, n (%)</b>	1 (6.7)	0 (0)	
<b>Sphingomonas paucimobilis, n (%)</b>	0 (0)	1 (2.2)	
<b>Polymicrobial, n (%)</b>	1 (6.7)	1 (2.2)	

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# CONCLUSIONS

## The debate is (still) open:

- Evidence from RCTs:
  - Two trials reported 2 suspected BSI and one CRBSI, respectively
  - RCTs usually did not specifically target PVC-BSI as primary outcome (rare occurrence)
  - Despite large numbers at first glance, all RCTs were underpowered for detecting differences in PVC-BSI
  - PVC inserted in non-critical situations
  - Randomization NOT at day 3 or 4
- Large observational studies:
  - ↑ risk of PVC-BSI

**ICU?**

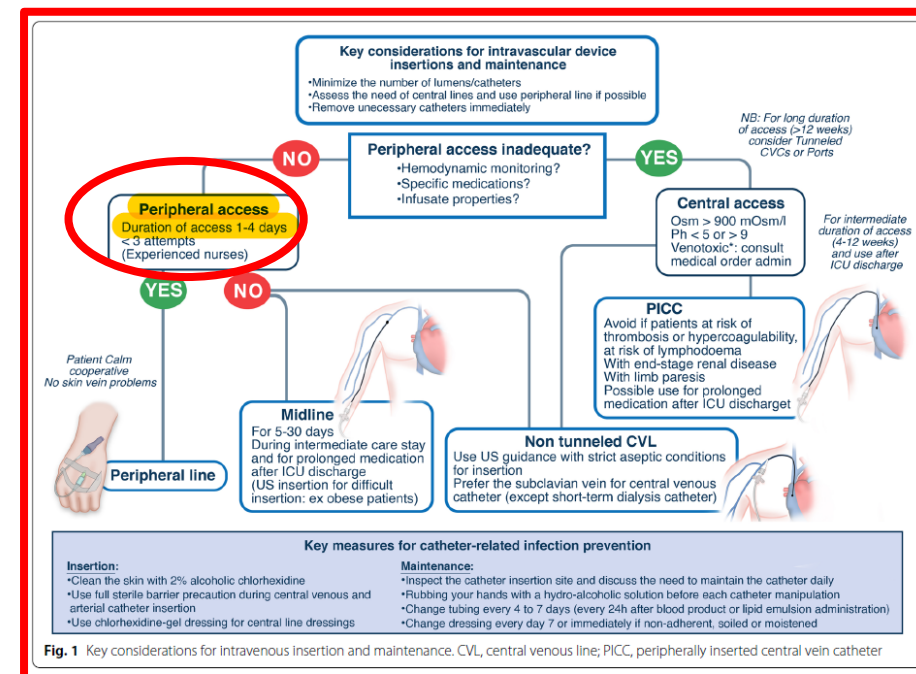
# CONCLUSIONS

The debate is (still) open:

- According to “insertion recommendations”:
  - PVC should not be inserted for long infusions

Figure 3. Venous access device recommendations for infusion of peripherally compatible infusate.

Device Type	Proposed Duration of Infusion			
	≤5 d	6–14 d	15–30 d	≥31 d
Peripheral IV catheter	No preference between peripheral IV and US-guided peripheral IV catheters for use ≤5 d			
US-guided peripheral IV catheter		US-guided peripheral IV catheter preferred to peripheral IV catheter if proposed duration is 6–14 d		
Nontunneled/acute central venous catheter		Central venous catheter preferred in critically ill patients or if hemodynamic monitoring is needed for 6–14 d		
Midline catheter		Midline catheter preferred to PICC if proposed duration is ≤14 d		



# CONCLUSIONS

## The debate is (still) open:

- **1 PVC-BSI per 10'000** catheter-days → justification for routine replacement of PVCs?
  - PVC-BSI is the rarest among many complications around vascular access.
- Routine replacement → **high number of used catheters** per hospital stay
- Clinically indicated removal maybe reduced device-related **costs**
- Repeated insertions
  - Patient discomfort and decreased venous capital for patients
  - HCWs → increased risks of needle-stick injuries and is time-consuming for vascular access teams
- **Phlebitis**: unclear - new data suggest a reduction with routine replacement

- Routine replacement reduces **extravasation**
- Rates of catheter failure due to **blockage** were probably lower in the routine replacement group
- **CRBSI**
  - CRBSI → morbidity & mortality.
  - *S. aureus* infections?

CONTRA

PRO

!!!BANALIZATION!!!



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!!!!!!THANK YOU!!!!!!