Catheter-related infections in intensive care units. Closing the knowledge gap with data from four randomized trials.

Dr. med. Niccolò Buetti

CONTENTS

1) Project: general remarks
   - Background
   - Main objective & implementation: four studies and merging
   - Flow-chart & cohort description

2) Specific analyses
   a) Central venous catheters *versus* short-term dialysis catheters
   b) Microorganisms and insertion site
   c) Local signs and catheter-related infections

1. PROJECT: GENERAL REMARKS

1.1 BACKGROUND:

0.459 (95% CI, 0.381-0.554) for CLABSI

- Short-term cath … vent in the intensive care u…
- Central venous … lf of all ICU patients.
- One third of all … heter (**AC**), resulting in abo…
- Short-term dialy… terized by infection rates as high as …
- All these cathet… alization duration, hospital costs, patient mor… critically ill adult patients.

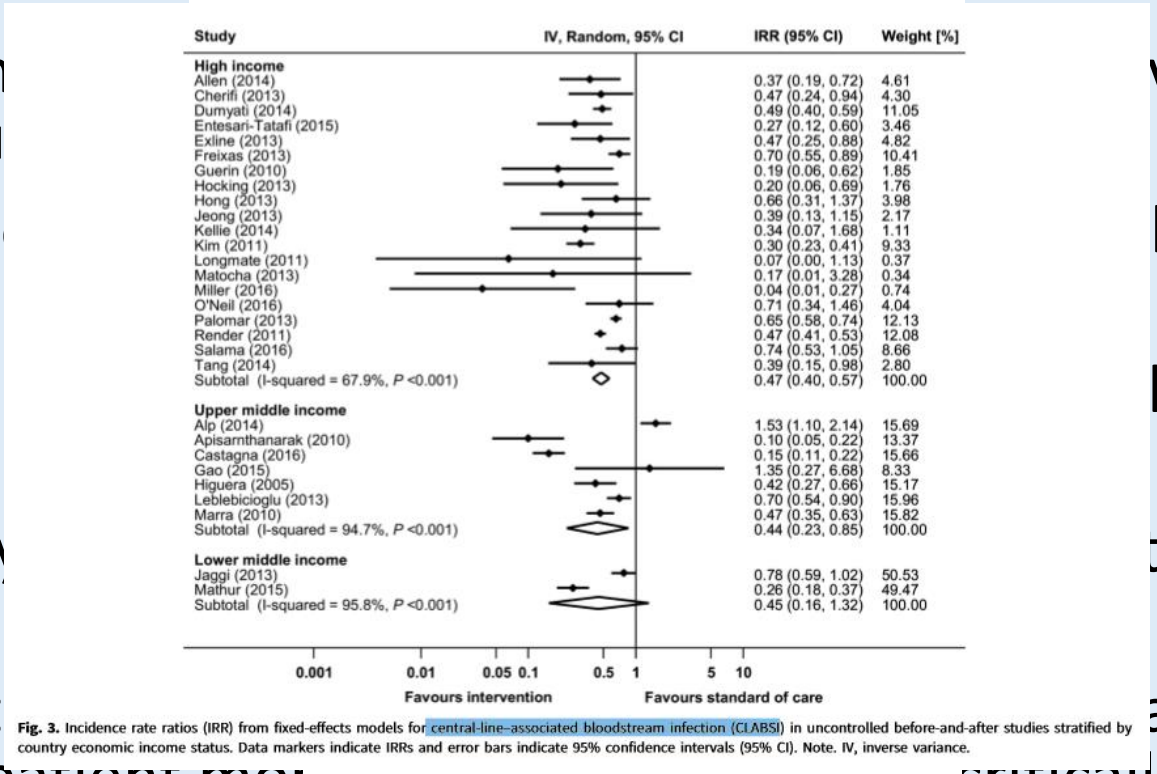


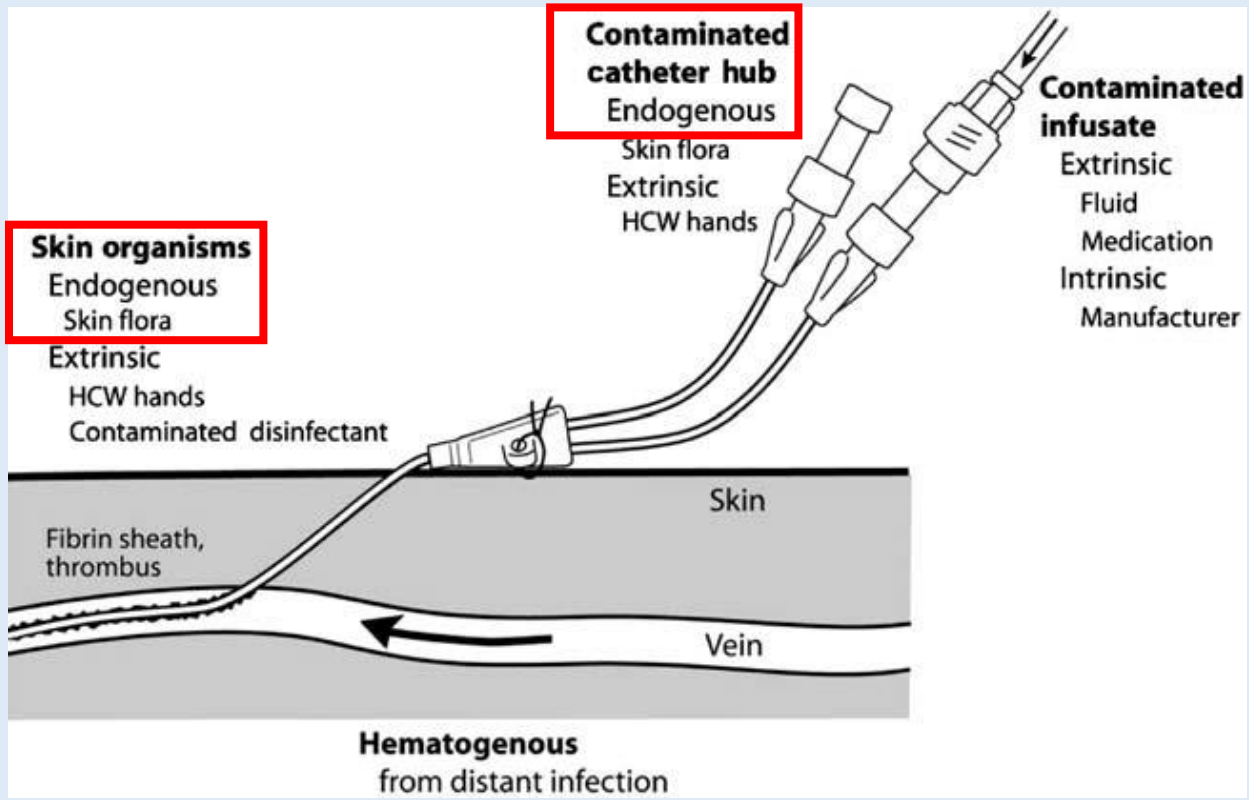
Fig. 3. Incidence rate ratios (IRR) from fixed-effects models for central-line–associated bloodstream infection (CLABSI) in uncontrolled before-and-after studies stratified by country economic income status. Data markers indicate IRRs and error bars indicate 95% confidence intervals (95% CI). Note. IV, inverse variance.

→ **PREVENTABLE!!!**

Blot SI *et al.,* CID, 2005. O'Grady NP *et al.,* CID, 2011. Dudeck MA *et al.,* Am j inf con, 2015. O'Horo JC *et al.,* Crit care med, 2014. Schneider A *et al.,* ICM, 2017. Schreiber W et al., ICHE, 2018.

1. PROJECT: GENERAL REMARKS

1.1 BACKGROUND & PATHOGENESIS:



Safdar N, Maki DG., ICM, 2004.

Extraluminal: microorganisms contaminate the catheter during the insertion and subsequently migrate further along the outer lumen of the catheter

Endoluminal: microorganisms from the hands of healthcare workers contaminating and colonizing the catheter hub during care characterize long-term catheter (?) infections

1. PROJECT: GENERAL REMARKS

1.2 MAIN OBJECTIVE AND IMPLEMENTATION:

- **To explore determinants (risk and prognostic factors) of catheter-related bloodstream infections.**
- **Creation of large data base:**
  - Data from four large randomized trials investigating prevention measures for catheter-related infections.
  - Merging the data was facilitated by the fact that all these studies rely on the same definitions and similar inclusion criteria.
  - Data quality controls have been ensured by study data monitoring during the data collection and before database lock.

1. PROJECT: GENERAL REMARKS

1.2 IMPLEMENTATION: DRESSING 1

Chlorhexidine-Impregnated Sponges and Less Frequent Dressing Changes for Prevention of Catheter-Related Infections in Critically Ill Adults

A Randomized Controlled Trial

Context Use of a chlorhexidine gluconate–impregnated sponge (CHGIS) in intravascular catheter dressings may reduce catheter-related infections (CRIs). Changing catheter dressings every 3 days may be more frequent than necessary.

Objective To assess superiority of CHGIS dressings regarding the rate of major CRIs (clinical sepsis with or without bloodstream infection) and noninferiority (less than 3% colonization-rate increase) of 7-day vs 3-day dressing changes.

Design, Setting, and Patients Assessor-blind, 2×2 factorial, randomized controlled trial conducted from December 2006 through June 2008 and recruiting patients from 7 intensive care units in 3 university and 2 general hospitals in France. Patients were adults (>18 years) expected to require an arterial catheter, central-vein catheter, or both inserted for 48 hours or longer.

Conclusions Use of CHGIS dressings with intravascular catheters in the intensive care unit reduced risk of infection even when background infection rates were low. Reducing the frequency of changing unsoiled adherent dressings from every 3 days to every 7 days modestly reduces the total number of dressing changes and appears safe.

Tir[illegible] JF *et al.,* JAMA, 2009.

1. PROJECT: GENERAL REMARKS

1.2 IMPLEMENTATION: DRESSING 2

Randomized Controlled Trial of Chlorhexidine Dressing and Highly Adhesive Dressing for Preventing Catheter-related Infections in Critically Ill Adults

Rationale: Most vascular catheter-related infections (CRIs) occur extraluminally in patients in the intensive care unit (ICU). Chlorhexidine-impregnated and strongly adherent dressings may decrease catheter colonization and CRI rates.

Objectives: To determine if chlorhexidine-impregnated and strongly adherent dressings decrease catheter colonization and CRI rates.

Methods: In a 2:1:1 assessor-masked randomized trial in patients with vascular catheters inserted for an expected duration of 48 hours or more in 12 French ICUs, we compared chlorhexidine dressings, highly adhesive dressings, and standard dressings from May 2010 to July 2011. Coprimary endpoints were major CRI with or without catheter-related bloodstream infection (CR-BSI) with chlorhexidine versus nonchlorhexidine dressings and catheter colonization rate with highly adhesive nonchlorhexidine versus standard nonchlorhexidine dressings. Catheter-colonization, CR-BSIs, and skin reactions were secondary endpoints.

Conclusions: A large randomized trial demonstrated that chlorhexidine-gel–impregnated dressings decreased the CRI rate in patients in the ICU with intravascular catheters. Highly adhesive dressings decreased dressing detachment but increased skin and catheter colonization.

Timsit JF *et al.*, Am J Respir Crit Care Med, 2012.

1. PROJECT: GENERAL REMARKS

1.2 IMPLEMENTATION: ELVIS

Ethanol Lock and Risk of Hemodialysis Catheter Infection in Critically Ill Patients
A Randomized Controlled Trial

Abstract

Rationale: Ethanol rapidly eradicated experimental biofilm. Clinical studies of ethanol lock to prevent catheter-related infections (CRIs) suggest preventive efficacy. No such studies have been done in intensive care units (ICU).

Objectives: To determine whether ethanol lock decreases the risk of major CRI in patients with short-term dialysis catheters (DCs).

Methods: A randomized, double-blind, placebo-controlled trial was performed in 16 ICUs in seven university hospitals and one general hospital in France between June 2009 and December 2011. Adults with insertion of a nontunneled, nonantimicrobial-impregnated double-lumen DC for an expected duration greater than 48 hours, to perform renal-replacement therapy or plasma exchange, were randomly allocated (1:1) to receive a 2-minute catheter lock with either 60% wt/wt ethanol solution (ethanol group) or 0.9% saline solution (control group) at the end of DC insertion and after each renal-replacement therapy or plasma exchange session. The main outcome was major CRI defined as either catheter-related clinical sepsis without bloodstream infection or catheter-related bloodstream infection during the ICU stay.

Conclusions: A 2-minute ethanol lock does not decrease the frequency of infection of DCs in ICU patients.

Souweine B *et al.,* Am J Respir Crit Care Med, 2015.

1. PROJECT: GENERAL REMARKS

1.2 IMPLEMENTATION: CLEAN

Skin antisepsis with chlorhexidine–alcohol versus povidone iodine–alcohol, with and without skin scrubbing, for prevention of intravascular-catheter-related infection (CLEAN): an open-label, multicentre, randomised, controlled, two-by-two factorial trial

Summary

Background Intravascular-catheter-related infections are frequent life-threatening events in health care, but incidence can be decreased by improvements in the quality of care. Optimisation of skin antisepsis is essential to prevent short-term catheter-related infections. We hypothesised that chlorhexidine–alcohol would be more effective than povidone iodine–alcohol as a skin antiseptic to prevent intravascular-catheter-related infections.

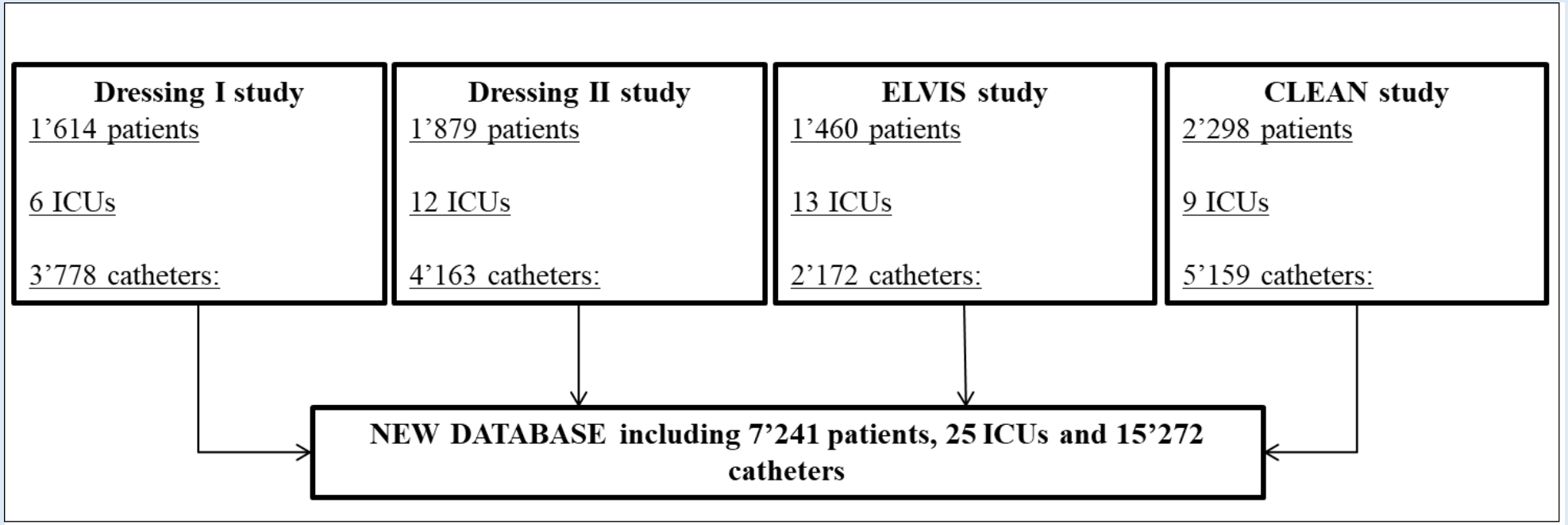
Methods In this open-label, randomised controlled trial with a two-by-two factorial design, we enrolled consecutive adults (age ≥18 years) admitted to one of 11 French intensive-care units and requiring at least one of central-venous, haemodialysis or arterial catheters. Before catheter insertion, we randomly assigned (1:1:1:1) patients via a secure web-based
number generator (permuted blocks of eight, stratified by centre) to have all intravascular catheters
chlorhexidine–70% isopropyl alcohol (chlorhexidine–alcohol) or 5% povidone iodine–69%
alcohol), with or without scrubbing of the skin with detergent before antiseptic appli
not masked to group assignment but microbiologists and outcome ass
incidence of catheter-related infections with chlorhexidine–alcoh
treat population. This study is registered with ClinicalTrials.
ntention-to-
to new participants.

Interpretation For skin antisepsis, chlorhexidine–alcohol provides greater protection against short-term catheter-related infections than does povidone iodine–alcohol and should be included in all bundles for prevention of intravascular catheter-related infections.

…loz O *et al.* Lancet 2015.

1. PROJECT: GENERAL REMARKS

1.3 FLOW-CHART



Footnote:
- Only patients who received a catheter were included
- Some centers were regrouped

1. PROJECT: GENERAL REMARKS

1.3 COHORT DESCRIPTION

PATIENTS

SEX	F	2606 (36)
	M	4635 (64)
AGE, mean (std) / median (IQR) / min-max		62 (15.8) / 64 [53 ; 74] / 18-97
ADMISSION CATEGORY	Medical	5448 (75.3)
	Planned surgery	494 (6.8)
	Urgent surgery	1295 (17.9)
ORIGIN	Emergency unit	3248 (44.9)
	Clinic unit	3086 (42.6)
	ICU	536 (7.4)
	Other	371 (5.1)
MAIN REASON FOR ICU ADMISSION	Septic shock	1572 (21.7)
	Surgery, planned	243 (3.4)
	Trauma	435 (6)
	MOF	218 (3)
	Cardiac shock	585 (8.1)
	Haemorrhagic shock	310 (4.3)
	Other shock	207 (2.9)
	Acute respiratory failure	1646 (22.7)
	Acute COPD exacerbation	140 (1.9)
	Acute kidney insufficiency	546 (7.5)
	Coma	690 (9.5)
	Continuos surveillance	647 (8.9)

1. PROJECT: GENERAL REMARKS

1.3 COHORT DESCRIPTION

PATIENTS

No comorbidity	4246 (58.6)
HIV	162 (2.2)
Cancer	395 (5.5)
Chronic renal failure	355 (4.9)
Chronic cardiac failure	533 (7.4)
Immunosupression	424 (5.8)
Organ transplant (SOT)	276 (3.8)
Hemopathy	381 (5.3)
Diabetes	583 (8.1)
Chronic respiratory failure	376 (5.2)
VM in the first 24h	5331 (73.6)
NIV in the first 24h	1418 (19.6)
No vasopressor at inclusion	2663 (36.8)
SAPS II score, mean (std) / median (IQR)	55.6 (20.9) / 54 [40 ; 70]
SOFA score , mean (std) / median (IQR)	10.9 (5.2) / 10 [7 ; 14]
LOS hospital, mean (std) / median (IQR)	35 (38.7) / 24 [12 ; 45]
LOS ICU, mean (std) / median (IQR)	16.2 (20.9) / 9 [5 ; 20]
Hospital mortality	2835 (39.2)
ICU mortality	2436 (33.6)

1. PROJECT: GENERAL REMARKS

1.3 COHORT DESCRIPTION

CATHETERS

Experience	Junior	9314 (61.1)
	Senior	5924 (38.9)
Catheter type	AC	6375 (41.7)
	CVC	6168 (40.4)
	DC	2729 (17.9)
Insertion site	Jugular	2876 (18.8)
	Subclavian	2260 (14.8)
	Femoral	6015 (39.4)
	Radial	4108 (26.9)
Right side		9091 (59.6)
No Ultrasound		7587 (83)
Numbers of lumens, mean (std) / median (IQR)		2 (0.9) / 2 [1 ; 3] / 1-4
Skin antisepsis	Non-Chlorhexidine	8329 (54.5)
	Chlorhexidine	6943 (45.5)
Dressing	CHX-Sponge	1953 (12.8)
	CHX-Gel	2108 (13.8)
	Tegaderm HP	988 (6.5)
	Standard dressing	10223 (66.9)

1. PROJECT: GENERAL REMARKS

1.3 COHORT DESCRIPTION

CATHETERS

MV at insertion	11553 (75.7)
Vasopressor at insertion	7526 (52.2)
Antimicrobial at insertion	9602 (62.9)
Lipid administration	2711 (17.8)
Heparin administration	5098 (33.4)
Packed red cells transfused	2278 (14.9)
Colonization	1236 (8.1)
CRBSI	116 (0.8)
MCRI	164 (1.1)
Catheter-days, mean (std) / median (IQR)	7 (6.5) / 5 [2 ; 9]

Outcomes…

CONTENTS

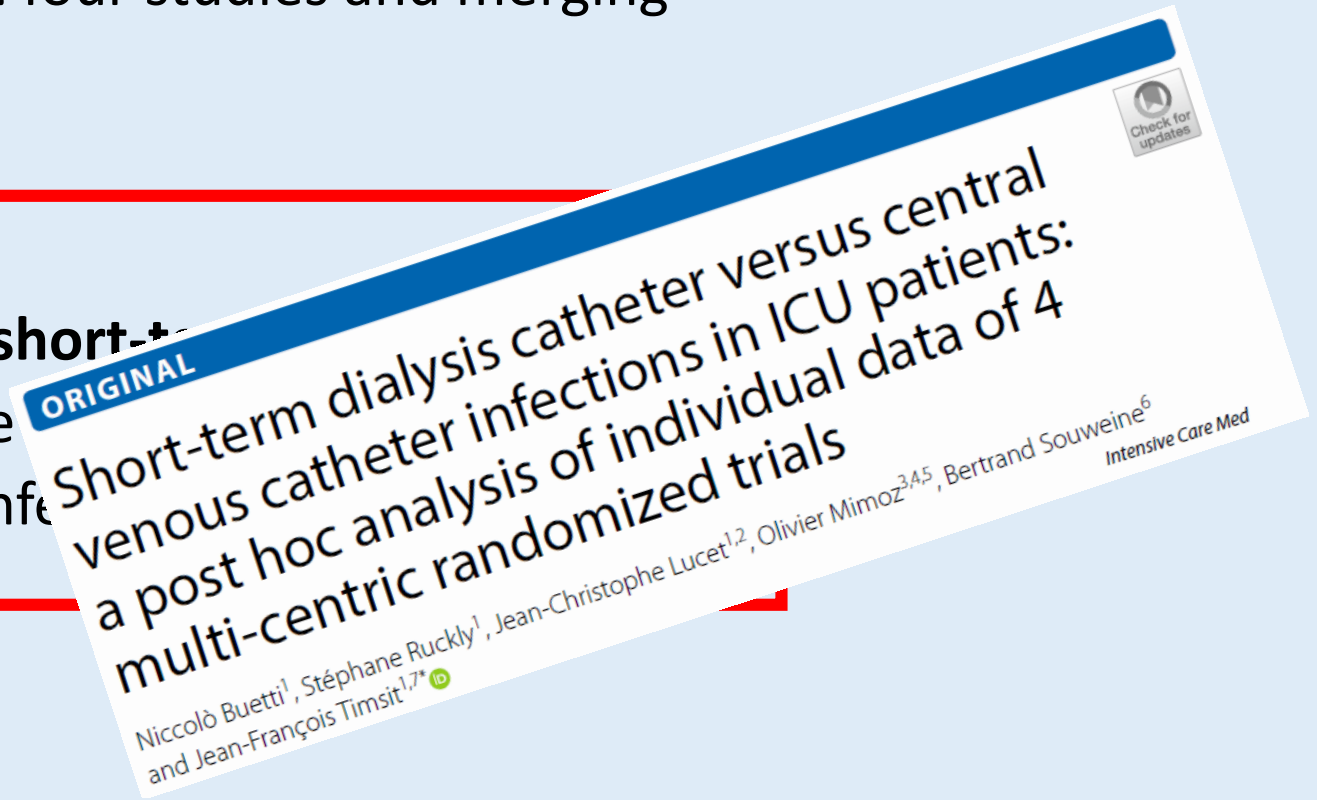
1) Project: general remarks
   - Background
   - Main objective & implementation: four studies and merging
   - Flow-chart and cohort description

2) Specific analyses

a) Central venous catheters *versus* short-t

b) Microorganisms and insertion site

c) Local signs and catheter-related infe


ORIGINAL

Short-term dialysis catheter versus central venous catheter infections in ICU patients: a post hoc analysis of individual data of 4 multi-centric randomized trials

Niccolò Buetti[1], Stéphane Ruckly[1], Jean-Christophe Lucet[1,2], Olivier Mimoz[3,4,5], Bertrand Souweine[6] and Jean-François Timsit[1,7*]

Intensive Care Med

A) SHORT-TERM DIALYSIS CATHETER / CENTRAL VENOUS CATH

2.1 P

- IC… inj… dia…
- Dat… liter…
  - R… m…
- Data …
  - Dif… thr… (sub…

1) **Pathogenesis suggests differences (incidence rates and infectious risk over time)**
   FEW and OLD DATA…

2) **OBJECTIVE: to describe differences in infectious risk between DC and CVC**

Schneider A *et al.,* ICM, 2017.

A) SHORT-TERM DIALYSIS CATHETER *vs* CENTRAL VENOUS CATHETER ANALYSIS

2.2 METHODS

Patients:

- 2006 to 2014 in different ICUs in France.
- Only patients from ICU which recruited both DCs and CVCs included.

Catheters:

- Only DC and CVC included (= exclusion arterial catheters).
- Chlorhexidine-impregnated (CHG) dressing catheters: excluded.
- DC and CVC inserted in the subclavian vein: excluded.

Statistics:

- Risk differences in catheter infections (MCRI and CR-BSI) and colonization between DC and CVC and to describe the daily risk of colonization/infection according to the duration of catheterization.
- Univariate and multivariate marginal Cox models for clustered data.
- Skin colonization evaluation.

A) SHORT-TERM DIALYSIS CATHETER *vs* CENTRAL VENOUS CATHETER ANALYSIS

2.3 PATIENTS & CATHETER SELECTION

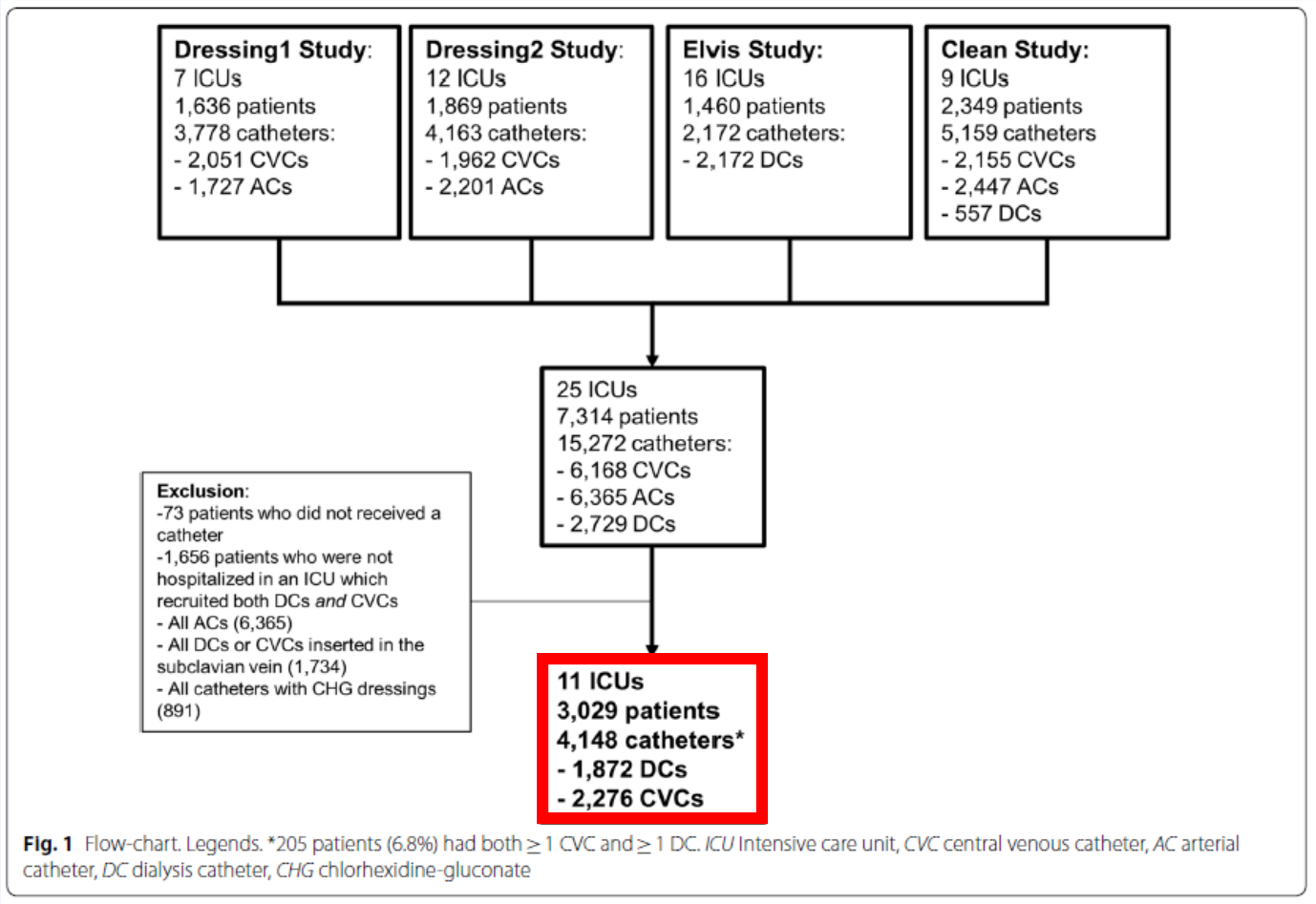
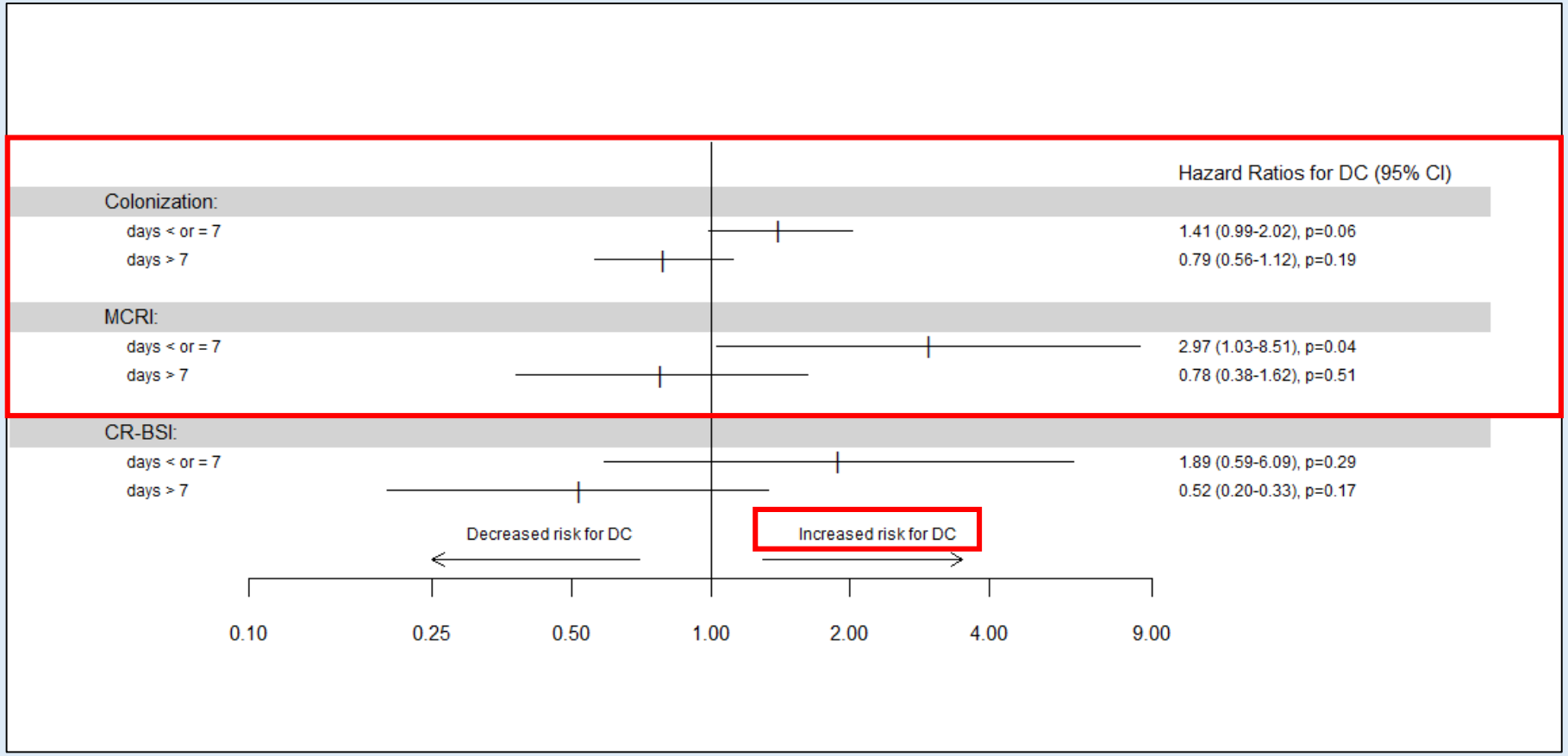


Fig. 1 Flow-chart. Legends. *205 patients (6.8%) had both ≥ 1 CVC and ≥ 1 DC. *ICU* Intensive care unit, *CVC* central venous catheter, *AC* arterial catheter, *DC* dialysis catheter, *CHG* chlorhexidine-gluconate

A) SHORT-TERM DIALYSIS CATHETER *vs* CENTRAL VENOUS CATHETER ANALYSIS

2.4 MAIN RESULTS: COLONIZATION, MCRI and CR-BSI



A) SHORT-TERM DIALYSIS CATHETER *vs* CENTRAL VENOUS CATHETER ANALYSIS

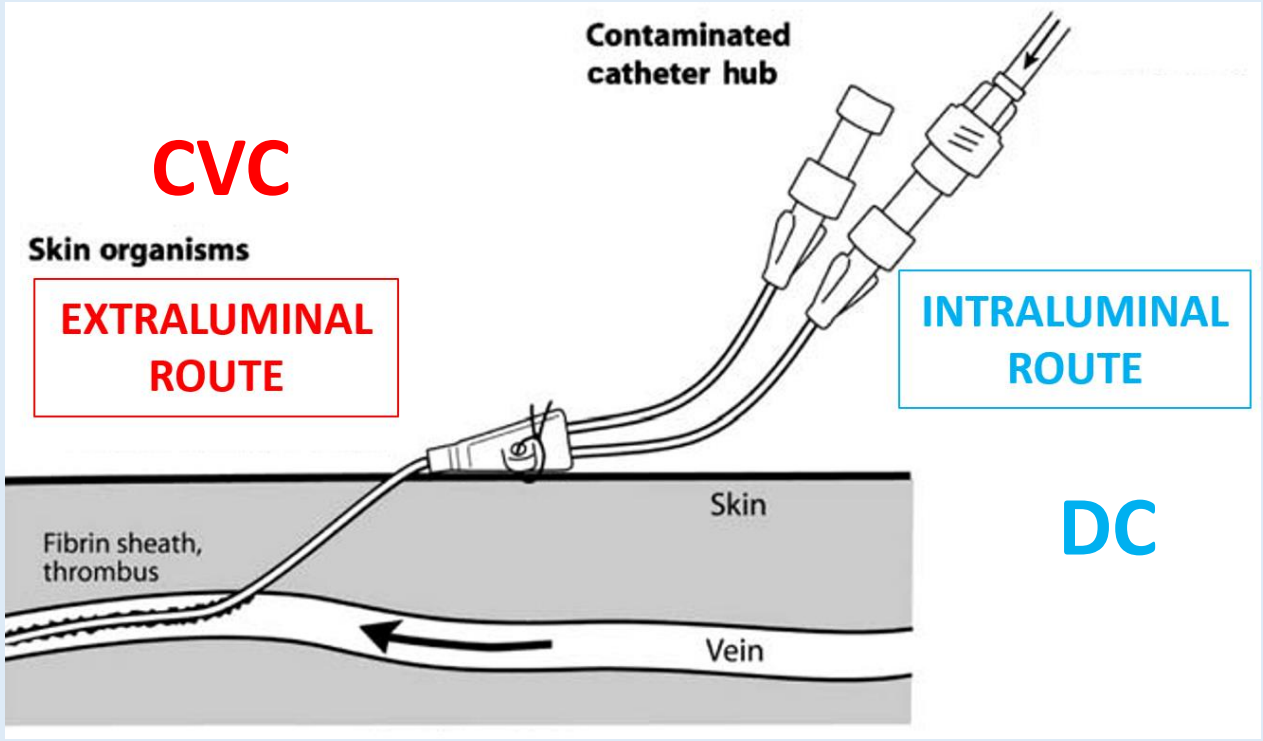
2.4 MAIN RESULTS: SKIN COLONIZATION AT REMOVAL

variable	CVC ($n=1548$)	DC ($n=363$)	p value*
All			
Sterile	233 (15.1)	4 (1.1)	<0.01
Low-grade colonization	666 (43)	234 (64.5)	
High-grade colonization	649 (41.9)	125 (34.4)	
≤ 7 days			
Sterile	158 (17.2)	2 (0.9)	<0.01
Low-grade colonization	426 (46.4)	150 (70.1)	
High-grade colonization	335 (36.5)	62 (29)	
>7 days			
Sterile	75 (11.9)	2 (1.3)	<0.01
Low-grade colonization	240 (38.2)	84 (56.4)	
High-grade colonization	314 (49.9)	63 (42.3)	

In 1911 catheters skin cultures were performed

A) SHORT-TERM DIALYSIS CATHETER *vs* CENTRAL VENOUS CATHETER ANALYSIS

2.5 DISCUSSION



Several studies targeted the intraluminal route (i.e. lock) for preventing catheter-related infections: negative results…

CVC: main infection route→ extraluminal route

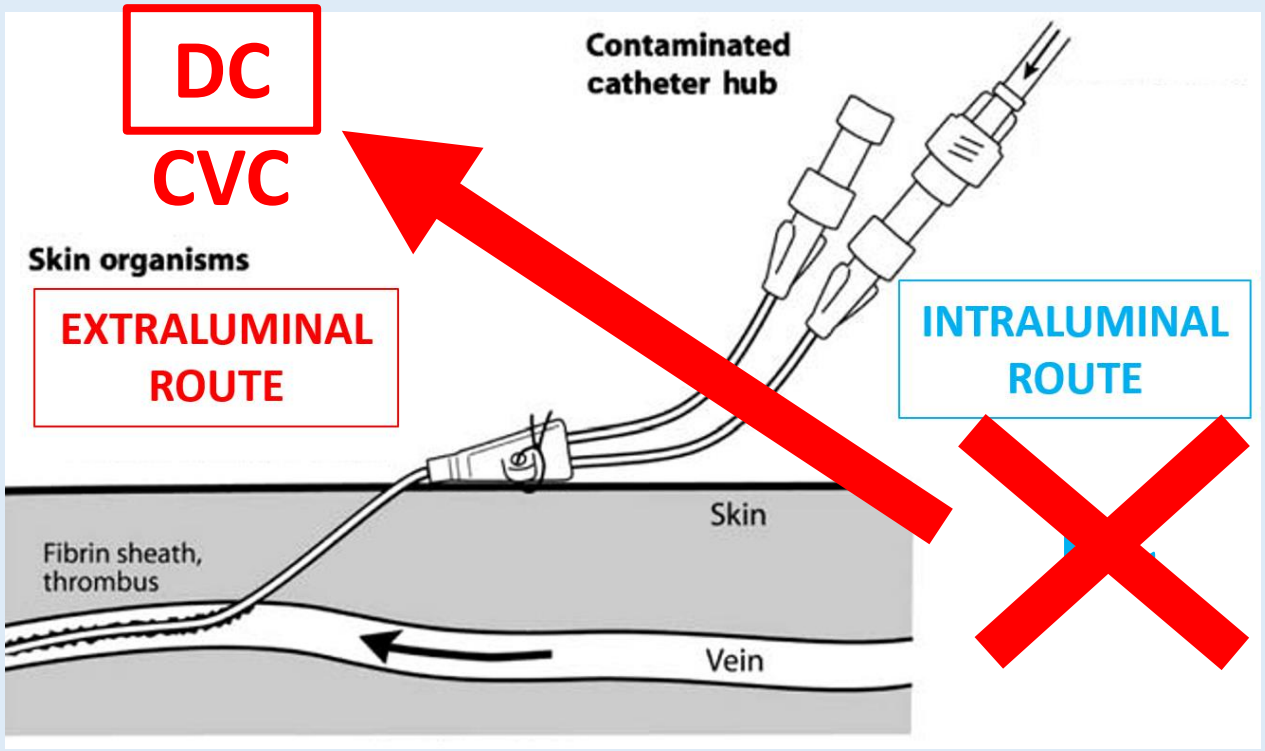
DC: frequent manipulations during DC → the intraluminal route predisposed to DC colonization/infection

HOWEVER OUR RESULTS…

Figure modified from Safdar N, Maki DG, ICM, 2004. Mermel LA, CID, 2011. Souweine *et al.*, Am J Respir Crit Care Med, 2015. Perez-Granda MJ *et al.*, PLOS one, 2014. Hermite M *et al.*, ICM, 2012.

A) SHORT-TERM DIALYSIS CATHETER *vs* CENTRAL VENOUS CATHETER ANALYSIS

2.5 DISCUSSION



Several studies targeted the intraluminal route (i.e. lock) for preventing catheter-related infections: negative results…

CVC: main infection route→ extraluminal route

DC: frequent manipulations during DC → the intraluminal route predisposed to DC colonization/infection

HOWEVER OUR RESULTS…

…suggested that the extraluminal route → main mechanism of DC infection.

A) Infectious risk higher after the catheter insertion

B) DCs were associated with an increased skin colonization around the catheter insertion site

Figure modified from Safdar N, Maki DG, ICM, 2004. Mermel LA, CID, 2011. Bouza *et al.*, Crit Care Med, 2005

A) SHORT-TERM DIALYSIS CATHETER *vs* CENTRAL VENOUS CATHETER ANALYSIS

2.5 DISCUSSION

- Our findings may substantially influence future prevention cares for DC.

- Targeted prevention strategies should focus on the first week after the catheter insertion.

- Introduction of CHG dressing in the first 7 days for DC (?).

CONTENTS

1) Project: general remarks
   - Background
   - Main Objective & implementation: four studies and merging
   - Flow-chart

2) Specific analyses

a) Central venous catheters *versus* short-term dialysis catheters

b) Microorganisms and insertion site

c) Local signs and catheter-related infections

B) MICROORGANISMS AND INSERTION SITE

2.1 INTRODUCTION

- Empiric therapy catheter-related i
  microorganisms.
- Gram-nega
  sp

OBJECTIVE: to describe the epidemiology of causative microorganisms of catheter-related infection and colonization according to the insertion site.

nsidered for

ogens of short-term intravascular
ding to the catheter insertion site.

Rupp M et al., Infectious disease clinics of North America, 2018.
Lorente L et al., Crit Care Med, 2007. Lorente L et al., Crit Care Med, 2008.

B) MICROORGANISMS AND INSERTION SITE

2.2 METHODS

Patients:

- 2006 to 2014 in different ICUs in France.

Catheters:

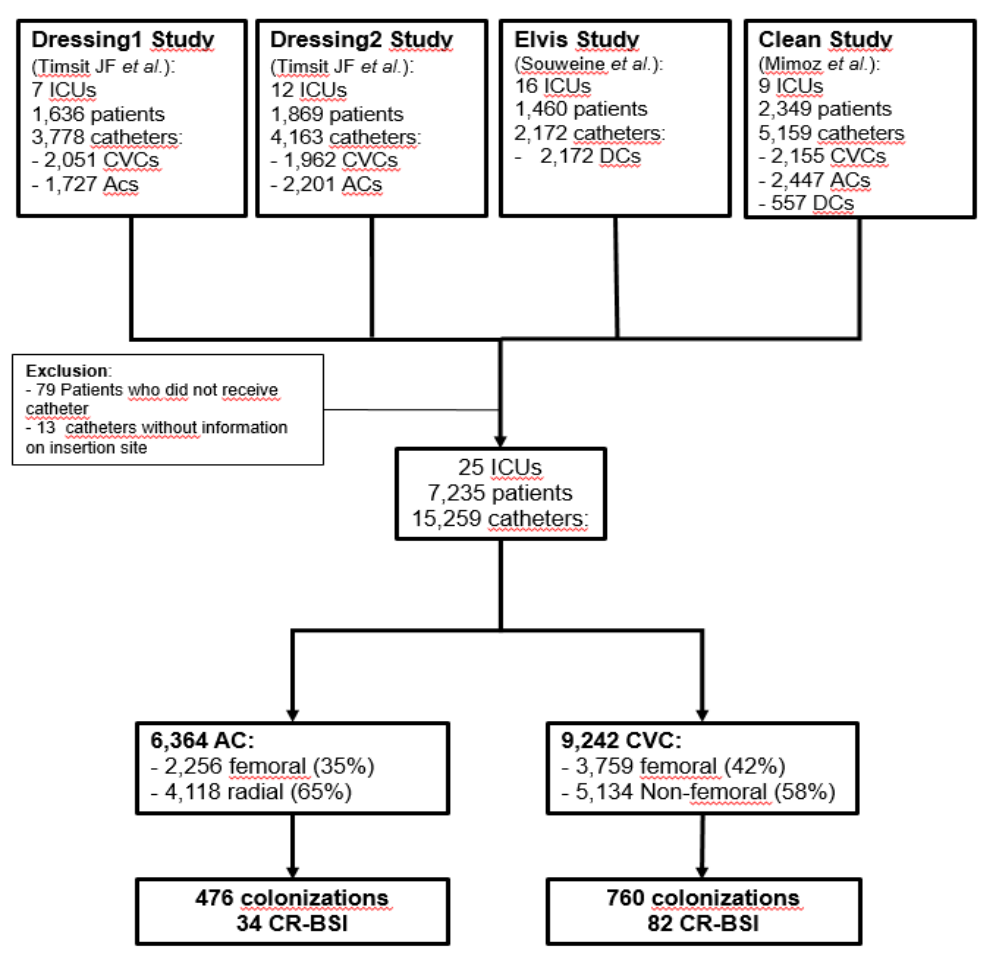
- all

Statistics:

- The microbiological, epidemiological, clinical and microbiological characteristics of the colonized and infected catheters (CR-BSI) compared between insertion site groups: Wilcoxon-, chi square- or Fisher-test.
- Confirmatory analyses: logistic regression models for clustered data with the response variable “non-fermenting Gram-negative bacilli”.

B) MICROORGANISMS AND INSERTION SITE

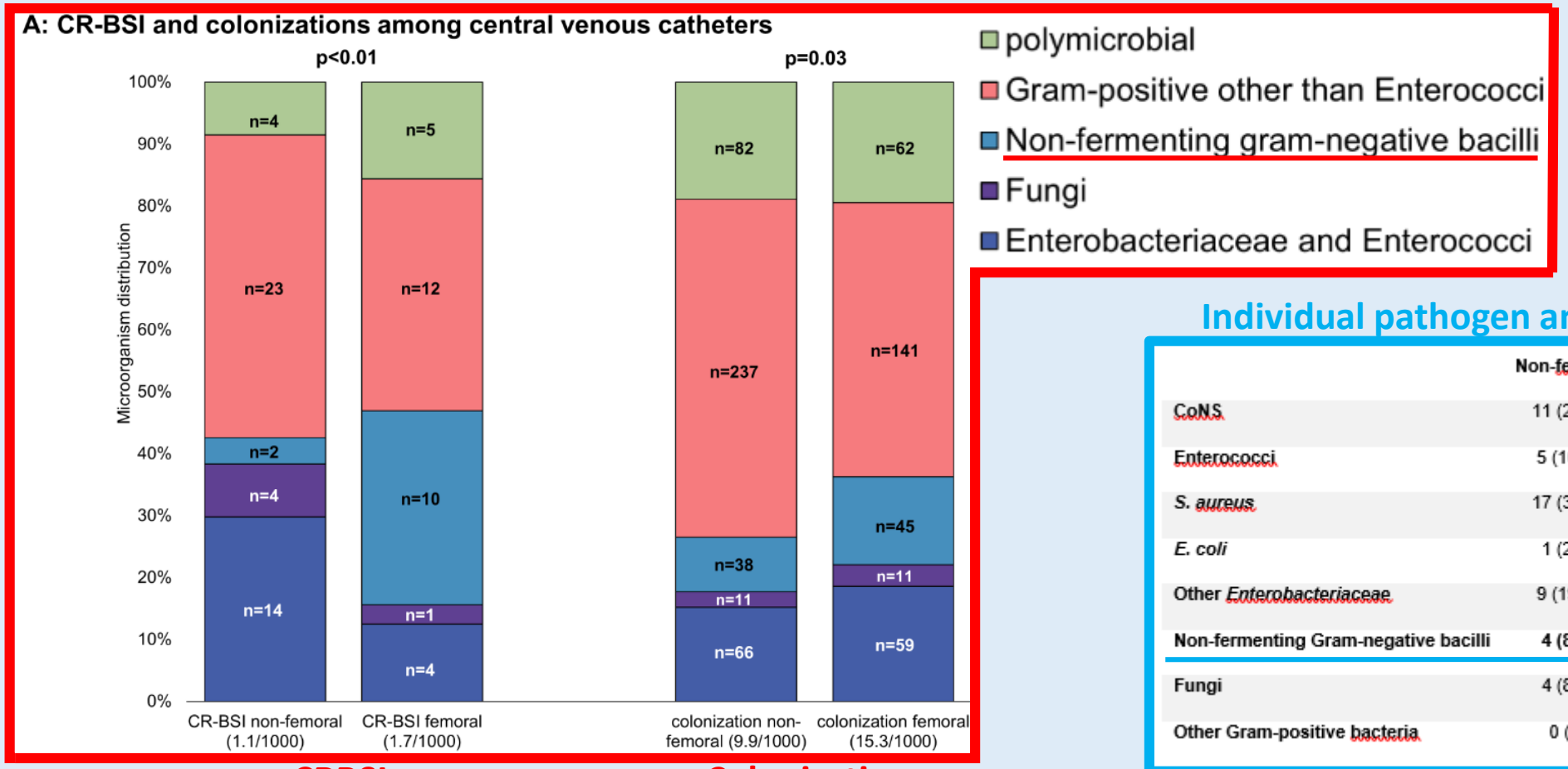
2.3 PATIENTS & CATHETERS



B) MICROORGANISMS AND INSERTION SITE

2.4 RESULTS: CVCs

First exploratory analysis



CRBSI **Colonization**

After adjustment for confounding factors: **Femoral site OR for NFGN CRBSI 6.33, CI 95% 1.59-25.28, p<0.01.**

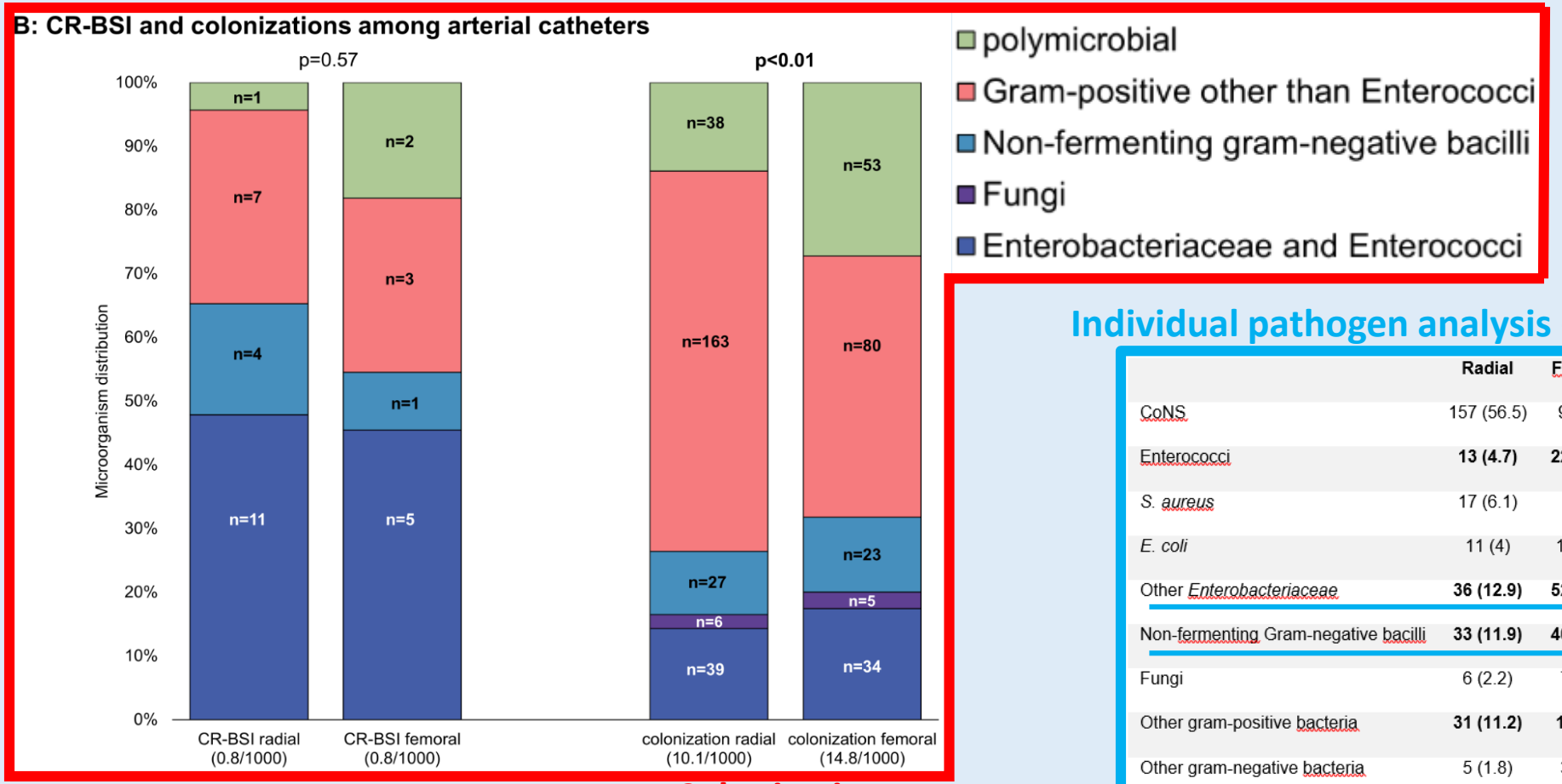
Individual pathogen analysis CR-BSI

	Non-femoral	Femoral	p-value
CoNS	11 (23.4)	10 (28.6)	0.60
Enterococci	5 (10.6)	0 (0)	0.05
S. aureus	17 (36.2)	6 (17.1)	0.06
E. coli	1 (2.1)	1 (2.9)	0.83
Other *Enterobacteriaceae*	9 (19.1)	7 (20)	0.92
Non-fermenting Gram-negative bacilli	**4 (8.5)**	**11 (31.4)**	**<0.01**
Fungi	4 (8.5)	1 (2.9)	0.29
Other Gram-positive bacteria	0 (0)	1 (2.9)	0.24

B) MICROORGANISMS AND INSERTION SITE

2.4 RESULTS: Arterial catheters

First exploratory analysis



CRBSI **Colonization**

Individual pathogen analysis (colonization)

	Radial	Femoral	p-value
CoNS	157 (56.5)	97 (49)	0.11
Enterococci	**13 (4.7)**	**22 (11.1)**	**<0.01**
S. aureus	17 (6.1)	6 (3)	0.12
E. coli	11 (4)	11 (5.6)	0.41
Other *Enterobacteriaceae*	**36 (12.9)**	**52 (26.3)**	**<0.01**
Non-fermenting Gram-negative bacilli	**33 (11.9)**	**40 (20.2)**	**0.01**
Fungi	6 (2.2)	7 (3.5)	0.36
Other gram-positive bacteria	**31 (11.2)**	**11 (5.6)**	**0.03**
Other gram-negative bacteria	5 (1.8)	3 (1.5)	0.81

B) MICROORGANISMS AND INSERTION SITE

2.5 DISCUSSION

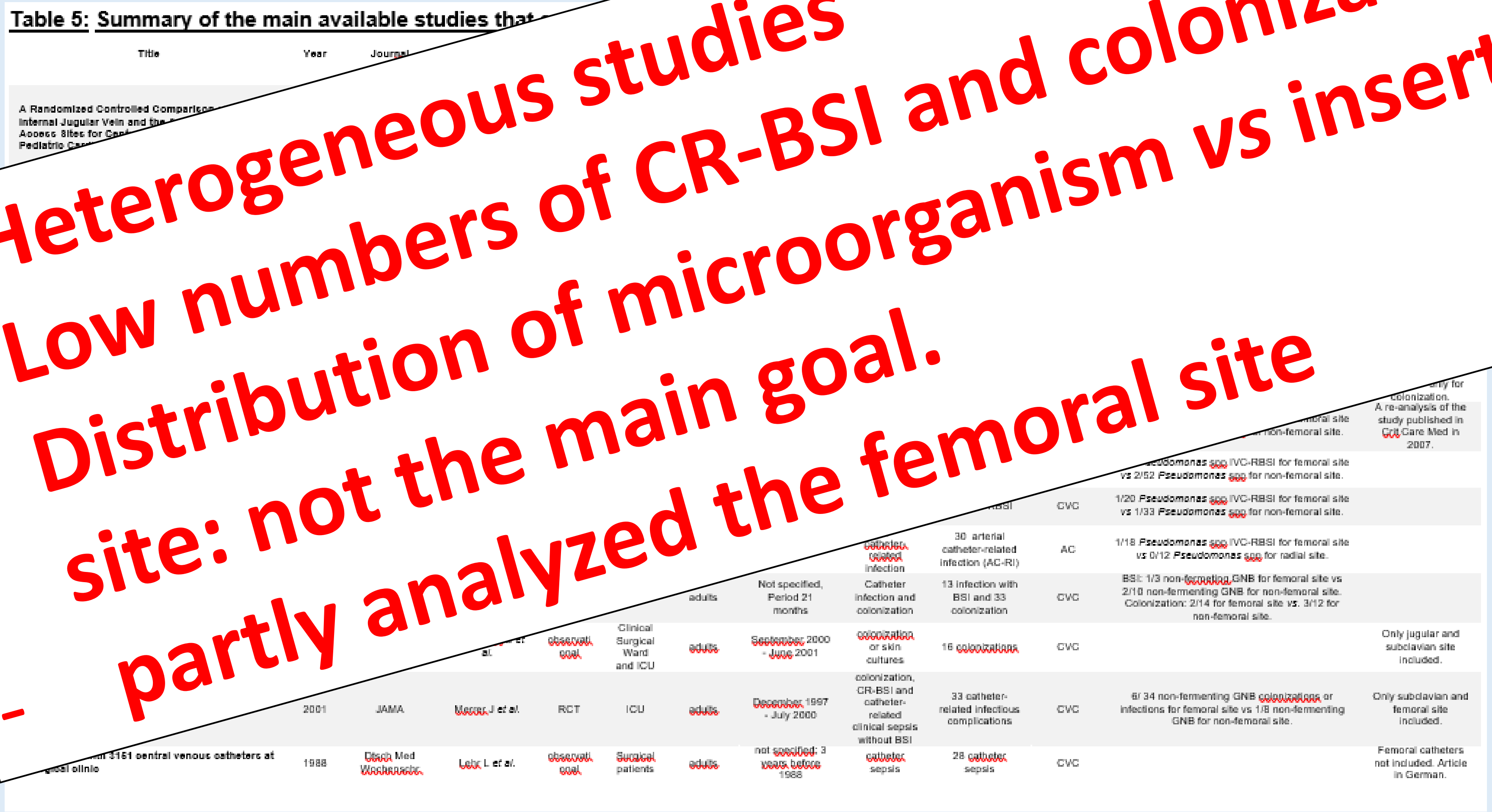


Table 5: Summary of the main available studies that ...

Title | Year | Journal ...

A Randomized Controlled Comparison ... Internal Jugular Vein and the ... Access Sites for Cent... Pediatric Cardi...

... only for colonization. | A re-analysis of the study published in Crit Care Med in 2007.
... for femoral site ... non-femoral site.
... Pseudomonas spp IVC-RBSI for femoral site vs 2/52 Pseudomonas spp for non-femoral site.
... RBSI | CVC | 1/20 Pseudomonas spp IVC-RBSI for femoral site vs 1/33 Pseudomonas spp for non-femoral site.
Catheter-related infection | 30 arterial catheter-related infection (AC-RI) | AC | 1/18 Pseudomonas spp IVC-RBSI for femoral site vs 0/12 Pseudomonas spp for radial site.
adults | Not specified, Period 21 months | Catheter infection and colonization | 13 infection with BSI and 33 colonization | CVC | BSI: 1/3 non-fermenting GNB for femoral site vs 2/10 non-fermenting GNB for non-femoral site. Colonization: 2/14 for femoral site vs. 3/12 for non-femoral site.
... al. | observational | Clinical Surgical Ward and ICU | adults | September 2000 - June 2001 | colonization or skin cultures | 16 colonizations | CVC | | Only jugular and subclavian site included.
2001 | JAMA | Merrer J et al. | RCT | ICU | adults | December 1997 - July 2000 | colonization, CR-BSI and catheter-related clinical sepsis without BSI | 33 catheter-related infectious complications | CVC | 6/34 non-fermenting GNB colonizations or infections for femoral site vs 1/8 non-fermenting GNB for non-femoral site. | Only subclavian and femoral site included.
... 3161 central venous catheters at ... clinic | 1988 | Dtsch Med Wochenschr | Lehr L et al. | observational | Surgical patients | adults | not specified; 3 years before 1988 | catheter sepsis | 28 catheter sepsis | CVC | | Femoral catheters not included. Article in German.

- Heterogeneous studies
- Low numbers of CR-BSI and colonizations
- Distribution of microorganism vs insertion site: not the main goal.
- partly analyzed the femoral site

B) MICROORGANISMS AND INSERTION SITE

2.5 DISCUSSION

Our findings may **influence the selection of empirical antibiotic therapy** with two main recommendations:

1) Antipseudomonal antibiotics should be administered together with antibiotics targeting Gram-positive microorganisms if a CR-BSI related to a femoral catheter is suspected.

2) Antifungal therapy may not be indicated in selected patient populations for suspected intravascular catheter infection.

CONTENTS

1) Project: general remarks
   - Background
   - Main Objective & implementation: four studies and merging
   - Flow-chart

2) Specific analyses

a) Central venous catheters *versus* short-term dialysis catheters

b) Microorganisms and insertion site

c) Local signs and catheter-related infections

C) LOCAL SIGNS AND CATHETER-RELATED INFECTIONS

OBJECTIVES:

1) **Local signs at insertion site and infection: association?**
2) **Which factors influenced local signs?**
3) **Which clinical conditions may predict infections if inflammation at insertion site is present?**

Safdar N, Maki DG, Crit Care Med, 2002. Braun E et al., Clin Microbiol Infect, 2014.
Buetti N et al., BMJ open, 2018.

C) LOCAL SIGNS AND CATHETER-RELATED INFECTIONS

2.2 METHODS

Patients:

- 2006 to 2014 in different ICUs in France.

Catheters:

- All (with documented local signs).

Outcomes:

- CRBSI
- Local signs (at removal): redness, pain, non-purulent discharge, purulent discharge and ≥1 local sign

Statistics:

- Evaluate the association between CRBSI and local sign.
- Identify the risk factors for developing a specific local sign.

} Univariate and multivariate logistic regressions.

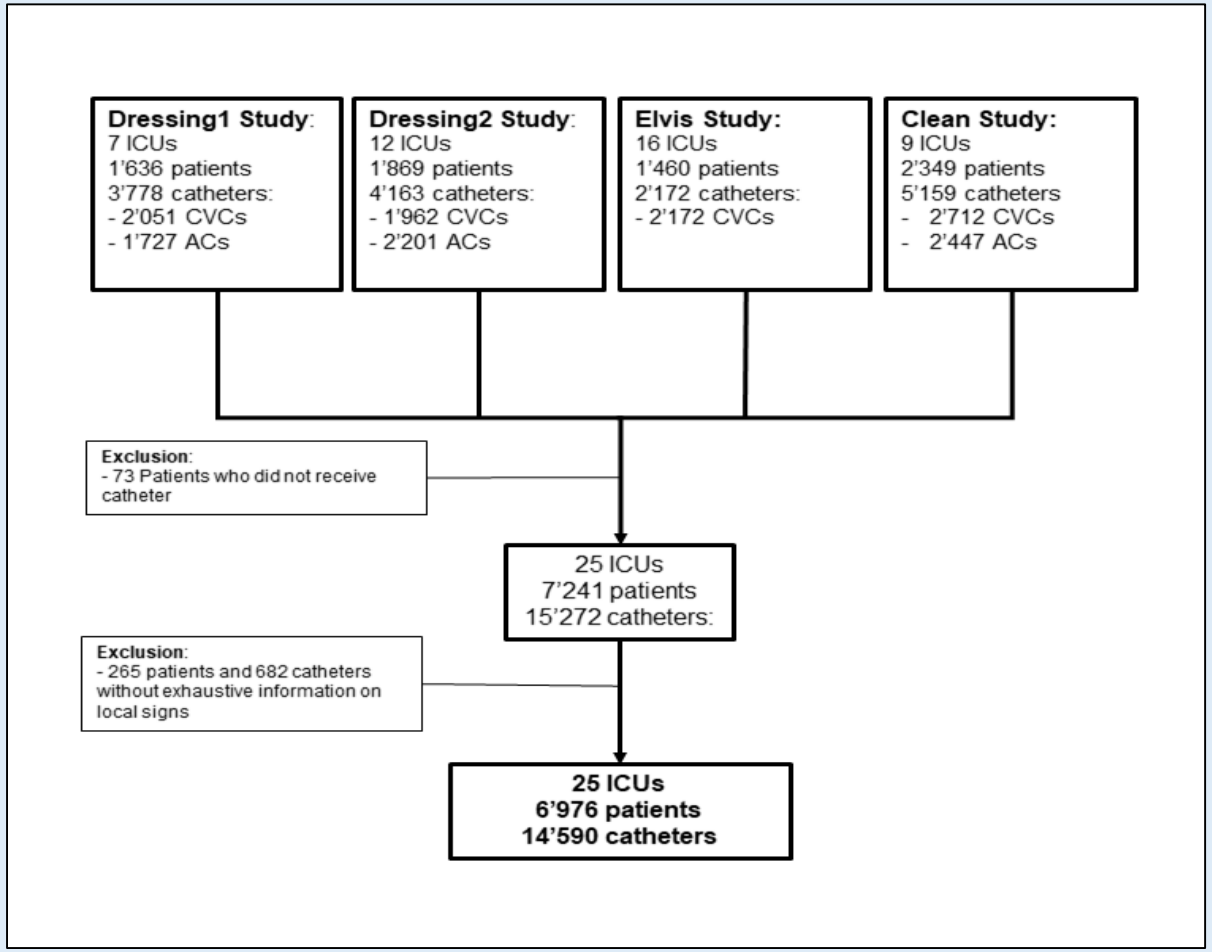
- Identify the role of the different local signs for developing CRBSI in subgroup of clinically relevant populations.

} Cochran's Q test

Image from Rupp M et al., Infectious disease clinics of North America, 2018.

C) LOCAL SIGNS AND CATHETER-RELATED INFECTIONS

2.3 PATIENTS & CATHETERS



C) LOCAL SIGNS AND CATHETER-RELATED INFECTIONS

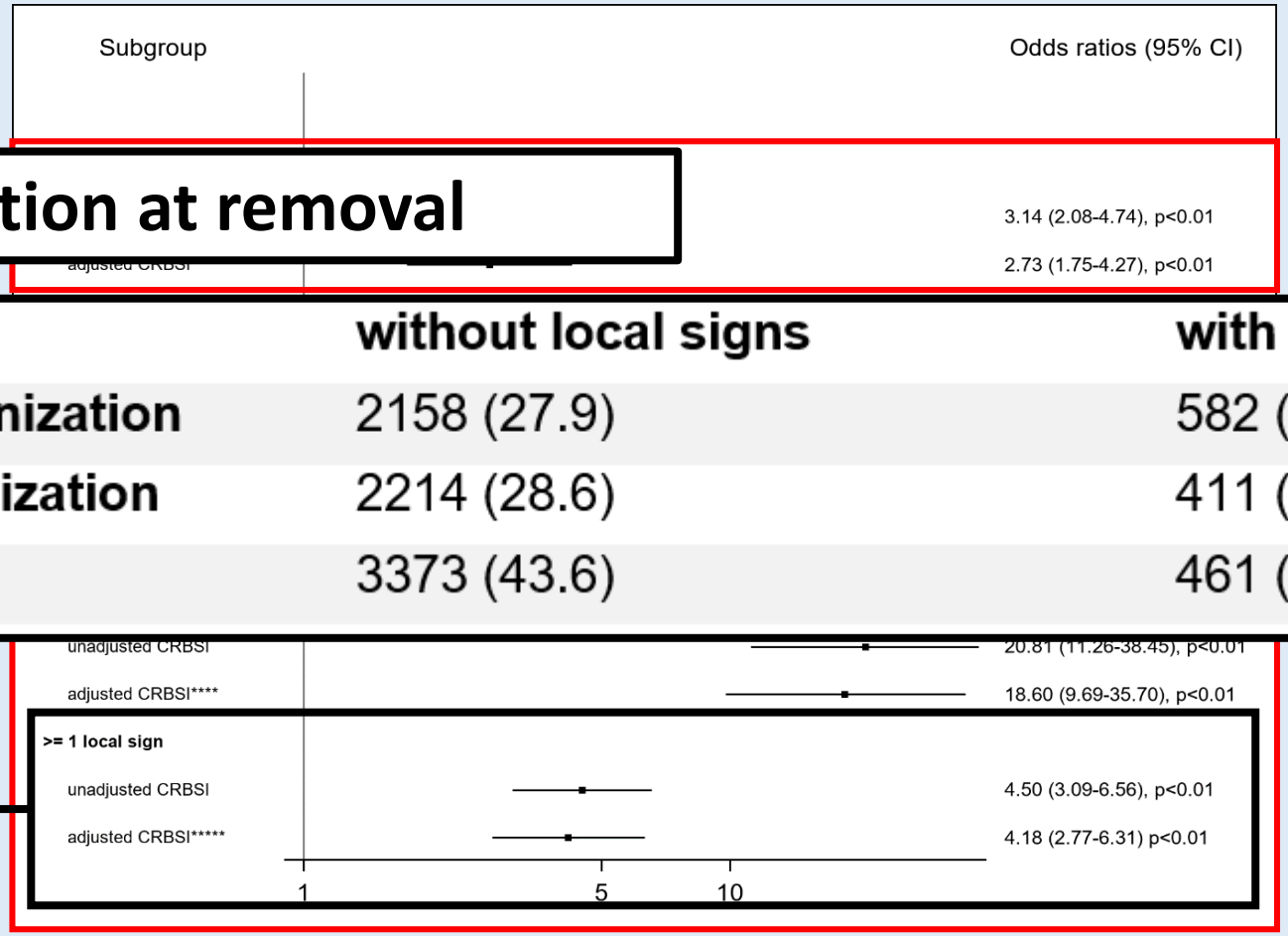
2.3 RESULTS

	Prevalence of local sign	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
Redness`(n=1633)	11.2	28.1 (20.4-37.2)	88.9 (88.4-89.4)	2.0 (1.4-2.7)	99.4 (99.2-99.5)
Pain (n=59)	0.4	1.7 (0.3-5.9)	99.6 (99.5-99.7)	3.3 (0.6-11.3)	99.2 (99.1-99.4)
Non-purulent discharge (n=251)	1.7	6.1 (2.8-11.2)	98.3 (98.1-98.5)	2.8 (1.2-5.6)	99.3 (99.1-99.4)
Purulent discharge (n=102)	0.7	11.4 (6.3-18.6)	99.4 (99.2-99.5)	12.7 (7.1-20.8)	99.3 (99.2-99.4)
≥1 local sign (n=1938)	13.3	40.4 (31.4-49.6)	86.9 (86.4-87.5)	2.4 (1.8-3.2)	99.5 (99.3-99.6)

C) LOCAL SIGNS AND CATHETER-RELATED INFECTIONS

2.3 RESULTS

Association local signs & CRBSI



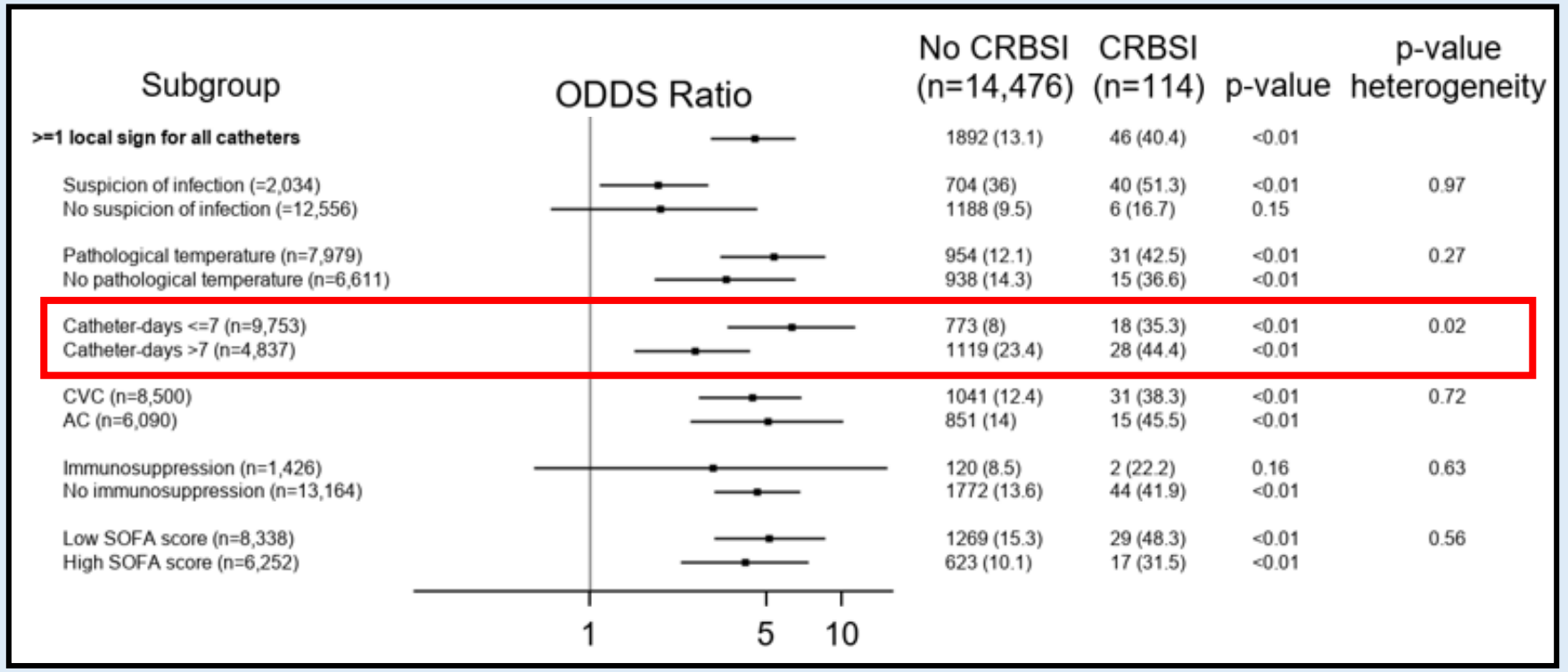
Skin colonization at removal

	without local signs	with ≥1 local sign	
high-grade colonization	2158 (27.9)	582 (40)	<0.01
low-grade colonization	2214 (28.6)	411 (28.3)	
sterile	3373 (43.6)	461 (31.7)	

Variables indipendently associated with (less) ≥1 local signs (multivariate analysis):

C) LOCAL SIGNS AND CATHETER-RELATED INFECTIONS

2.3 RESULTS



At least one sign was more predictive for CRBSI in the first 7 days of catheter maintenance (OR 6.30 *vs.* OR 2.61 for >7 days, $p_{\text{for heterogeneity}}=0.02$).

C) LOCAL SIGNS AND CATHETER-RELATED INFECTIONS

2.4 DISCUSSION

- Old study: insertion site appearance was not associated with catheter colonization or CVC-related bloodstream infections.

  → **In contrast to our results**!

- CRBSI in our cohort were due to *S. aureus* and Gram-negative bacilli: only 14% CoNS *vs* Safdar *et al*. :

Microoganism	n	%
CoNS	15	14.15
Staphylococcus aureus	21	19.81
Enterococci	2	1.89
Enterobacteriaceae	22	20.75
Non-fermenting gram-negative bacilli	16	15.09
Other gram-negative	1	0.94
Fungi	5	4.72
Polymicrobial CRBSI	24	22.64

Table 2. Microbial profile of central venous catheter–related blood stream infections

Pathogen	No.
Coagulase-negative staphylococci	27
Enterococci	4
Enterobacter cloacae	1
Klebsiella pneumoniae	1
Burkholderia cepacia	1
Candida species	1

Safdar N, Maki DG, Crit Care Med, 2002.

C) LOCAL SIGNS AND CATHETER-RELATED INFECTIONS

2.4 DISCUSSION

Table 3: Practical clinical implications.

Factors that independently decreased local signs at insertion site:	- Older age - Severe ill patients - Immunosuppression - Catheter maintenance ≤7 days
Factors influencing the management of catheter	- Redness, non-purulent discharge and purulent discharge were significantly associated to CRBSI compared to pain. - Local signs observed in the first 7 days are highly predictive for intravascular catheter infections. - Pathological temperature, catheter type and severity of illness in the presence of local signs do not help clinician in predicting intravascular catheter infections.


MERCI!!!
niccolo.buetti@gmail.com