

# Prévention de l'infection du site opératoire

Gabriel Birgand

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*Guadeloupe 2023*

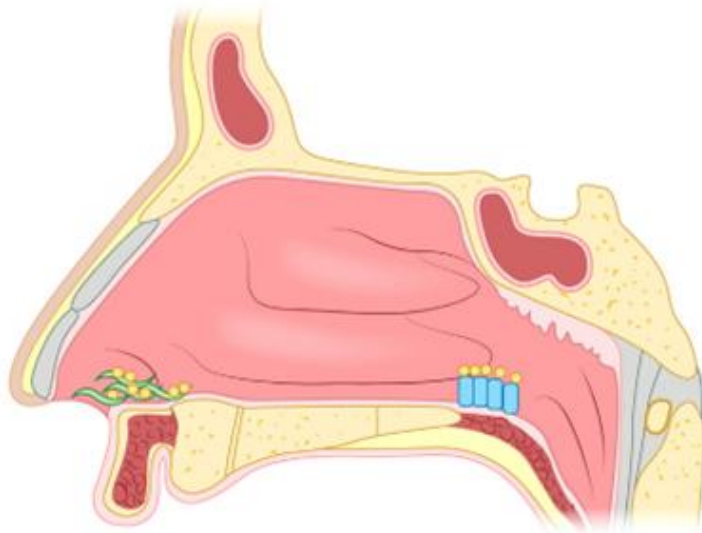
# Revue de littérature

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## Portage préopératoire de *S.aureus*



Chir. Gén. : 23%  
Chir. Ortho. : 23% (15-29%)

### Risque ISO *S.aureus*

x 2 à 10 Chir. Card.  
x 4 Chir. Gen.  
x 3 Chir. Ortho.



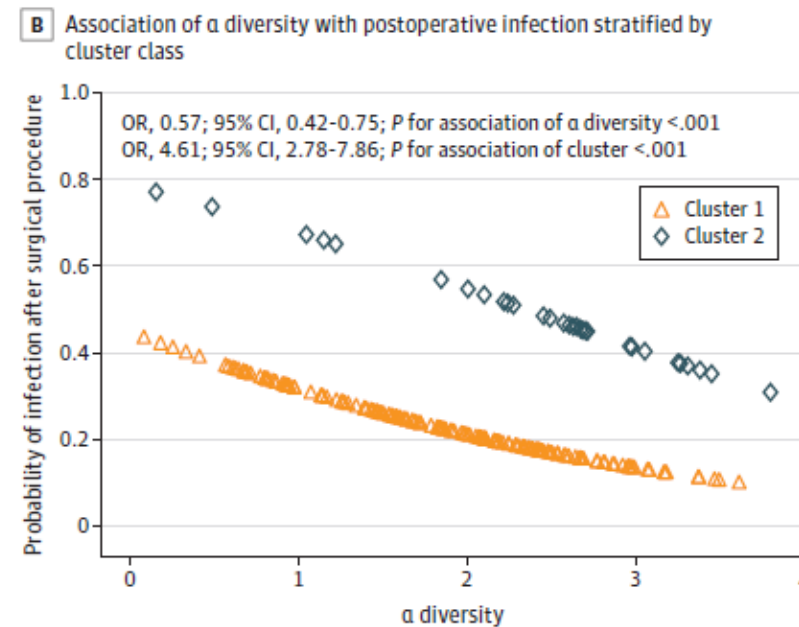
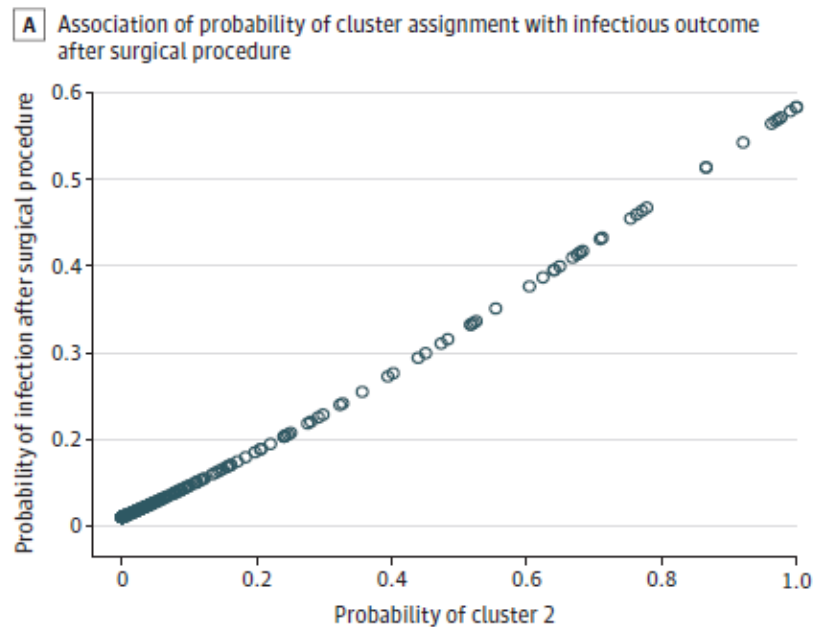
## ISO à *S.aureus*



### *S. aureus* identiques portage/infection:

- 66% en chir ortho  
- 76-85% en chir. Gen, Card  
Mais, 12 à 53% infectés sans portage

- Etude cas témoin nichée appariée d'une cohorte de chir. Card., vascu.
  - 53 patients infectés (ISO, bactériémies) vs 144 non infectés appariés



Cluster 2 = OR, 4.61; 2.78-7.86; P < .001 d'infection indépendamment de la diversité  
Microbiome nasal potentiel biomarqueur du risque d'infection post-op

# Physiopathology of SSI

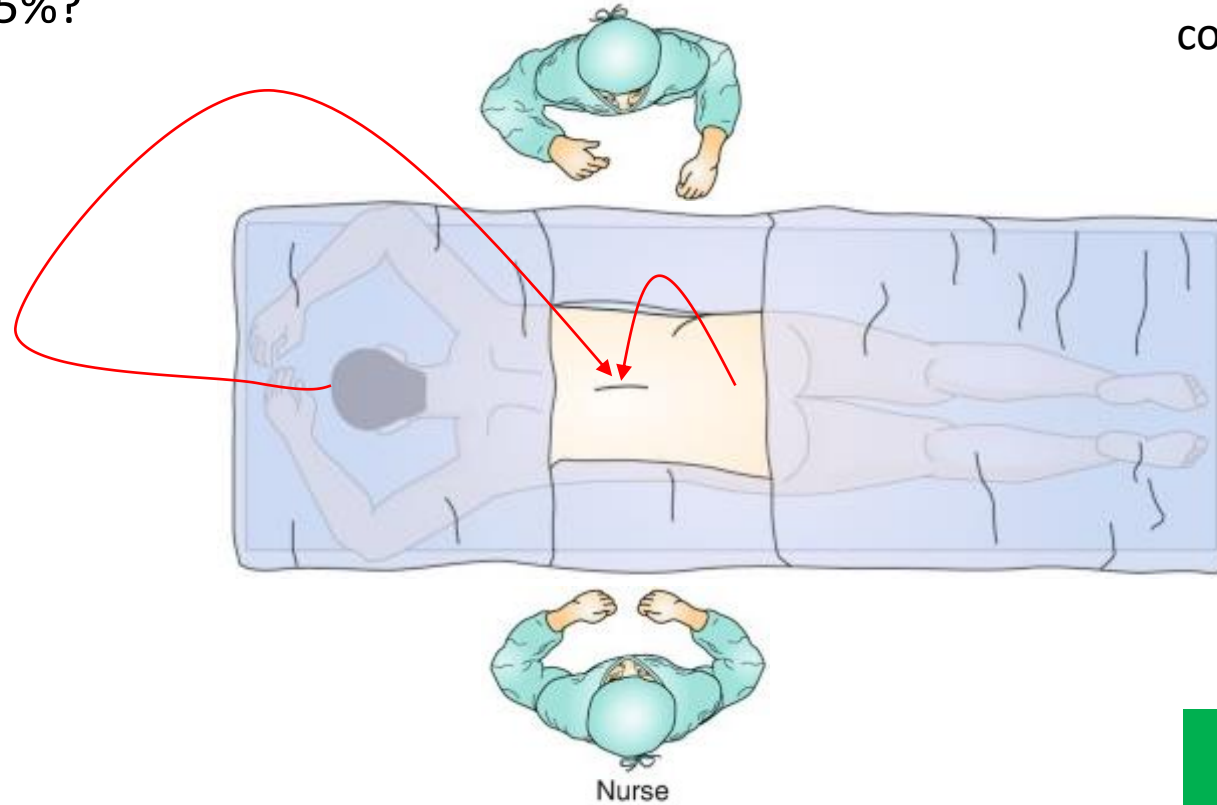
## Intraoperative contaminations

### Patient's endogenous flora

≈ 70% to 95%?

### Airborne transmission

MO originating from the patient  
contaminating the wound through the air

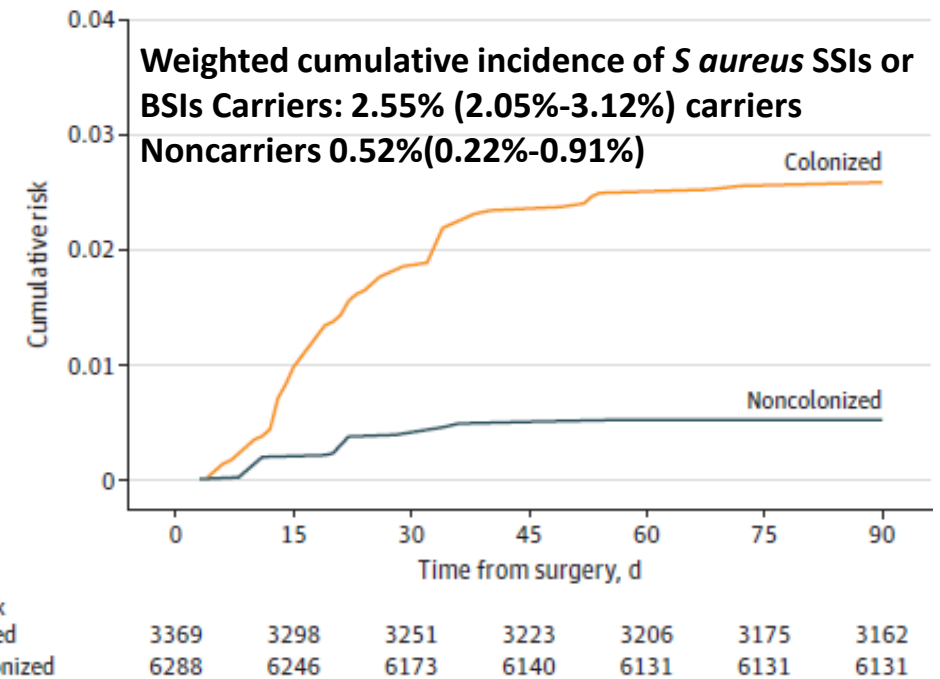


Air ventilation system  
Aseptic measures

# Postoperative *Staphylococcus aureus* Infections in Patients With and Without Preoperative Colonization

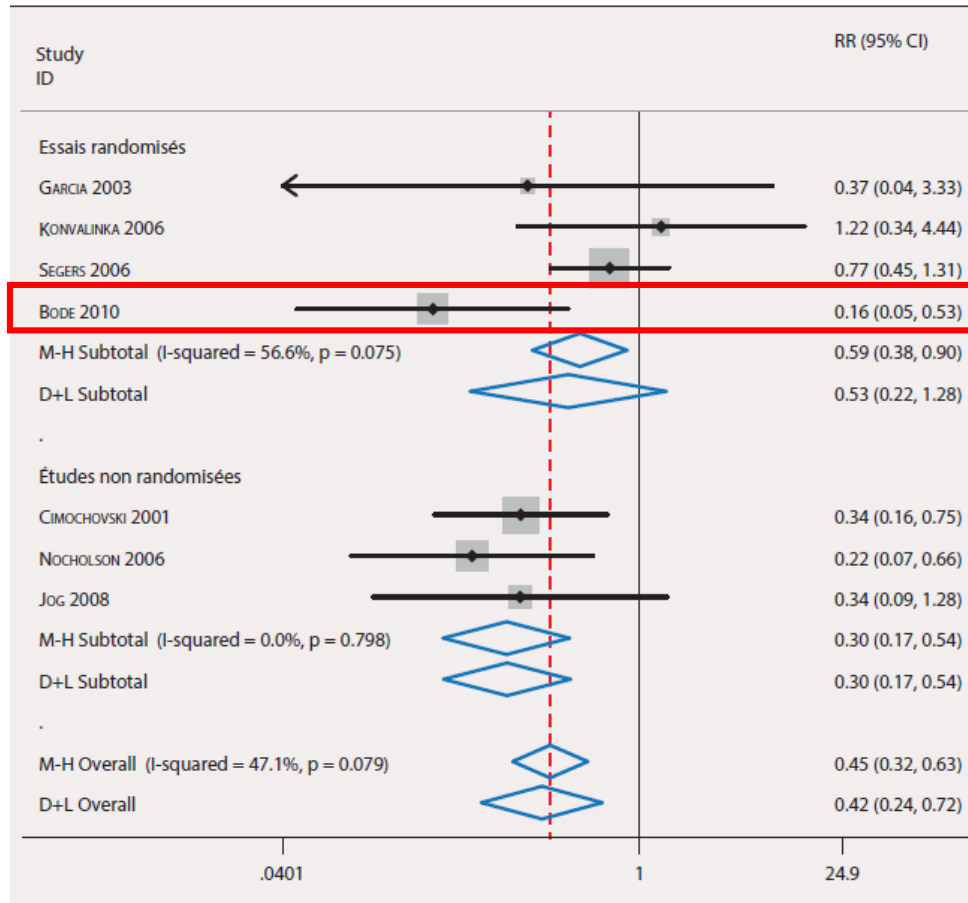
- To assess the occurrence of postoperative *S aureus* SSIs and BSIs and quantify its association with patient-related and contextual factors
  - 33 hospitals in 10 European countries, December 16, 2016, and September 30, 2019
  - 5004 patients, 3369 (67.3%) *S aureus* carriers; 100 *S aureus* SSIs or BSIs within 90 days after surgery.

Risk factor	Multivariable analysis for the association with <i>S aureus</i> SSIs and BSIs <sup>a</sup>	
	Adjusted HR (95% CI)	P value
<b>Preoperative <i>S aureus</i> colonization status<sup>b</sup></b>		
Colonized	4.38 (2.19-8.76)	<.001
Noncolonized	1 [Reference]	
Nonremovable implant before surgery	2.00 (1.15-3.49)	.01
<b>Type of surgery</b>		
Cardiovascular surgery	1.91 (0.86-4.22)	.11
Mastectomy	5.13 (1.87-14.08)	.002
Neurosurgery	2.47 (1.09-5.61)	.03
Emergency surgery	2.42 (0.67-8.84)	.18



*S. aureus* carriage associated with an increased risk of developing *S aureus* SSIs and BSIs, and with modifiable & nonmodifiable etiologic factors

# Décontamination avant chirurgie : *où en est-on ?*



*Pays bas, 917 pts porteurs S. aureus, dont n = 391 en chirurgie cardiothoracique, mupirocine + chlorhexidine*

	Mupi + CHG (n= 504)	Placebo (n= 413)	RR (IC95%)
IN à S. aureus	17 (3.4%)	32 (7.7%)	0.42 (0.23-0.75)
Source de l'infection :			
endogène	12	25	0.39 (0.20-0.77)
Exogène	4	6	0.55 (0.16-1.92)
Indéterminé	1	1	
Localisation de l'infection			
ISO profonde (chez opéré)	4 (0.9%)	16 (4.4%)	0.21 (0.07-0.62)
ISO superf (chez opéré)	7 (1.6%)	13 (3.5%)	0.45 (0.18-1.11)
Pneumopathie	2	2	
Autre	4	1	
Chirurgie cardio-thoracique	3/220	15/171	0,14 (0,04-0,51)



- **SF2H 2013 :**

- Décolonisation des porteurs de *S. aureus* uniquement pour la chirurgie cardiaque

- **USA, SHEA/IDSA 2014 :**

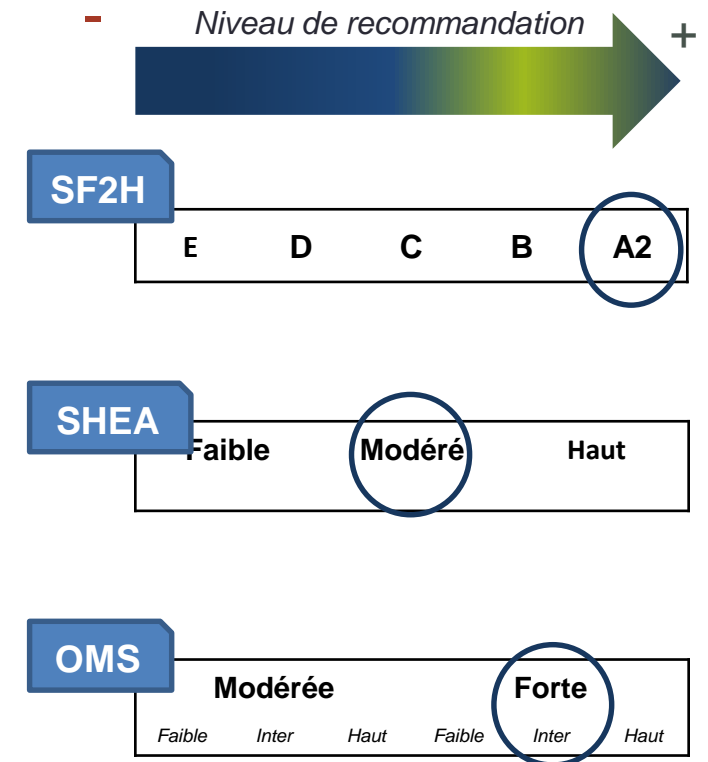
- Dépistage et décolonisation du *S. aureus* (MSSA et MRSA) pour les chirurgies à risque (cardiaque)

- **OMS 2016 :**

- Chirurgie cardio-thoracique avec portage nasal connu
- Mupirocine 2% pour patients connus porteurs de *S. aureus* +/- douche à la Chlorhexidine

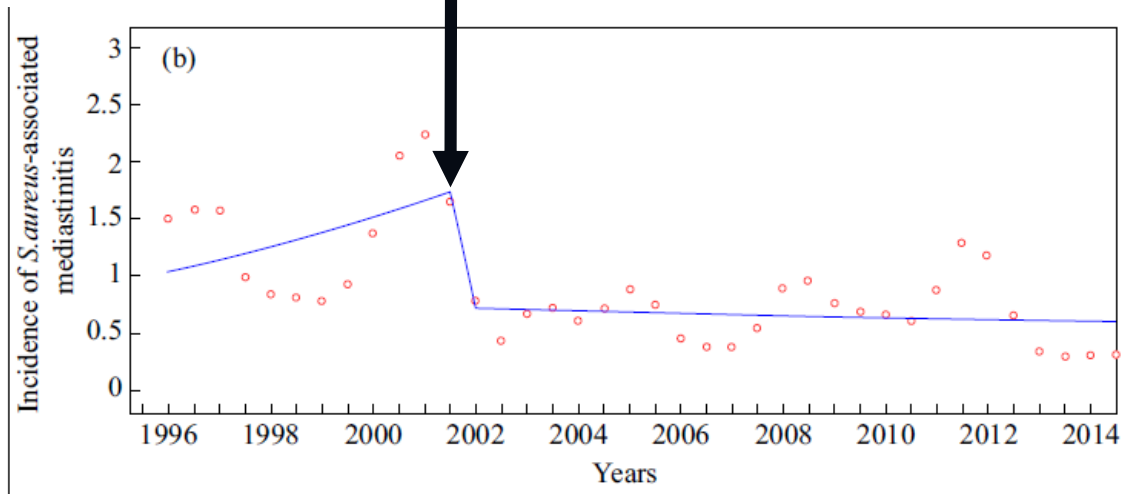
- **UK, NICE 2019 :**

- **Considérer** mupirocine + CHG avant interventions ou *S. aureus* est cause vraisemblable d'ISO (fonction du type de procédure, risque individuel, impact de l'ISO)



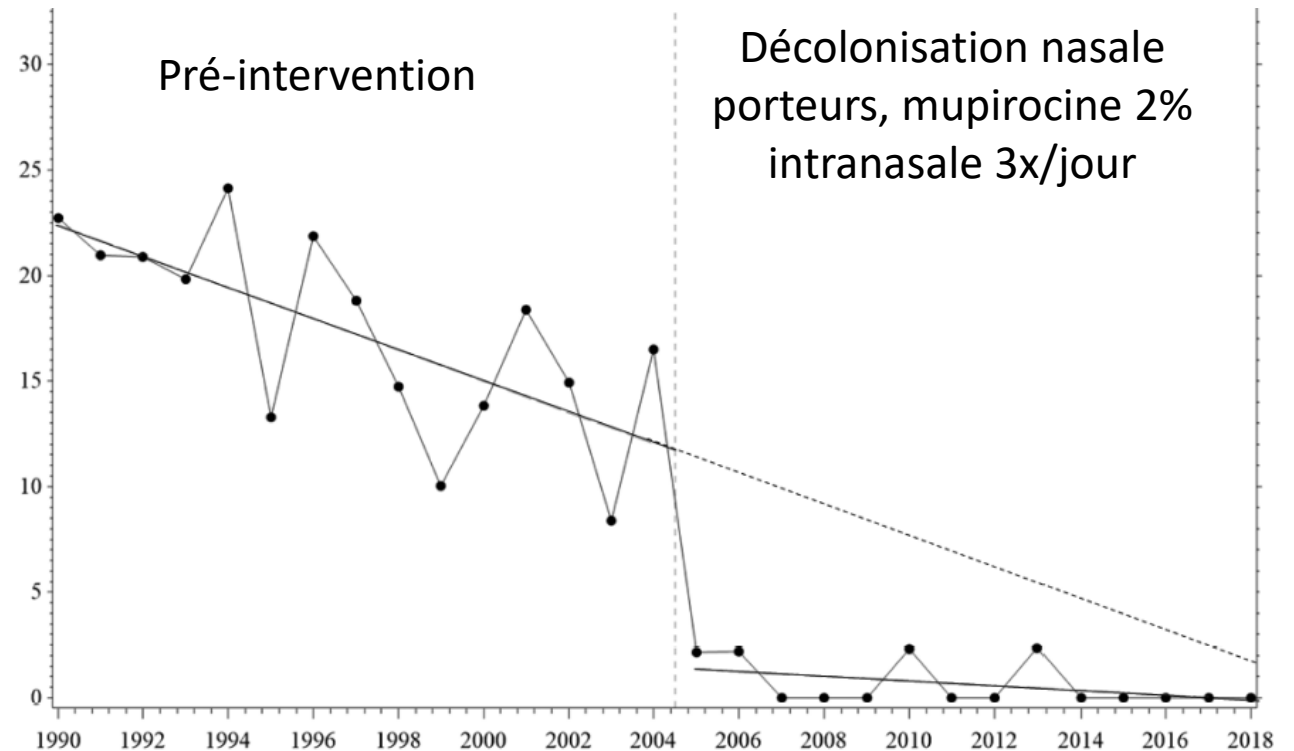
## Médiastinites, Hôpital Bichat

Décolonisation  
universelle



Lemaignen A et al, *J Hosp Infect* 2018

## Médiastinites, Madrid, Espagne



Rafael San-Juan *cid* 2021:73  
DOI: 10.1093/cid/ciab073

# Questions en suspens

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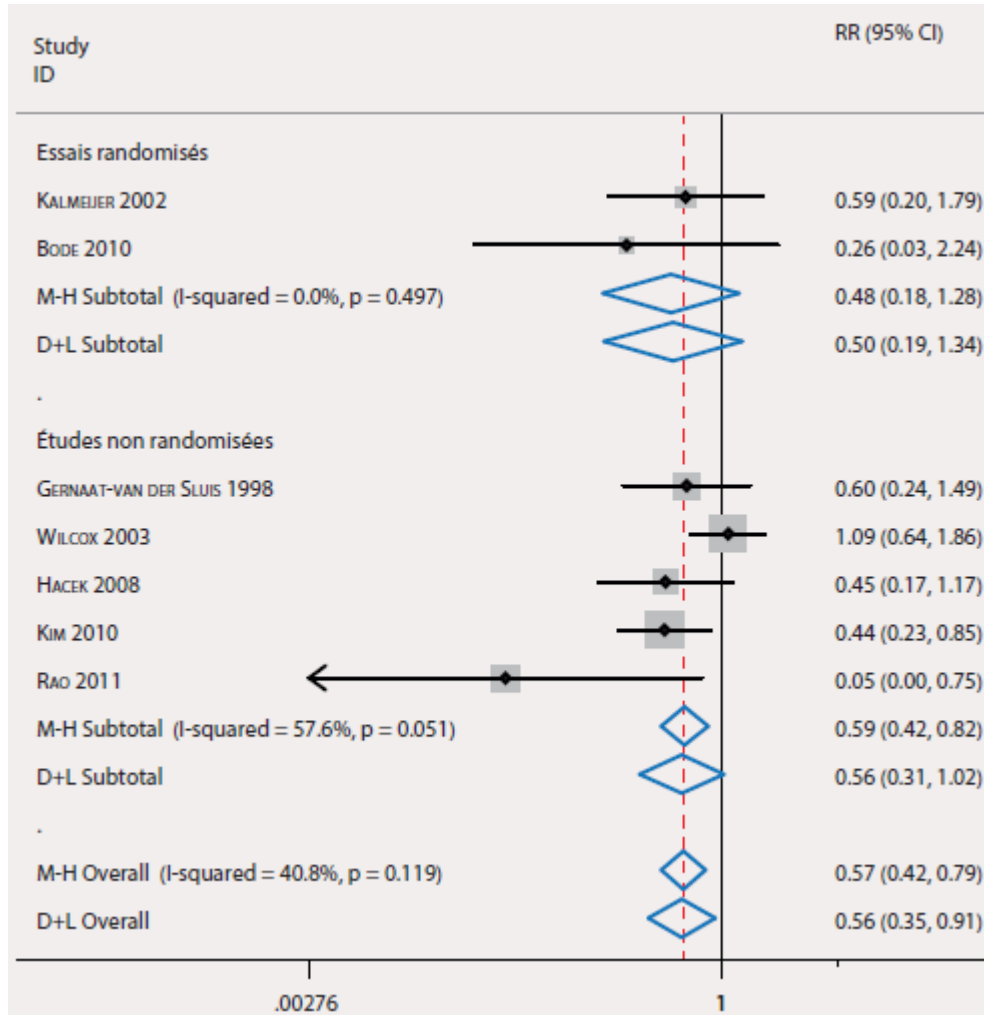
- **Aucune recommandation SF2H 2013 concernant :**
  - La décolonisation du portage de *S. aureus* diminue-t-elle le taux d'ISO à *S. aureus* :
    - En chirurgie orthopédique prothétique programmée ?
    - En chirurgie de classe de contamination 1 ?
  - Dépistage nasal de *Staphylococcus aureus* est-il un préalable indispensable à la décolonisation ?
  - Quelle stratégie de décolonisation du portage de *S. aureus* ?
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# Décolonisation en chirurgie ortho



## Aucune recommandation SF2H car :

- Cotation Grade
    - Essais randomisés : niveau de preuve faible
    - Etudes observationnelles : niveau de preuve très faible
  - Physiopathologie différente de l'ISO a *S. aureus*
  - Incidence de l'ISO a *S. aureus* plus faible
  - Absence d'un essai de haut niveau de preuve
- Un essai randomisé en double aveugle multicentrique est nécessaire pour améliorer le niveau de preuve et répondre a cette question.

ISO-RAISIN 2018	Chirurgie cardiaque		Chirurgie orthopédique	
	PAC	Valve	PTH	PTG
Nombre d'actes	15765	20092	137805	78587
Taux d'ISO	4,36%	-	1,35%	0,90%
Nbre d'ISO	687	-	1860	707
Proportion <i>S. aureus</i>	14% = 96		37%=950	

Effectif nécessaire pour montrer une diminution du taux d'ISO :

- 4% à 2% d'ISO en chirurgie cardiaque : N = 2282 patients
- 1,35 à 1% en chirurgie orthopédique : N = 29758 patients

## À partir de quel seuil d'infection à *S. aureus* ?

- Ch. cardiaque : dépister 250 patients pour identifier 23 porteurs et éviter une infection à *S. aureus* (Bode, NEJM 2010)

→ Nbre de Sujets Nécessaire : 250

- PTH, PTG (Berthelot et al, EJCMID, 2010) **10000**
  - 2% d'infection (superf et profonde) 200
  - 28% dues à *S. aureus* 56
  - Portage pre-op de *S. aureus* : 9/22 (41%) 23
  - Souche nasale identique à souche ISO : < 6/22 <15
  - Réduction du risque de 60% chez les porteurs < 10

→ NSN : >1000, et environ une ISO évitée/20

- **USA, Institute for Healthcare Improvement 2012 :**

- Arthroplasties hanche/genou : Dépistage *S. aureus*. Si positif décolonisation mupirocine 3 jrs avant + 5 jours et douche CHG

- **USA, SHEA/IDSA 2014 :**

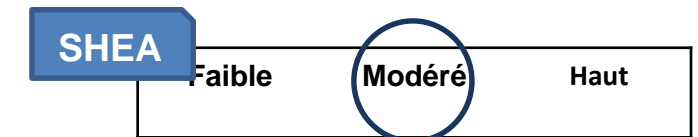
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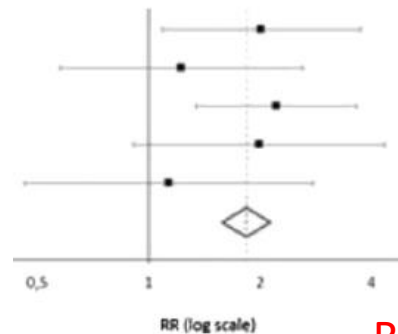
## Revue systématique et méta-analyse, 1/01/2020

- 24 articles sur la decontamination toute chirurgie orthopédique

### Décontamination nasale

Studies	Estimate (95% CI)
Gernaat-van der Sluis et al 1998	2.01 (1.09-3.73)
Kalmeijer et al 2002	1.23 (0.58-2.61)
Coskun et al 2004	2.22 (1.34-3.66)
Hacek et al 2008	1.99 (0.91-4.36)
Hadley et al 2010	1.13 (0.46-2.79)

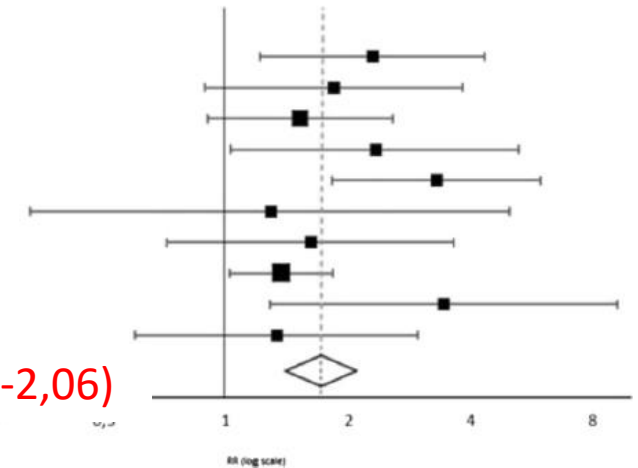
RR ISO sans déconta : 1,85 (1,08-2,62)



### Décontamination nasale et cutanée

Studies	Estimate (95% CI)
Rao et al 2011	2.29 (1.21-4.34)
Barbero Allende et al 2014	1.84(0.89-3.82)
Baratz et al 2015	1.52(0.90-2.57)
Malcolm et al 2015	2.33 (1.03-5.25)
Sporer et al 2016	3.29 (1.82-5.96)
Sousa et al 2016	1.28 (0.33-4.99)
Barbero et al 2017	1.61 (0.71-3.64)
Jeans et al 2018	1.37 (1.02-1.82)
Peiffort et al 2019	3.43 (1.28-9.20)
Romero-Palacios et al 2019	1.33 (0.60-2.95)

RR ISO sans déconta : 1,71 (1,34-2,06)



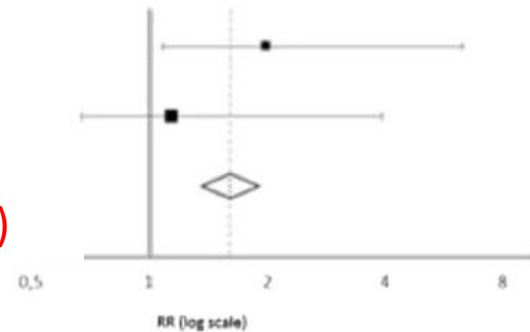
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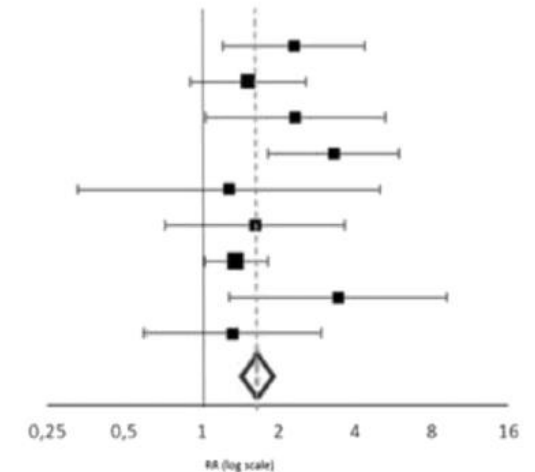
Risque relatif : 1,60 (0,35-2,86)



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Romero-Palacios et al 2019	1.33 (0.60-2.96)

Risque relatif : 1,70 (1,32-2,09)



*Décolonisation peut réduire les ISO en chirurgie orthopédique prothétique*

Revue systématique de la littérature (1994-2020)

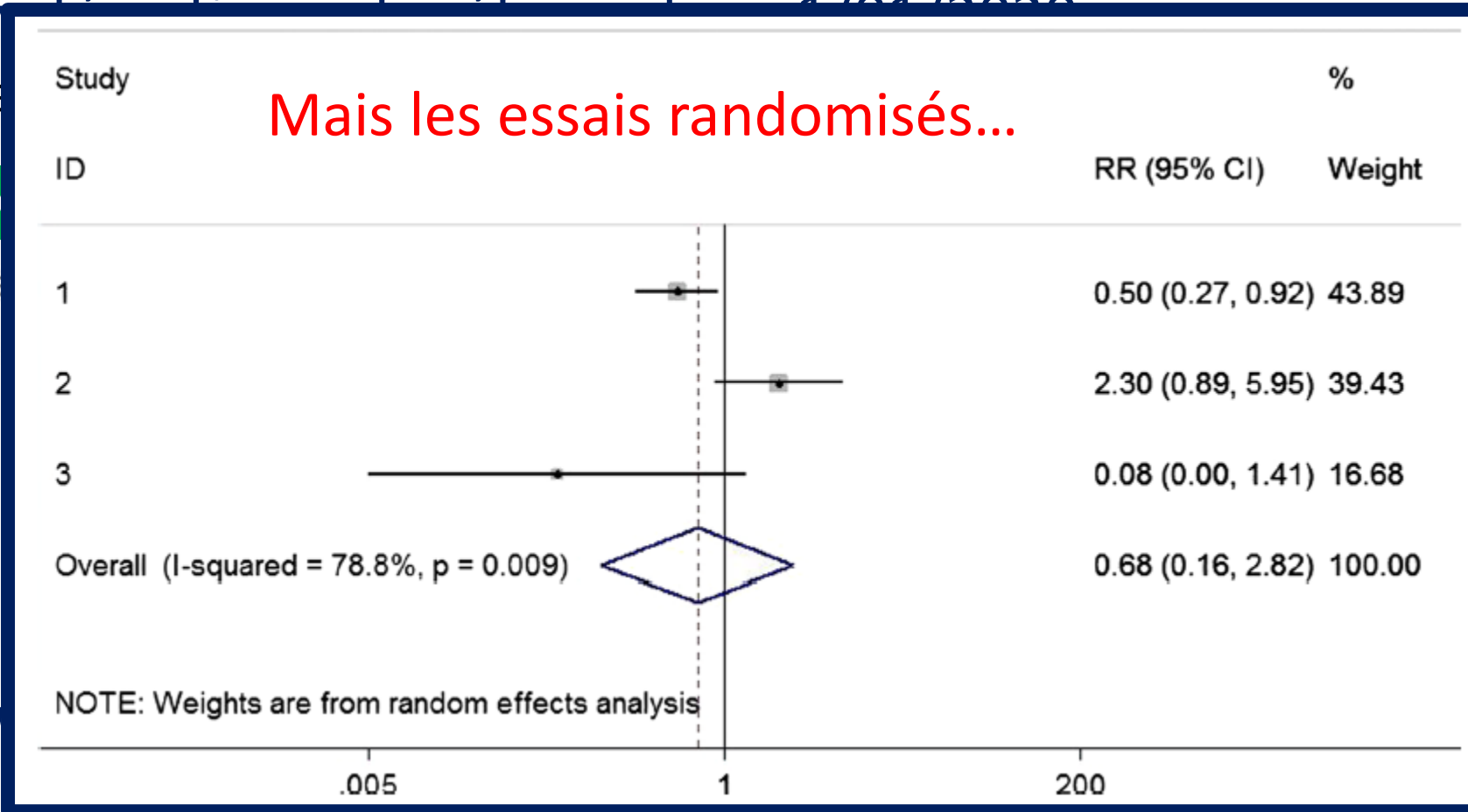
- 15 études

**D**

- Studies
- Hacek et al 2008
  - Hadley et al 2010

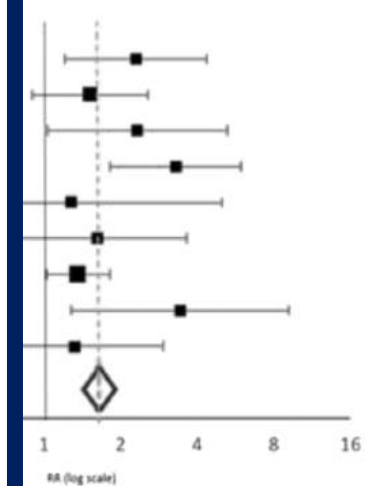
Risque relatif : 1,

Décolonisation  
chirurgie



e

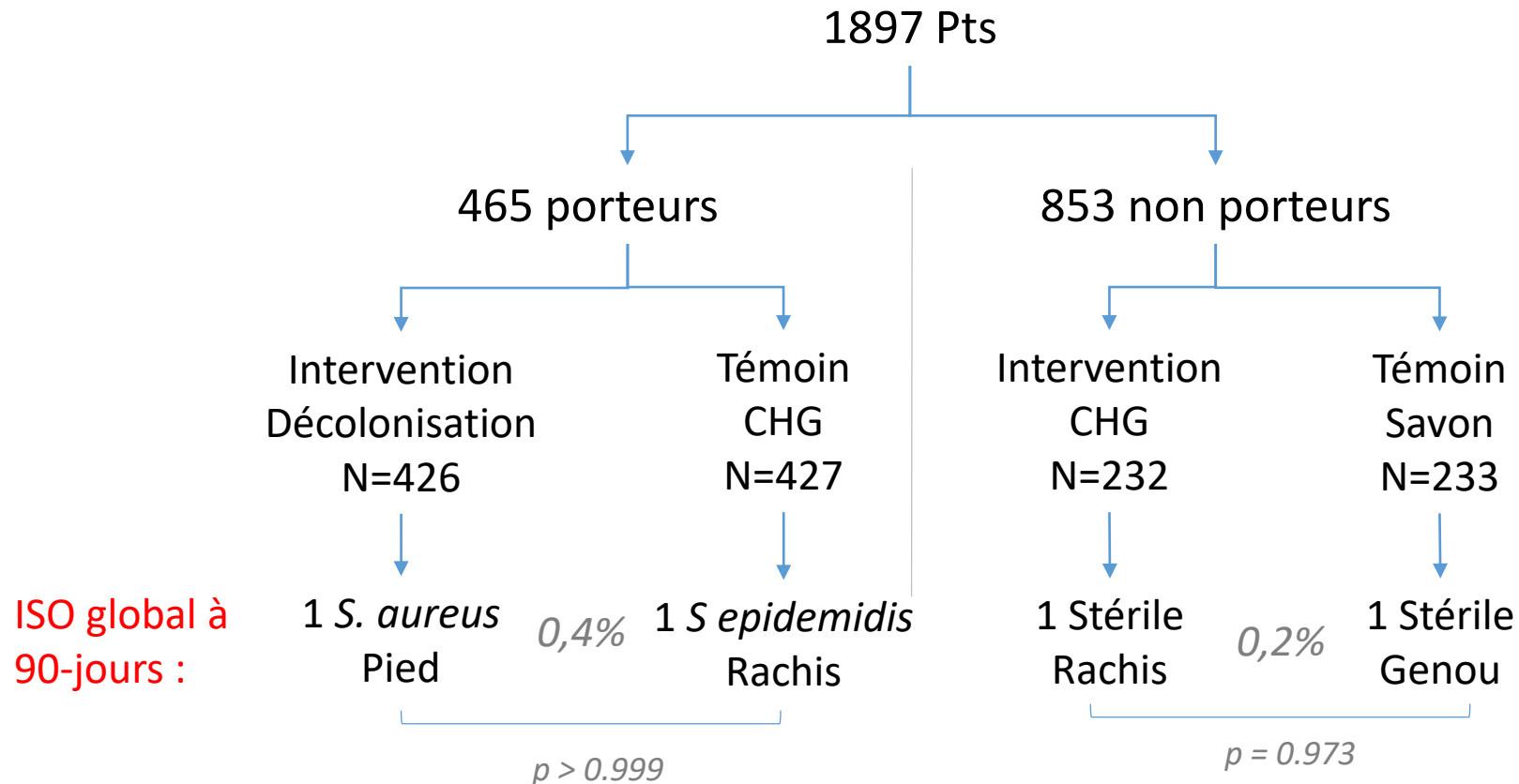
cutanée



# Décolonisation en chirurgie orthopédique

*En chirurgie orthopédique programmée*

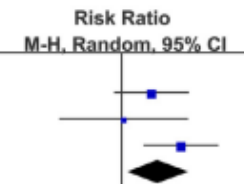
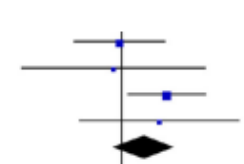
Etude randomisée, simple aveugle, monocentrique, Bern Suisse



- Calcul d'effectifs sur la base d'un taux d'ISO de 4%
- 15,000 patients nécessaires pour établir une prevue
- Faible durée de suivi : pas + d'ISO à 2 ans

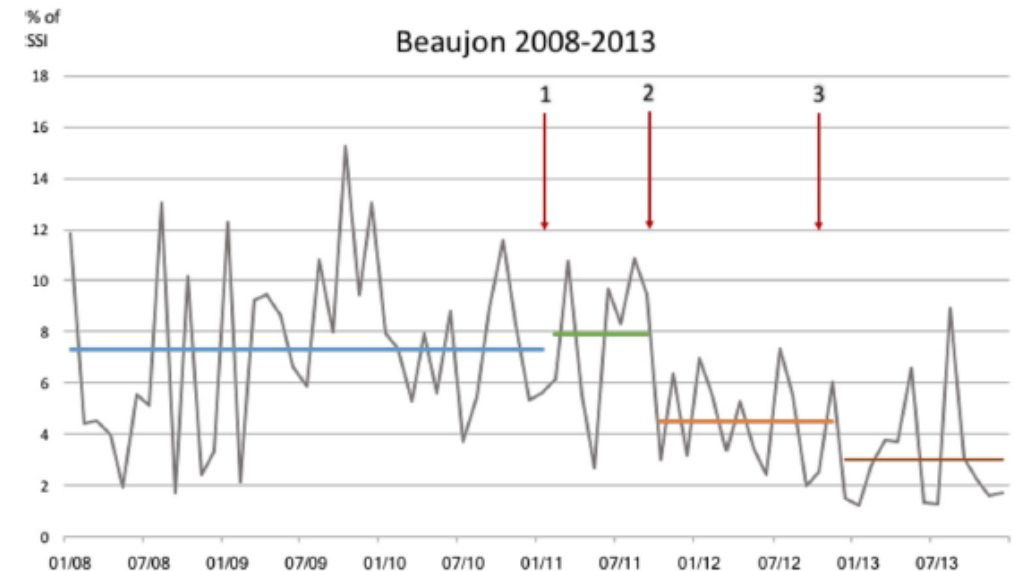
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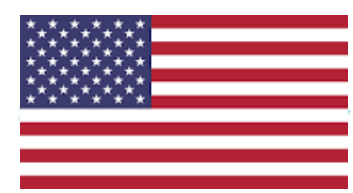
- 10,650 patients dépistés, 221 colonisés à SARM
- 244 ISO, dont 57 à SARM

Study or Subgroup	MRSA positive		MRSA negative		Weight	Risk Ratio		Risk Ratio M-H, Random, 95% CI
	Events	Total	Events	Total		M-H, Random, 95% CI		
<b>Pas de décolonisation</b>								
Thakkar 2014	3	25	24	494	22.1%	2.47 [0.80, 7.65]		
Nielsen 2018	1	28	36	1072	8.9%	1.06 [0.15, 7.48]		
Kawabata 2018	3	49	46	4524	22.0%	6.02 [1.94, 18.70]		
<b>Subtotal (95% CI)</b>		<b>102</b>	<b>46</b>	<b>6090</b>	<b>53.0%</b>	<b>3.04 [1.22, 7.62]</b>		
<b>Décolonisation</b>								
Ramos 2016	2	96	77	3460	16.0%	0.94 [0.23, 3.75]		
Luhmann 2016	0	17	11	322	4.6%	0.78 [0.05, 12.72]		
Kobayashi 2018	2	5	13	127	20.4%	3.91 [1.19, 12.85]		
Mallet 2018	0	1	26	330	6.0%	3.12 [0.28, 35.40]		
<b>Subtotal (95% CI)</b>		<b>119</b>	<b>26</b>	<b>4239</b>	<b>47.0%</b>	<b>1.98 [0.78, 5.02]</b>		

## Etude observationnelle

- Bicentrique 5314 patients, 7 ans
  - 1: Modification de l'antibioprophylaxie
  - 2: Décolonisation programmée
  - 3: Décolonisation tous patients





# SHEA/IDSA/APIC Practice Recommendation



## Quelques changements



### Qui est responsable de quoi?

#### Pratiques essentielles

- **Contrôle de la glycémie** post-chirurgical pour tout patient
- **ATB oral** et parentéral **avant chirurgie colorectale**
- **Décolonisation** antistaph en chirurgie card. et ortho.
  - Autres actes si matériel prothétique
- Préparation vaginale antiseptique avant césarienne
- **Lavage de plaie** peropératoire en chirurgie propre
- Utilisation de bundle/checklist de bonnes pratiques
- **Feedback** des taux d'ISO et d'observance aux professionnels

#### Mesure additionnel

- Utilisation des **pansements à pression négative**
- **Sutures imprégnées d'ATS**

Non recommandé : ATBP Vancomycin en routine

Non résolu: oxygénation, ATB poudre, tenue chirurgicale

Organizational Role	Responsibilities
Senior management (executives, senior directors) (Note: regulatory requirement for US hospitals)	Ensure sufficient funds, expertise, and commitment to an infection prevention and control (IPC) program that effectively prevents healthcare-associated infections (HAIs) and the transmission of epidemiologically important pathogens.
Surgical services leadership (surgeon, anesthesia, perioperative nursing leaders)	Ensure all perioperative staff are aware of their roles and expectations as they relate to SSI prevention. Advocate for the support of senior leadership.
Surgical services staff (surgeons, anesthesiologists/CRNAs, perioperative nurses and technicians)	Ensure execution of prevention measures consistently for all procedures. Escalate questions and concerns to senior surgical leadership.
Pharmacists	Ensure proper medications for SSI prevention are available when needed. Promote evidence-based, cost-effective choice of antimicrobial prophylaxis.
Infection preventionists	Ensure surveillance for SSI is thorough and aligns with national standards. Support prevention efforts as subject-matter experts, coaches, and observers of process and outcome. Educate staff and audit compliance on practical application <sup>361</sup> of infection control related policies and processes
Environmental services staff	Ensure correct processes for cleaning perioperative and related areas, and adequate number, training, and support of staff.
Information services	Support SSI prevention efforts through data collection automation and analysis, leverage different platforms (electronic health record, billing databases) to ensure standard and consistent data streams.

# Questions en suspens

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# Quelle stratégie adopter ?

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RFE commune SFAR – SFCTCV – RAC chirurgie cardiaque 2021

- **Sans dépistage microbiologique**
- **Décolonisation nasale par mupirocine 2% dans chaque narine**
  - *Argumentaire : ↘ portage de SARM nasal en réanimation + chirurgie cardiaque, sans ATBR*
  - *Nez + gorge : 44% de succès, Nez seul : 30%, Gorge seule : 26% (Mertz, Clin Infect Dis 2007)*
- **Décontamination oropharyngée** systématique par bain de bouche biquotidien à la chlorhexidine
  - *Argumentaire : ↘ infections nosocomiales, infections respiratoires (pneumopathies post-op), ISO en chirurgie cardiaque*
- Débuter **au moins 48h avant la chirurgie et pour une durée totale de 5-7 jours**

**OMS: mupirocine 2% avec ou sans toilette à la CHG**

Les autres sites fréquemment colonisés peuvent être considérés.

Mais en l'absence d'évidence aucune recommandation ne peut être émise.



- Recommandations unanimes pour la décolonisation en chir. cardiaque
  - **Mais reste insuffisamment appliquée en routine +++**
  - Stratégie par **décolonisation universelle** la plus coût-efficace, sans les contraintes de la décolonisation ciblée
- Décolonisation en chirurgie orthopédique prothétique
  - Nombreuses études observationnelles positives mais aucun essai randomisé
  - **Coût-efficacité ? Intérêt de la décolonisation / autres mesures ?**
    - Bénéfice : individuel important, mais probablement peu d'infections prévenues
    - Risque : faible sur le plan individuel, mais grand nombre d'actes → coût logistique/résistances
  - Décolonisation pour les autres chirurgies propres ? Neurochir, Sénologie ?

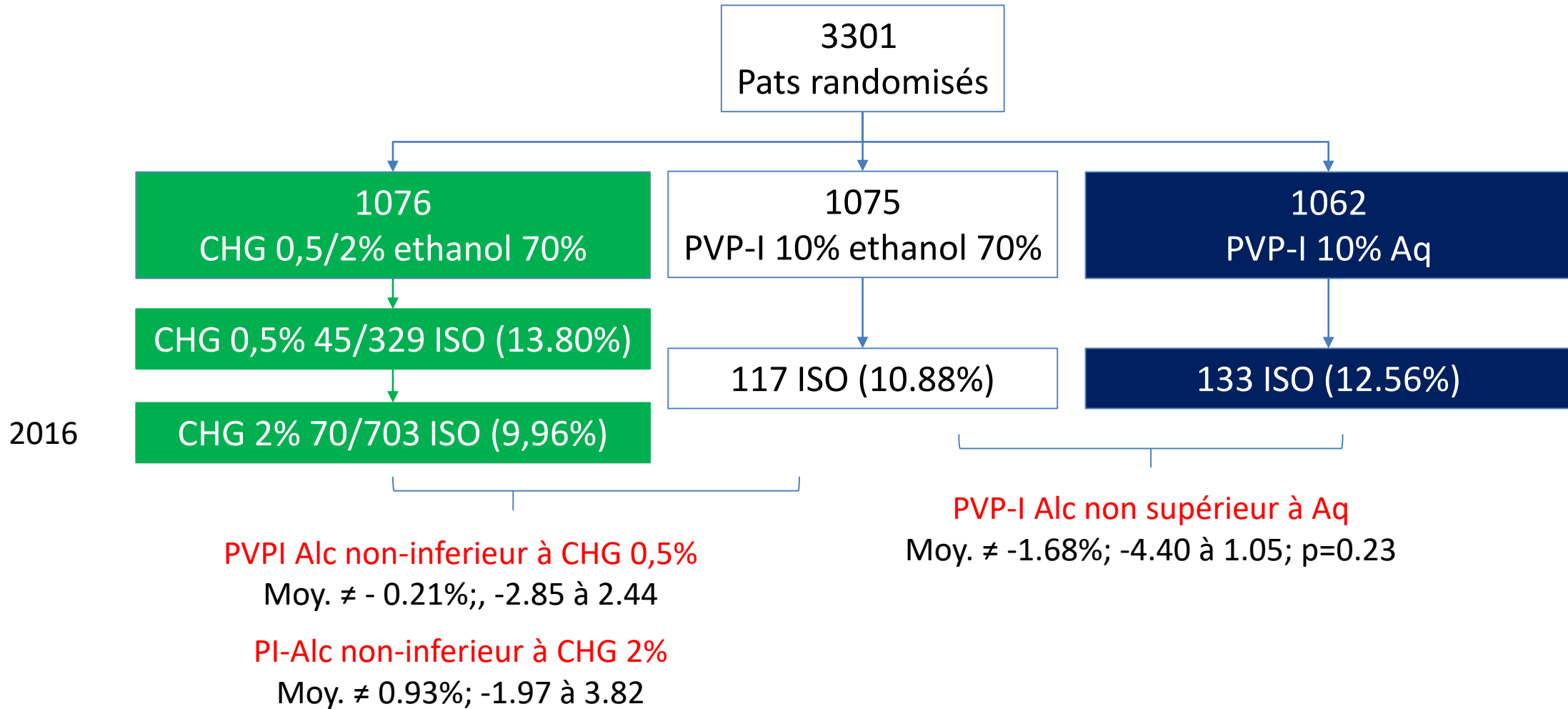


# CHG ou PVP-I ?

- Etude bicentrique, prospective, combinée **non-inferiorité (PI-Alc v CAlc) et superiorité (PI-Alc vs PI-Aq) RCT**
  - Non-inferiorité de PI-Alc comparée à CHG-alc
  - Superiorité de PI-Alc comparée à PI-Aq
- **Participants:** adultes bénéficiant de chirurgie programmée ou semi-urgente avec incision cutanée
  - Stratification par catégorie d'incision selon le CDC
- **Outcomes:**
  - ISO dans les 30 jours et 90 jours lors d'implant
  - Taux de complications global, DDS, readmission et effet indésirable



# CHG ou PVP-I ?





# CHG ou PVP-I ?

- Recommandations actuelles
  - NICE: 1er choix doit être CHG alcoolique
  - CDC: Antiseptique alcoolique
  - WHO: **CHG alcoolique**, plutôt que la PVP-I Aq ou Alc
    - Meta-analyse, excluant les essais, avec des concentrations inconnues indiquait pas d'avantage pour la chlorhexidine (OR 0.84; 95% CI 0.68-1.04)
- Limites
  - Deux hôpitaux participants dans une seule ville
  - Impossibilité de procéder en aveugle (couleur des produits)

Etude sans support de l'industrie  
Prépa cut avec PVP-I Alc pas inférieur à la CHG Alc sur la survenue d'ISO, taux de complications, DDS et readmissions

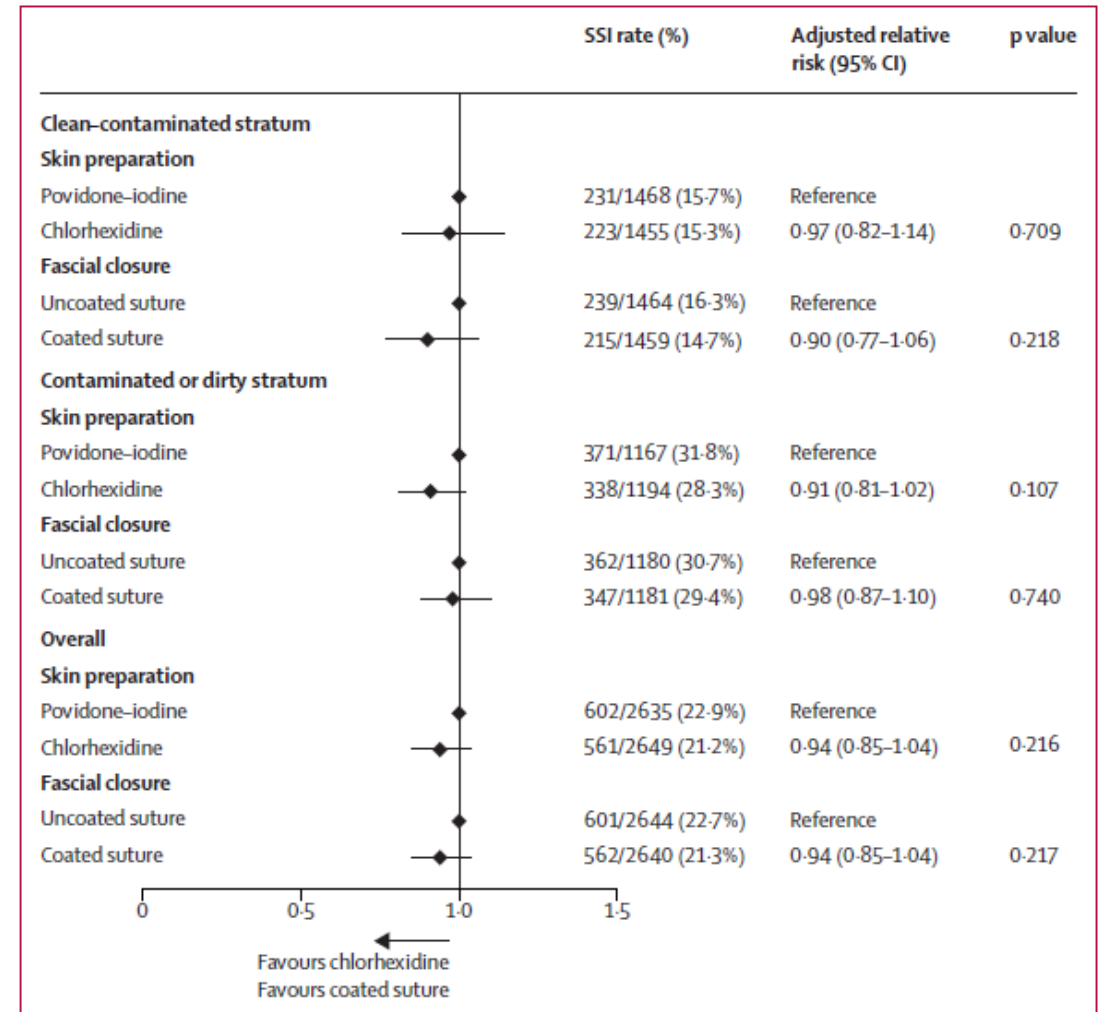


# Prépa cut et sutures imprégnées

- Essai randomisé 2 × 2, en chirurgie abdominale **propre-contaminée, contaminée ou sale**, avec incision cutanée
- 54 hôpitaux de 7 pays **faibles revenus**

2% Alc CHG	Suture non imprégnée
	Suture imprégnée Triclosan
10% Aq PVPI	Suture non imprégnée
	Suture imprégnée Triclosan

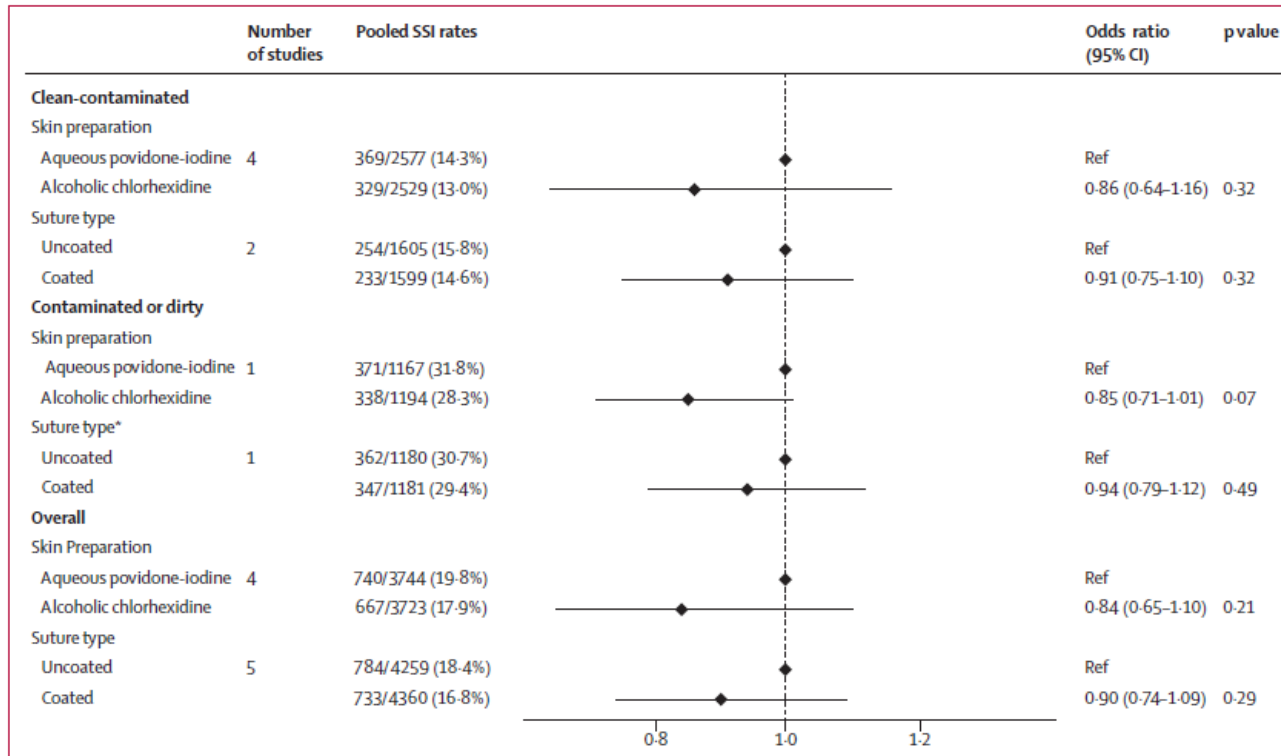
Pas d'évidence en faveur de la CHG alcoolique ou de sutures imprégnées de triclosan en chirurgie propre-contaminée, contaminée ou sale dans les pays à faibles revenus





# Prépa cut et sutures imprégnées

- Revue systématique et méta-analyse
  - Essais randomisés testant 2% CHG Alc vs PVI-Aq ou suture-Triclosan, en **chirurgie propre contaminée, contaminée, ou sale**



## Taux d'ISO :

- CHG Alc : 17.9% OR: 0.8, 0.6–1.0; p=0.2
- PVP-I Aq : 19.8%
- Suture Triclosan : 16.8% OR: 0.9, 0.7–1.1, p=0.3
- Non-imprégnée : 18.4%

- Inclusion des RCTs menés rigoureusement (FALCON)  
 - Recommandations globales à revisiter (OMS)  
 - RCT nécessaires dans des chirurgies avec des taux d'ISO importants.



# Antiseptie / chirurgie sur fracture

## Etude Aqueous-PREP

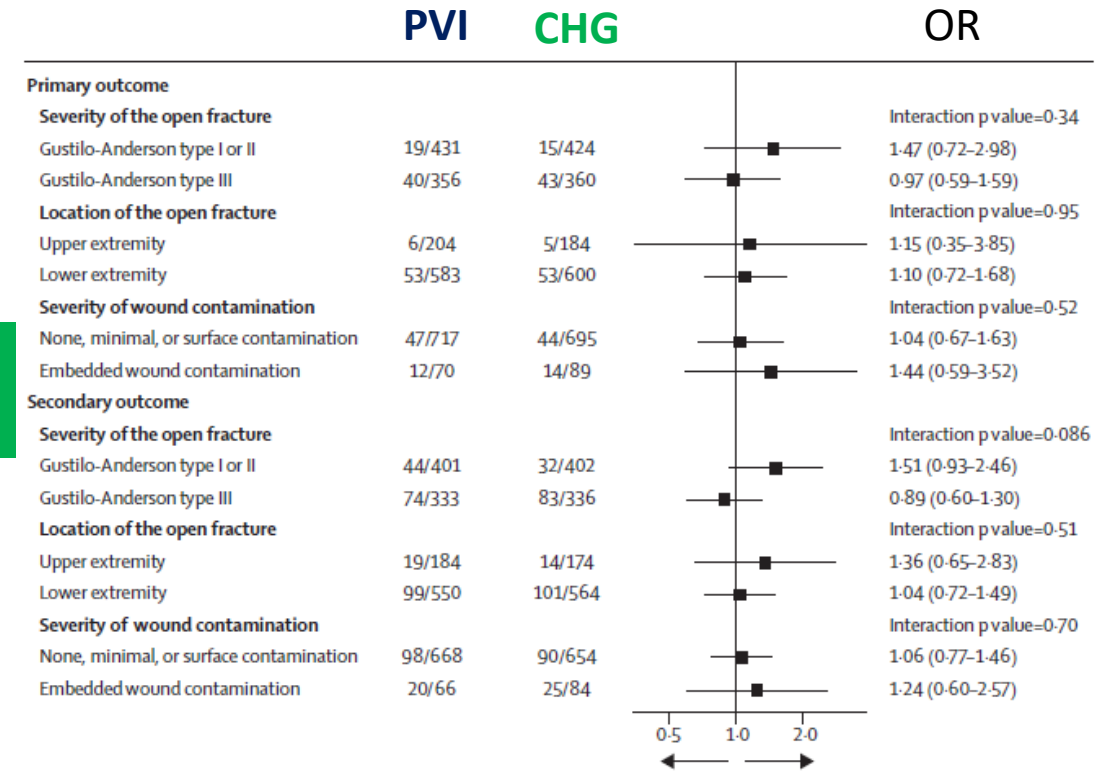
- Comparaison de l'effet de la PVI 10% aqueuse vs CHG 4% aqueuse sur le risque d'ISO fracture ouverte
- Essai randomisé en cluster, 14 hôpitaux Canada, Espagne, US
- Fracture externe ouverte traité par fixateur externe

PVI aq 10%  
n=787

ATBP parent C2G,  
sans prep col

CHG aq 4%  
n=836

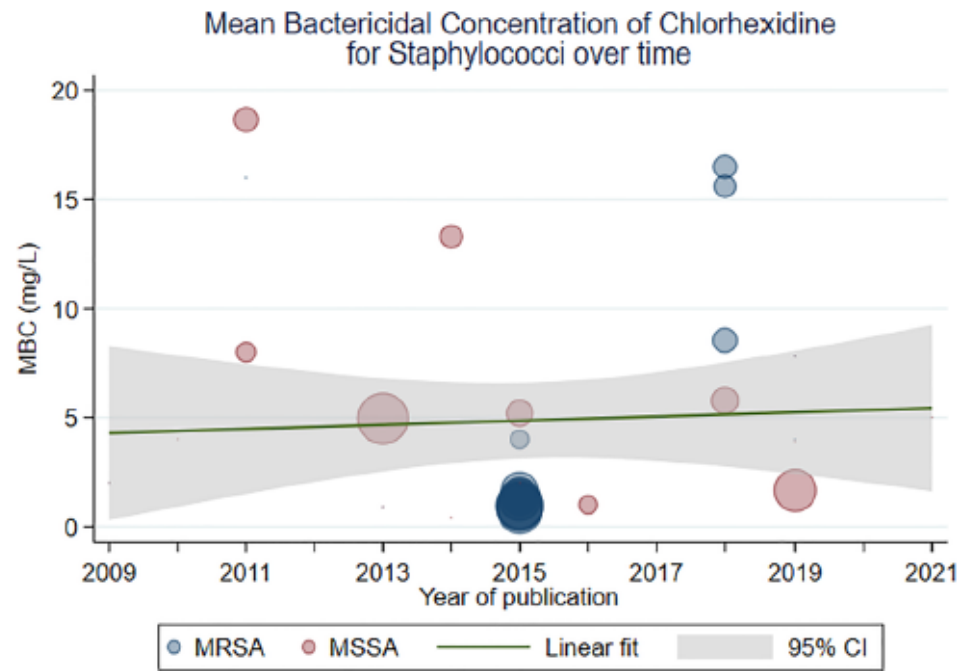
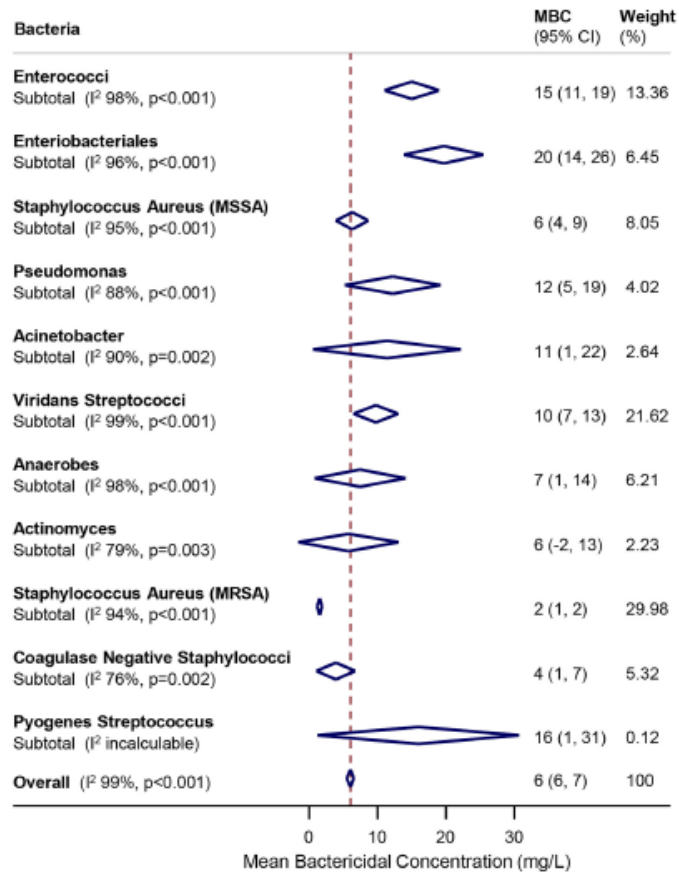
	PVI aq 10% n=787	OR 1.1, 0.7- 1.6; p=0.6	CHG aq 4% n=836
ISO	59 (7%)		58 (7%)
ISO sup	13 (2%)		7 (1%)
ISO prof	27 (3%)		36 (5%)
Reop	118 (16%)		115 (16%)



Pour fixation de fracture ouverte, PVI ou CHG aq peuvent être utilisées en fonction de disponibilité, contre-indications, du coût. Implication pour l'antiseptie des plaie ouvertes.

# Sensibilité bactérienne à la CHX et PVI au cours du temps

- Méta-Analyse pour déterminer si les concentration minimales de bactéricidie de CHX ou PVI a changé au fil du temps, chez les principaux pathogènes responsables d'ISO



Pas de changement visible de la sensibilité des pathogènes causant des ISO au fil du temps. Cependant, la définition de diminution de sensibilité et résistance des pathogène est nécessaire, de même que les méthodes pour évoluer ce phénomène.





# Irrigation de plaie

- Essai randomisé de supériorité (1:1), hopital Japonais
- Chirurgie gastro-abdo programmée (propre-conta)
- Avant fermeture de plaie, irrigation par
  - 1 min 40 mL de PVI aqueuse 10%
  - 1 min 100 mL d'NaCl
- ISO à 30 jrs
- Effectifs: hypothèse de réduction de 50% des ISO
  - 4.7% gpe intervention vs 9.4% gpe témoin
  - 930 patients pour 80% de puissance, risque  $\alpha$  0,05
- Juin 2019, Mars 2022
  - 473 patients PVI aqueuse 10%
  - 468 patients NaCl

} 70% Laparo

- Reconsidérer les recommandations CDC et WHO concernant l'irrigation à la PVP-I en chirurgie gastro-abdo
- SHEA: Des essais randomisés nécessaires sur l'irrigation ATB vs PVI en chirurgie intra-abdominale

	10% PVP-I	aqueous	RR
ISO	36 (7.6)	24 (5.1)	1.5 (0.9 - 2.5)
ISO sup	31 (6.6)	20 (4.3)	1.5 (0.9 - 2.6)
ISO prof	5 (1.0)	4 (0.8)	1.2 (0.3 - 4.6)

		Intervention		Témoin		p
		ISO		ISO		
Overall	Open	141	14 (9.9)	143	11 (7.7)	0.536
	Lap	332	22 (6.6)	325	13 (4.0)	0.12
Upper gastrointestinal	Total	79	4 (5.1)	80	2 (2.5)	0.443
	Open	45	3 (6.7)	49	2 (4.1)	0.668
Small bowel	Lap	34	1 (2.9)	31	0 (0)	1
	Total	12	0 (0)	12	2 (17)	0.478
Colorectal	Open	5	0 (0)	7	2 (29)	0.47
	Lap	7	0 (0)	5	0 (0)	1
Hepatobiliary pancreatic	Total	230	22 (9.6)	222	12 (5.4)	0.109
	Open	21	3 (14)	17	1 (5.9)	0.613
Others	Lap	209	19 (4.3)	205	11 (5.4)	0.184
	Total	151	10 (6.6)	151	8 (5.4)	0.809
	Open	69	8 (12)	69	6 (8.7)	0.779
	Lap	82	2 (2.4)	82	2 (2.4)	1
	Total	1	0 (0)	3	0 (0)	1
	Open	1	0 (0)	1	0 (0)	1
	Lap	0	0 (0)	2	0 (0)	1



ELSEVIER



- Essai randomisé de su
- Chirurgie gastro-abdo
- Avant fermeture de pl
  - 1 min 40 mL de PVI aq
  - 1 min 100 mL d'NaCl
- ISO à 30 jrs
- Effectifs: hypothèse d
  - 4.7% gpe intervention
  - 930 patients pour 80%
- Juin 2019, Mars 2022
  - 473 patients PVI aqueu
  - 468 patients NaCl

## Comparing the efficacy of povidone-iodine and normal saline in incisional wound irrigation to prevent superficial surgical site infection: a randomized clinical trial in gastric surgery

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### SUMMARY

**Background:** Prevention of surgical site infection (SSI) after gastrectomy has received increasing attention. Prophylactic incisional wound irrigation has been advocated to reduce SSI, but the choice of solution remains under debate.

**Aims:** To compare the efficacies of wound irrigation with normal saline (NS) and povidone-iodine (PVI) for the prevention of SSI after gastrectomy, and to identify the risk factors for SSI.

**Methods:** This randomized, single-centre clinical trial included 340 patients with gastric cancer. They were assigned at random into two groups (ratio 1:1) to receive either 0.9% NS or 1.0% PVI solution for incisional irrigation before wound closure. The primary endpoint was postoperative SSI within 30 days of gastrectomy, and the secondary endpoint was the length of hospital stay.

**Findings:** In total, 333 patients were included in the modified intent-to-treat group, and the SSI rate did not differ significantly between the PVI group (11/167, 6.59%) and the NS group (9/166, 5.42%) [odds ratio (OR) 1.131, 95% confidence interval (CI) 0.459–3.712;  $P=0.655$ ]. Moreover, the difference between the two groups in terms of length of hospital stay was not significant ( $P=0.301$ ). Body mass index (BMI) (OR 2.639, 95% CI 1.040–6.694;  $P=0.041$ ) and postoperative complications (OR 2.565, 95% CI 1.023–6.431;  $P=0.045$ ) were identified as independent risk factors for SSI.

**Conclusions:** NS and PVI had similar efficacy as prophylactic wound irrigation for the prevention of SSI after gastrectomy. The risk of SSI was higher in patients with high BMI or postoperative complications.

aqueous	RR
24 (5.1)	1.5 (0.9 - 2.5)
20 (4.3)	1.5 (0.9 - 2.6)
4 (0.8)	1.2 (0.3 - 4.6)

Intervention		Témoïn		p
ISO		ISO		
141	14 (9.9)	143	11 (7.7)	0.536
332	22 (6.6)	325	13 (4.0)	0.12
79	4 (5.1)	80	2 (2.5)	0.443
45	3 (6.7)	49	2 (4.1)	0.668
34	1 (2.9)	31	0 (0)	1
12	0 (0)	12	2 (17)	0.478
5	0 (0)	7	2 (29)	0.47
7	0 (0)	5	0 (0)	1
230	22 (9.6)	222	12 (5.4)	0.109
21	3 (14)	17	1 (5.9)	0.613
209	19 (4.3)	205	11 (5.4)	0.184
151	10 (6.6)	151	8 (5.4)	0.809
69	8 (12)	69	6 (8.7)	0.779
82	2 (2.4)	82	2 (2.4)	1
1	0 (0)	3	0 (0)	1
1	0 (0)	1	0 (0)	1
0	0 (0)	2	0 (0)	1

- Reconsidérer les recommand
- l'irrigation à la PVP-I en chiru
- SHEA: Des essais randomisés
- en chirurgie intra-abdominaire



# SHEA/IDSA/APIC Practice Recommendation



## Quelques changements



### Qui est responsable de quoi?

#### Pratiques essentielles

- **Contrôle de la glycémie** post-chirurgical pour tout patient
- **ATB oral** et parentéral **avant chirurgie colorectale**
- **Décolonisation** antistaph en chirurgie card. et ortho.
  - Autres actes si matériel prothétique
- Préparation vaginale antiseptique avant césarienne
- **Lavage de plaie** peropératoire en chirurgie propre
- Utilisation de bundle/checklist de bonnes pratiques
- **Feedback** des taux d'ISO et d'observance aux professionnels

#### Mesure additionnel

- Utilisation des **pansements à pression négative**
- **Sutures imprégnées d'ATS**

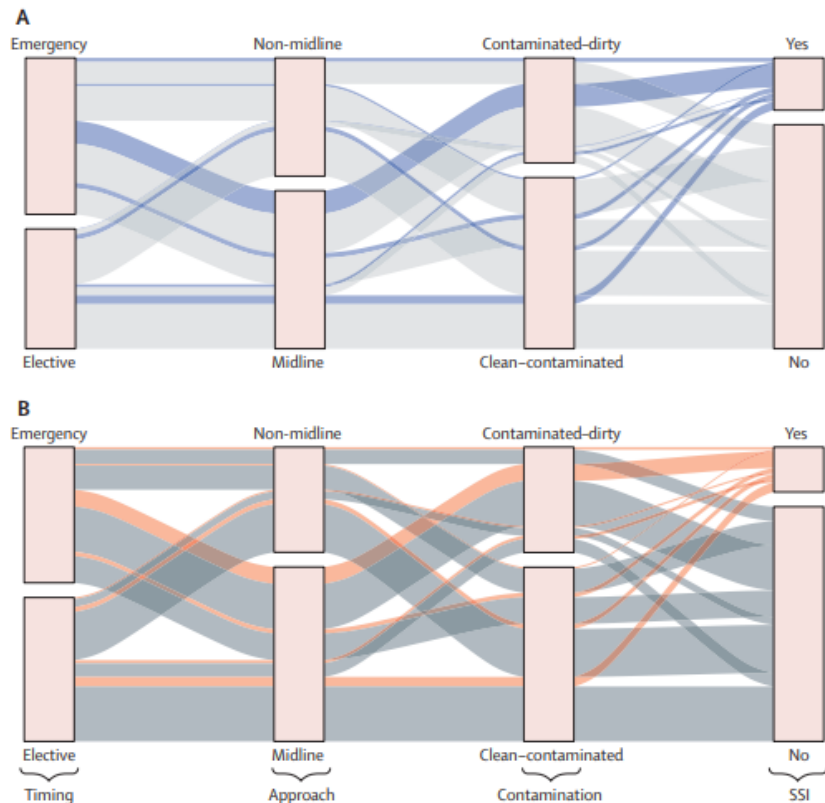
Non recommandé : ATBP Vancomycin en routine

Non résolu: oxygénation, ATB poudre, tenue chirurgicale

Organizational Role	Responsibilities
Senior management (executives, senior directors) (Note: regulatory requirement for US hospitals)	Ensure sufficient funds, expertise, and commitment to an infection prevention and control (IPC) program that effectively prevents healthcare-associated infections (HAIs) and the transmission of epidemiologically important pathogens.
Surgical services leadership (surgeon, anesthesia, perioperative nursing leaders)	Ensure all perioperative staff are aware of their roles and expectations as they relate to SSI prevention. Advocate for the support of senior leadership.
Surgical services staff (surgeons, anesthesiologists/CRNAs, perioperative nurses and technicians)	Ensure execution of prevention measures consistently for all procedures. Escalate questions and concerns to senior surgical leadership.
Pharmacists	Ensure proper medications for SSI prevention are available when needed. Promote evidence-based, cost-effective choice of antimicrobial prophylaxis.
Infection preventionists	Ensure surveillance for SSI is thorough and aligns with national standards. Support prevention efforts as subject-matter experts, coaches, and observers of process and outcome. Educate staff and audit compliance on practical application <sup>361</sup> of infection control related policies and processes
Environmental services staff	Ensure correct processes for cleaning perioperative and related areas, and adequate number, training, and support of staff.
Information services	Support SSI prevention efforts through data collection automation and analysis, leverage different platforms (electronic health record, billing databases) to ensure standard and consistent data streams.

# Routine sterile glove and instrument change at the time of abdominal wound closure to prevent SSI (ChEETAh)

- **Objective:** to test whether a routine change of gloves and instruments before wound closure reduced abdominal SSI
- **Methods:** multicentre, cluster randomised trial in seven low-income and middle-income countries
  - Between June 24, 2020 and March 31, 2022, 81 clusters were randomly assigned
  - current practice (42) versus intervention (39); routine change of gloves and instruments before wound closure for the whole scrub team).



Flow of patients across key surgical features. SSIs diagnosed within each patient group highlighted in **blue** for the current practice group (A) and **orange** for the intervention group (B).

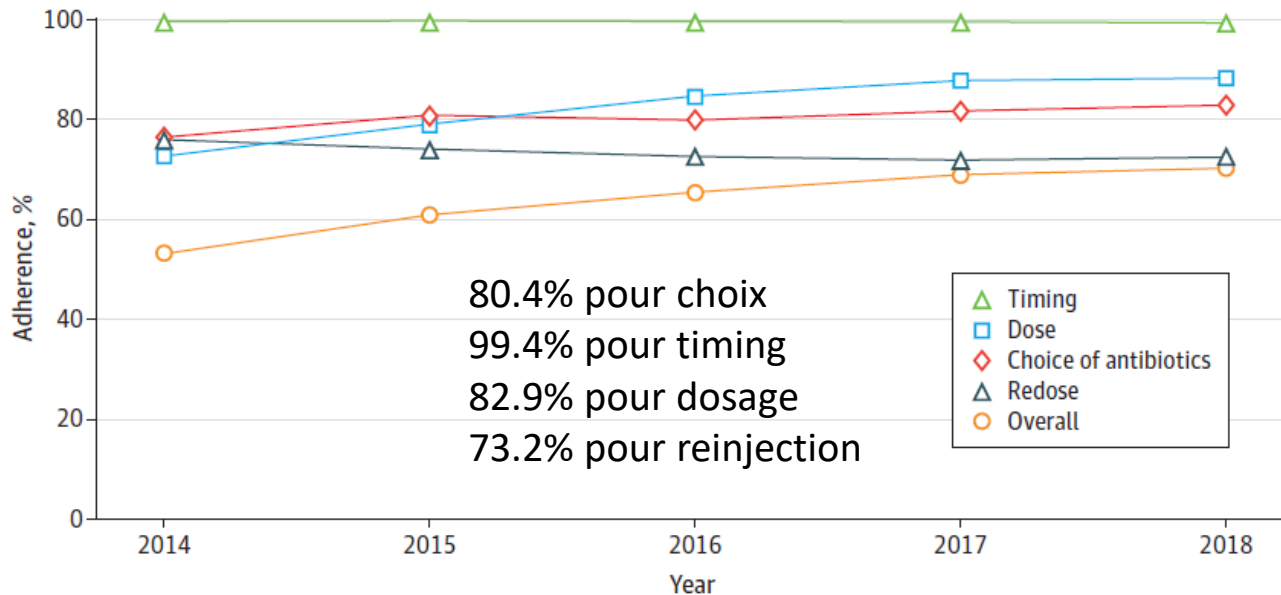
	Current practice group (n=7157)	Intervention group (n=6144)	Risk ratio* (95% CI)	p value
Mortality	455/7095 (6.4%)	394/6110 (6.4%)	0.88 (0.70–1.10)	0.26
Missing	62	34	..	..
Surgical site infection at discharge	706/7002 (10.1%)	484/5976 (8.1%)	0.77 (0.52–1.12)†	0.17
Missing	155	168	..	..
Readmission	243/6675 (3.6%)	194/5761 (3.4%)	1.02 (0.75–1.39)	0.89
Missing	482	383	..	..
Reoperation	157/6674 (2.3%)	89/5760 (1.5%)	0.73 (0.48–1.10)	0.14
Missing	483	384	..	..
Return to normal activities	4413/6623 (66.6%)	3651/5717 (63.9%)	0.99 (0.83–1.17)†	0.89
Missing	534	427	..	..
Length of hospital stay‡				
Median (IQR)	5 (3–8)	6 (4–9)	1.12 (0.97–1.25)§	0.083
Missing	547	503	..	..

Robust benefit to routinely changing gloves and instruments before abdominal wound closure



# Observance de l'antibioprophylaxie

- Cohorte de 414 851 patients de 31 hôpitaux
  - Taux global d'observance : 64.1%



## Facteurs associés à la non observance

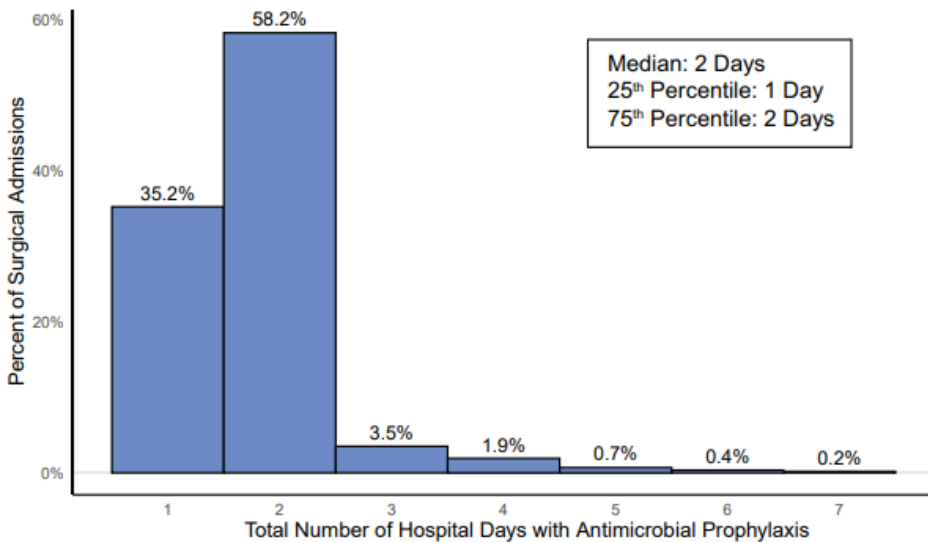
	OR
Urgence	1.35, 1.29-1.41
Heures non ouvrées	1.08, 1.04-1.13
Transfusion sang	1.30, 1.25-1.36
Orthopedie	0.26, 0.25-0.26
Gynecologie	0.38, 0.37-0.39
Urologie	0.74, 0.73-0.76
Anesth assistant seul	0.90, 0.87-0.92

Une approche large est necessaire pour évaluer l'observance des bonnes pratiques d'ATBP

# Adherence to Antimicrobial Prophylaxis Guidelines for Elective Surgeries across 825 United States Hospitals, 2019-2020

- Retrospective cohort study of adults who underwent elective craniotomy, hip/knee replacement, spinal procedure, or hernia repair in 2019–2020 at hospitals in the PINC AI (Premier) Healthcare Database

**A** Duration of Antimicrobial Prophylaxis Among Patients Undergoing Inpatient Elective Surgeries (n = 521091)



**Reason(s) for Guideline Nonadherence Across 212 331 Nonadherent Elective Surgical Procedures, by Surgery Type**

	Craniotomy (n = 8073)	Hip Replacement (n = 51 901)	Knee Replacement (n = 73 822)	Spinal Procedure (n = 72 781)	Hernia Repair (n = 5754)	Total (N = 212 331)
Inappropriate vancomycin use <sup>a</sup>	4406 (54.6)	40 010 (77.1)	55 722 (75.5)	62 330 (85.6)	962 (16.7)	163 430 (77.0)
Vancomycin + cefazolin	1903 (23.6)	28 348 (54.6)	37 536 (50.8)	42 937 (59)	198 (3.4)	110 922 (52.2)
Vancomycin monotherapy	926 (11.5)	4199 (8.1)	5906 (8.0)	8554 (11.8)	313 (5.4)	19 898 (9.4)
Vancomycin, cefazolin + gram-negative agent <sup>b, c</sup>	261 (3.2)	3018 (5.8)	4986 (6.8)	3715 (5.1)	98 (1.7)	12 078 (5.7)
Vancomycin, cefazolin + other <sup>b</sup>	274 (3.4)	1605 (3.1)	2973 (4.0)	1864 (2.6)	126 (2.2)	6842 (3.2)
Vancomycin + clindamycin	141 (1.7)	1669 (3.2)	2296 (3.1)	2032 (2.8)	20 (0.3)	6158 (2.9)
Vancomycin + other <sup>b</sup>	710 (8.8)	588 (1.1)	1089 (1.5)	1707 (2.3)	158 (2.7)	4252 (2.0)
Vancomycin + gram-negative agent <sup>c</sup>	191 (2.4)	583 (1.1)	936 (1.3)	1521 (2.1)	49 (0.9)	3280 (1.5)
Inappropriate gram-negative use <sup>c, d</sup>	1281 (15.9)	10 579 (20.4)	16 230 (22.0)	11 181 (15.4)	1746 (30.3)	41 017 (19.3)
Inappropriate clindamycin use <sup>e</sup>	831 (10.3)	5225 (10.1)	7672 (10.4)	5399 (7.4)	936 (16.3)	20 063 (9.4)
Spectrum too broad	1924 (23.8)	1855 (3.6)	2984 (4.0)	2721 (3.7)	2018 (35.1)	11 502 (5.4)
Inappropriate oral antibiotic use	500 (6.2)	2162 (4.2)	2851 (3.9)	2577 (3.5)	405 (7.0)	8495 (4.0)
Inappropriate spectrum <sup>b</sup>	197 (2.4)	273 (0.5)	458 (0.6)	134 (0.2)	973 (16.9)	2035 (1.0)
Spectrum too narrow	1481 (18.3)	990 (1.9)	3336 (4.5)	1105 (1.5)	96 (1.7)	7008 (3.3)

**B** Duration Distribution for Select Antimicrobial Agents

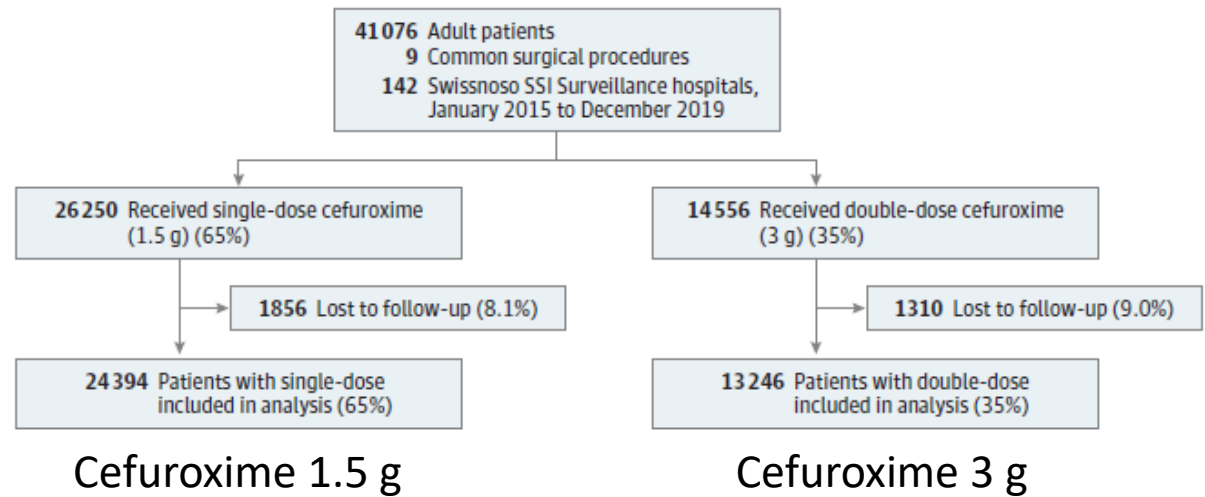
Antimicrobial Agent	No. (%)			
	Patients Receiving Agent	Patients Receiving Agent Only on Day 1	Patients Receiving Agent For 2 Days	Patients Receiving Agent > 2 Days
Cefazolin	458092	163667 (35.7)	273002 (59.6)	21423 (4.7)
Vancomycin	176966	147846 (83.5)	21802 (12.3)	7318 (4.1)
Clindamycin	24680	11684 (47.3)	11351 (46.0)	1645 (6.7)

59% were adherent to prophylaxis guidelines  
Unnecessary vancomycin use, which may increase the risk of AKI



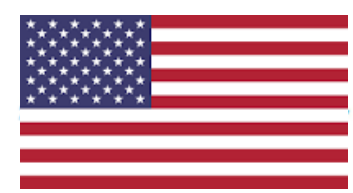
# Double-Dose pour Patients $\geq 80$ kg

- Objectif: Evaluer si la double-dose de cefuroxime ATBP est associée à une diminution des taux d'ISO chez les patients  $\geq 80$  kg
  - Etude de cohorte, adultes incluant 9 gestes majeurs de chirurgie



Variable	aOR (95% CI)	P value
Cefuroxime dose		
Single	1 [Reference]	NA
Double	0.89 (0.78-1.02)	.10
Weight category, kg		
80 to <90	0.76 (0.61-0.97)	.02
90 to <100	1.12 (0.87-1.47)	.37
100 to <120	0.99 (0.76-1.30)	.96
$\geq 120$	0.65 (0.42-1.01)	.06

Double-dose cefuroxime en ATBP pour les patients  $\geq 80$  kg n'est pas systématiquement associée à une diminution des taux d'ISO



# Allergie aux $\beta$ -lactamines et ISO

- Du fait de la surestimation des allergies aux  $\beta$ -lactamines, de nombreux patients ne reçoivent pas une ATBP avec cephalosporines
  - Cohorte retrospective monocentrique: Césariennes, vaginale, abdominale hysterectomie, colon, laminectomie, et rachis

Procedure	Reported BL Allergic	Reported NBL Allergic	P-value
Overall*	14/454 (3.1%) <sup>‡</sup>	34/2222 (1.5%) <sup>‡</sup>	<i>P</i> = 0.023
Cesarean Section*	6/150 (4%) <sup>‡</sup>	12/842 (1.4%) <sup>‡</sup>	<i>P</i> = 0.042
Abdominal Hyst	1/61 (1.6%) <sup>‡</sup>	2/285 (0.7%) <sup>‡</sup>	<i>P</i> = 0.442
Vaginal Hyst*	4/34 (11.8%) <sup>‡</sup>	1/150 (0.7%) <sup>‡</sup>	<i>P</i> = 0.004
Colon	0/47 (0.0%) <sup>‡</sup>	8/229 (3.5%) <sup>‡</sup>	<i>P</i> = 0.359
Laminectomy	2/84 (2.4%) <sup>‡</sup>	3/382 (0.8%) <sup>‡</sup>	<i>P</i> = 0.222
Spinal Fusion	1/78 (1.3%) <sup>‡</sup>	8/334 (2.4%) <sup>‡</sup>	<i>P</i> = 1

Antibiotic	Rate
Cefazolin	82/454 (18.1%)
Other Beta-lactams	17/454 (3.7%)
Vancomycin	136/454 (30.0%)
Clindamycin	197/454 (43.4%)
Fluoroquinolone	16/454 (3.5%)
Other	6/454 (1.3%)

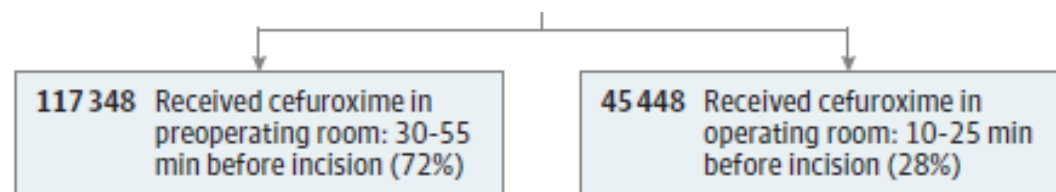
Multivariate logistic regression model:  
BL allergy associated with SSI: OR, 2.1, 1.1–3.9

Considering the 139 patients without a documented allergy reaction who did not receive a BL antibiotic, 298 patients potentially could have received a cefazolin-based regimen.

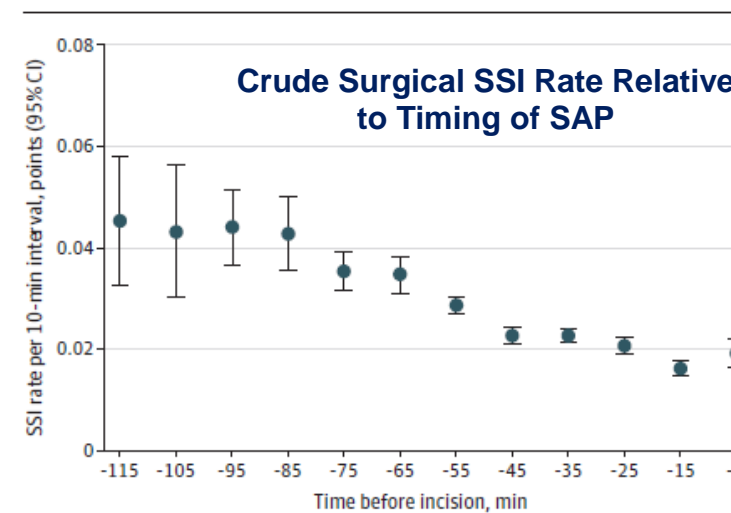


# Timing of Cefuroxime Surgical Antimicrobial Prophylaxis and Its Association With Surgical Site Infections

- **Objective:** To assess whether earlier vs later timing of administration of cefuroxime SAP is associated with the occurrence of SSI
- **Methods:** Adult patients who underwent 1 of 11 major surgical procedures with cefuroxime SAP, in the Swissnos SSI surveillance, between January 2009 and December 2020 at 158 Swiss hospitals.



- 2.4% Global SSI rate (5355 patients)
- 0 to 30 min: 1.9% (1468 patients)
- 31 to 60 min: 2.4% (2873 patients)
- 61 to 120 min: 3.7% (1013 patients)



Variable	aOR (95% CI)	P value
Timing of cefuroxime surgical antimicrobial prophylaxis administration prior to incision		
0-30 min	0.85 (0.78-0.93)	<.001
31-60 min	0.91 (0.84-0.98)	.01
61-120 min	1 [Reference]	NA

Administration of cefuroxime SAP closer to the incision time was associated with significantly lower odds of SSI, suggesting that cefuroxime SAP should be administered within 60 minutes prior to incision, and ideally within 10 to 25 min

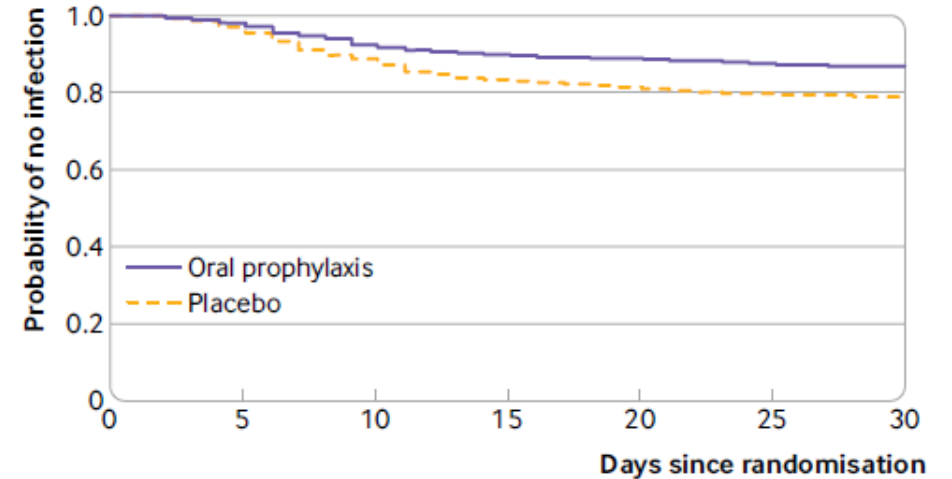
- Avant **chirurgie colorectale et transplantation hépatique**
  - Dépister E-BLSE et EPC
  - Modifier l'ABP chez les porteurs (reco conditionnelle)
- Avant **biopsie transrectale de prostate**
  - Dépister le portage d'Entérobactérie résistante aux FQ
  - Modifier l'ABP chez les porteurs (fosfo, aminosides)
- Dépistage dans les **21 jours** précédant l'intervention
- Pas de modification de la durée de l'ABP

Etude prospective de haute qualité requise :

- Evaluer l'impact de l'ATBP chez les porteurs d'EPC/ABRI pour chirurgie à haut risque
- Evaluer colonisation par des dépistages post-op

# Chirurgie colorectale





- UK, US, OMS: ATB oral + préparation colique
- Controverse sur prép colique (risque, intérêt...)
- Essai randomisé (1:1) 11 centres 2016-2019 double aveugle, traitement vs placebo
- Chir. Colo. laparo ou ouverte programmée
- Effectifs : 15% ISO placebo vs 9% ornidazole

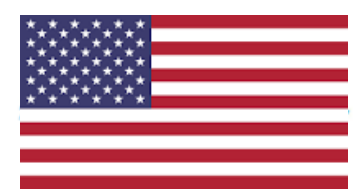


1 g d'ornidazole per os 12 h avant la chirurgie n=463	ATBP parent C2G, sans prep col	Placebo per os 12 h avant la chirurgie n=463
-------------------------------------------------------------	-----------------------------------	----------------------------------------------------

ISO	13.0%, 60/463	-40% de risque relatif d'ISO	21.6%, 100/463
ISO prof	4,8%		8%
ISO org/esp	5%		8,4%

Pas de diff sur le décès à 30 jrs

Subgroup	No of patients with event/ Total No of patients		Relative risk (95% CI)	Relative risk (95% CI)	P value for interaction
	Oral prophylaxis group	Placebo group			
All patients	60/463	100/463		0.60 (0.45 to 0.80)	
<b>Mechanical bowel preparation</b>					
Yes	15/153	47/160		0.33 (0.20 to 0.57)	0.006
No	45/310	53/303		0.83 (0.58 to 1.19)	
<b>Type of surgery</b>					
Colectomy	35/301	52/296		0.66 (0.44 to 0.98)	0.490
Rectal resection	25/162	48/167		0.54 (0.35 to 0.83)	



# SHEA/IDSA/APIC Practice Recommendation



## Quelques changements



### Pratiques essentielles

- **Contrôle de la glycémie** post-chirurgical pour tout patient
- **ATB oral** et parentéral **avant chirurgie colorectale**
- **Décolonisation** antistaph en chirurgie card. et ortho.
  - Autres actes si matériel prothétique
- Préparation vaginale antiseptique avant césarienne
- **Lavage de plaie** peropératoire en chirurgie propre
- Utilisation de bundle/checklist de bonnes pratiques
- **Feedback** des taux d'ISO et d'observance aux professionnels

### Mesure additionnel

- Utilisation des **pansements à pression négative**
- **Sutures imprégnées d'ATS**

Non recommandé : ATBP Vancomycin en routine

Non résolu: oxygénation, ATB poudre, tenue chirurgicale

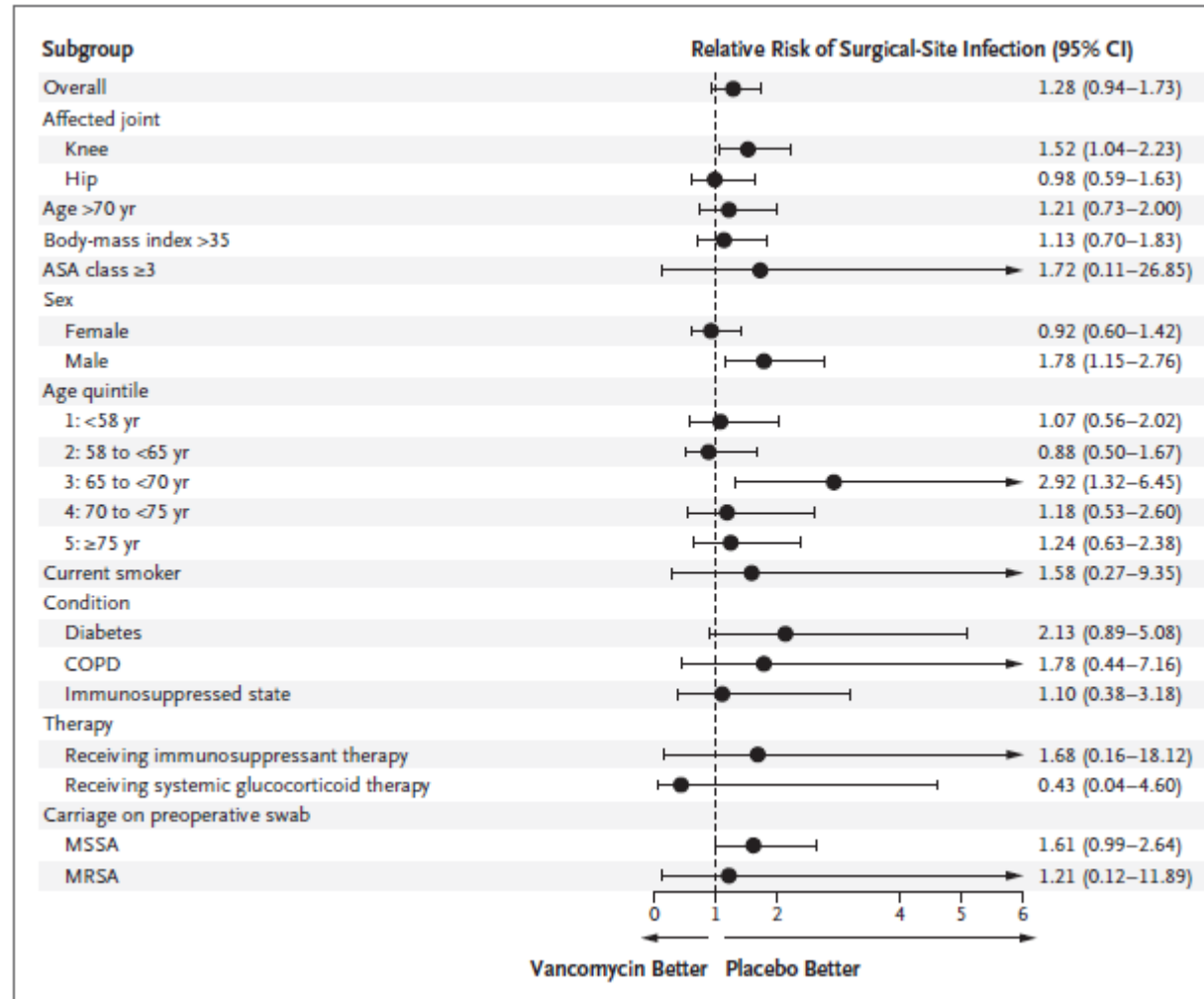
### Qui est responsable de quoi?

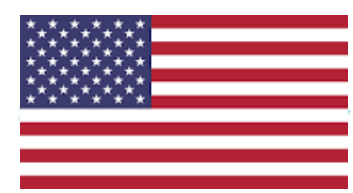
Organizational Role	Responsibilities
Senior management (executives, senior directors) (Note: regulatory requirement for US hospitals)	Ensure sufficient funds, expertise, and commitment to an infection prevention and control (IPC) program that effectively prevents healthcare-associated infections (HAIs) and the transmission of epidemiologically important pathogens.
Surgical services leadership (surgeon, anesthesia, perioperative nursing leaders)	Ensure all perioperative staff are aware of their roles and expectations as they relate to SSI prevention. Advocate for the support of senior leadership.
Surgical services staff (surgeons, anesthesiologists/CRNAs, perioperative nurses and technicians)	Ensure execution of prevention measures consistently for all procedures. Escalate questions and concerns to senior surgical leadership.
Pharmacists	Ensure proper medications for SSI prevention are available when needed. Promote evidence-based, cost-effective choice of antimicrobial prophylaxis.
Infection preventionists	Ensure surveillance for SSI is thorough and aligns with national standards. Support prevention efforts as subject-matter experts, coaches, and observers of process and outcome. Educate staff and audit compliance on practical application <sup>361</sup> of infection control related policies and processes
Environmental services staff	Ensure correct processes for cleaning perioperative and related areas, and adequate number, training, and support of staff.
Information services	Support SSI prevention efforts through data collection automation and analysis, leverage different platforms (electronic health record, billing databases) to ensure standard and consistent data streams.

# Trial of Vancomycin and Cefazolin as Surgical Prophylaxis in Arthroplasty

- Multicenter, double-blind, superiority, placebo-controlled trial
- Adult patients without known MRSA colonization, arthroplasty,
  - 1.5 g of vancomycin or normal saline placebo, + cefazolin prophylaxis
- 4113 patients in the modified intention-to-treat population
  - 2233 undergoing knee arthroplasty,
  - 1850 undergoing hip arthroplasty,
  - 30 undergoing shoulder arthroplasty
- Vanco group: 4.5% SSI
  - Knee: 5.7%, Hip: 3%
- Placebo group: 3.5%, RR: 1.28; 0.94-1.73; P = 0.1
  - Knee: 3.7%, Hip: 3.1%

Addition of vancomycin to cefazolin prophylaxis was not superior to placebo among patients without known MRSA colonization





# SHEA/IDSA/APIC Practice Recommendation



## Quelques changements



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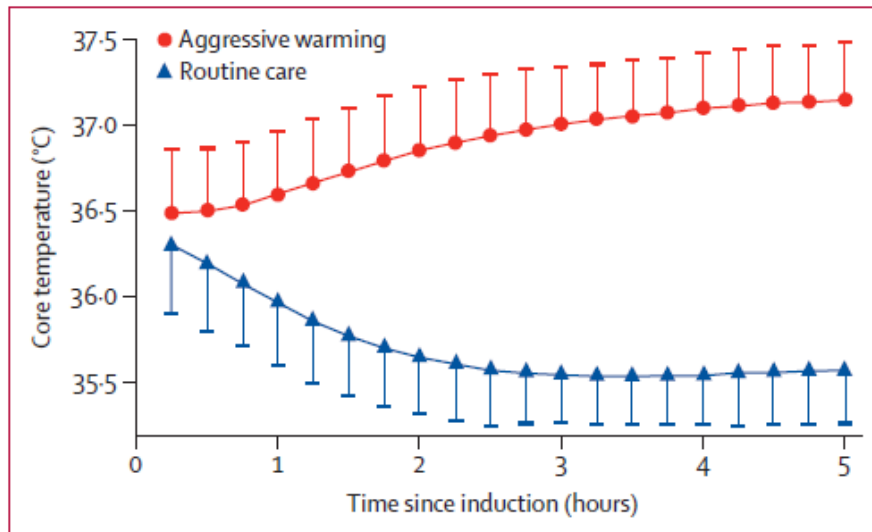
**Non résolu**: oxygénation, ATB poudre, tenue chirurgicale

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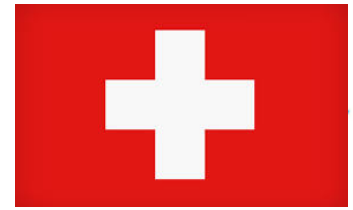
# Normothermie peropératoire

- Hypothermie potentiellement accroie le risque d'ISO
  - Constriction,  $\searrow$  delivery of immune cells;  $\searrow$  tissue oxygenation & oxidative killing;  $\searrow$  macrophage motility & antibody prod.
- Multicentrique, essai de supériorité, 12 sites en Chine et Cleveland Clinic
- 2507 patients avec réchauffement intensif (37°C) vs 2506 routine (35.5°C)



	Aggressive warming, n/N	Routine care, n/N	Relative risk
<b>Primary outcomes</b>			
Common effect	246/2497	239/2490	~0.9
Average relative effect			~0.6
<b>Secondary outcomes</b>			
MINS	233/2470	223/2468	~1.0
Non-fatal cardiac arrest	6/2493	15/2486	~0.4
Mortality	13/2489	17/2482	~0.8
Surgical site infection	178/2487 <b>7.2%</b>	157/2479 <b>6.3%</b>	~1.0
Transfusion requirement	254/2494	236/2486	~1.0
Hospital readmission	161/2462	135/2447	~1.0

L'incidence des complication cardiovasculaires à 30 jours était similaire pour les patients réchauffés en routile (35.5°C) vs réchauffés de manière intensive (37°C)



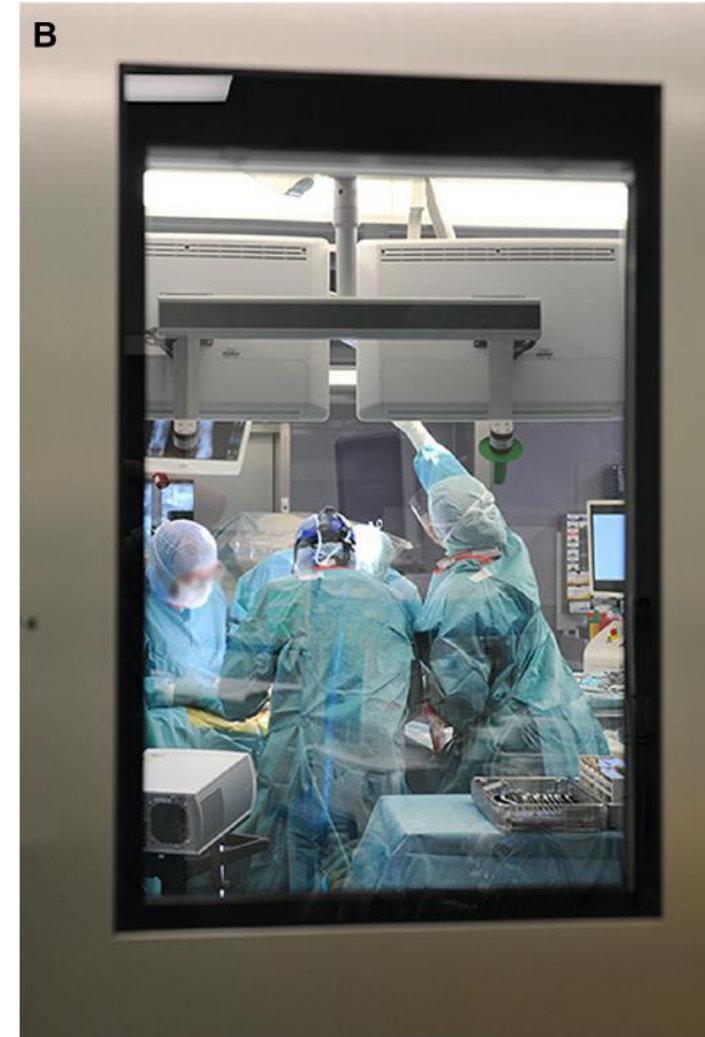
# Architecture des salles d'interventions

Salle d'intervention fermée

Salle ouverte de type hall opératoire jusqu'en 2016



Vs

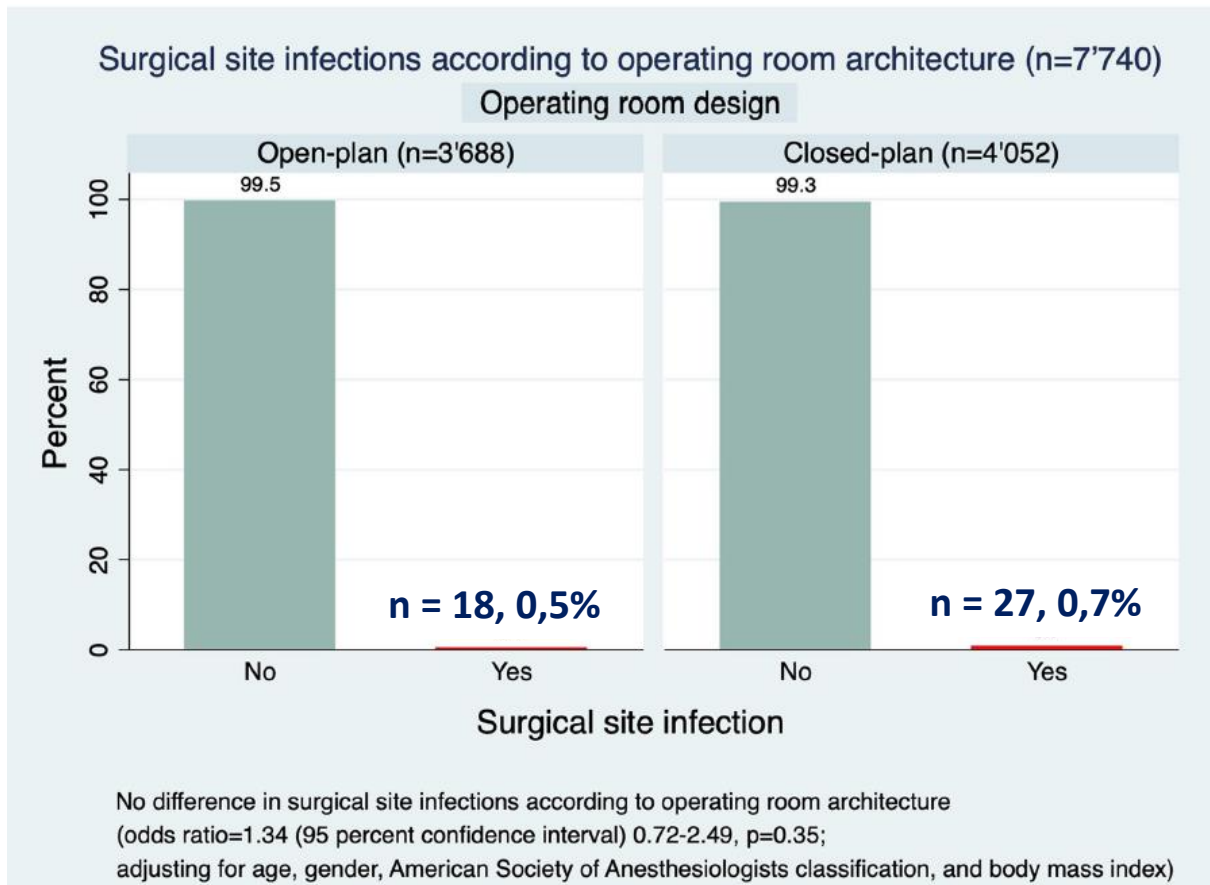






# Architecture des salles d'interventions

Large categories de chirurgie orthopédique entre 2016–2017



## Hypothèses:

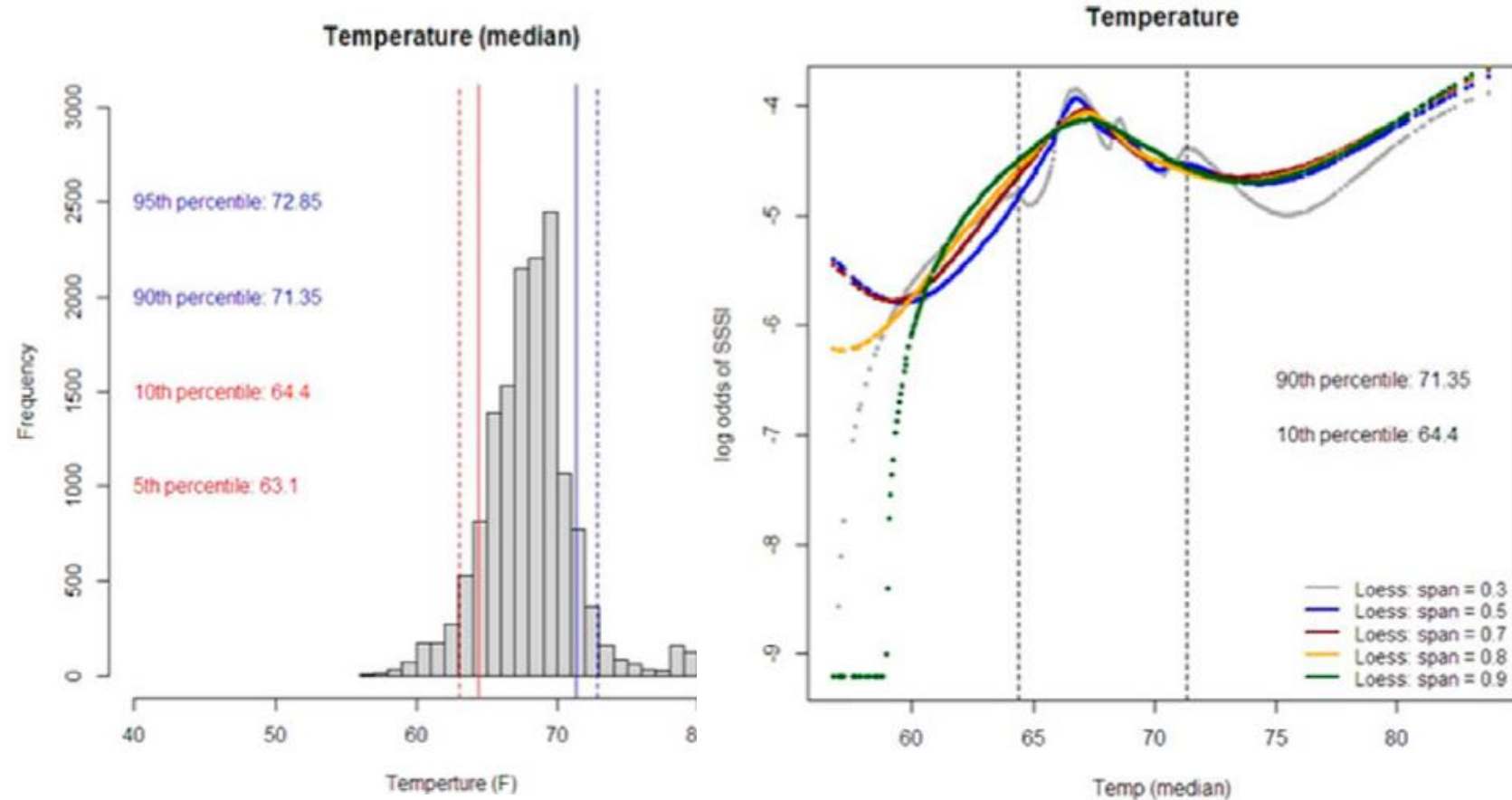
- ↗ ISO en hall opératoire du fait de la circulation
  - ↗ ISO en salle fermée du fait de la faible surface autour de la zone stérile
- Auteurs: *L'architecture ne semble pas jouer un rôle majeur dans le risque d'ISO*

## Limites revendiquées par les auteurs:

1. Outcome = Reprise pour ISO
2. ATBP modifiée en cours d'étude
3. Recherche des ISO sur le SI avec les mots "infection\*" et "déhiscence de plaie"
4. Risque d'erreur de type II, puissance stat
5. Focus sur peut de variables
6. Pas d'intégration de l'expérience du chirurgien
7. Autres facteurs modifiables non investigués

# The influence of operating room temperature and humidity on surgical site infection: A multisite ACS-NSQIP analysis

- All operations at 3 centers reported to the ACS-NSQIP (2016e2020)
- Ambient intraoperative temperature (°F) + relative humidity (RH) recorded in 15-min intervals.
- 14,519 operations analyzed with 179 SSIs (1.2%)



Significant deviations in intraoperative temperature/humidity are not associated with increased risk of SSI

# Physiopathology of SSI

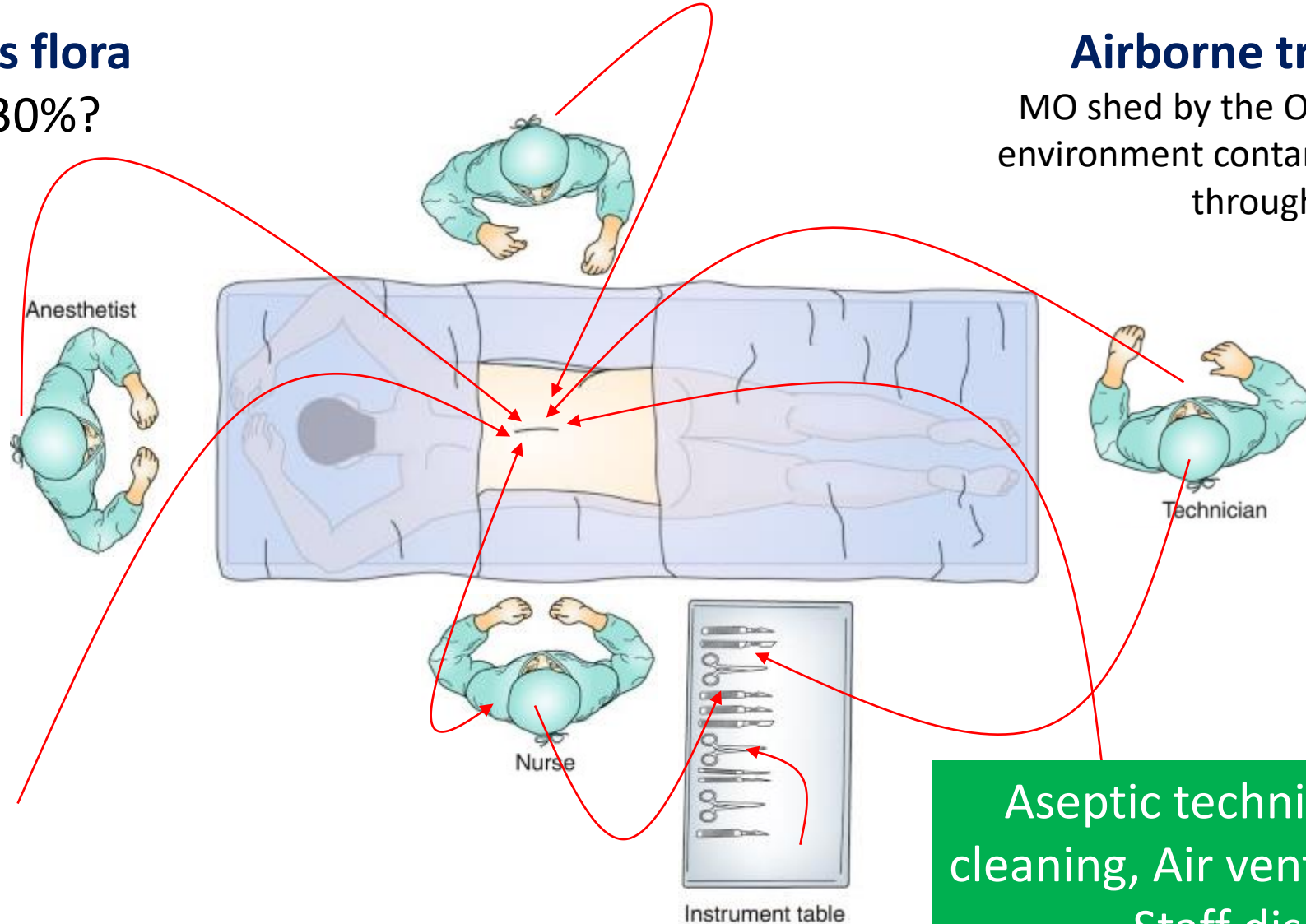
## Intraoperative contaminations

### Exogenous flora

≈ 5% to 30%?

### Airborne transmission

MO shed by the OR personnel or the environment contaminating the wound through the air



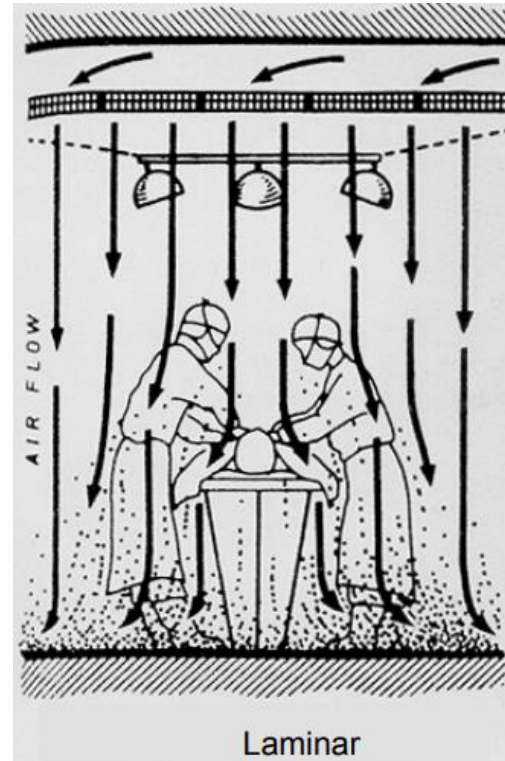
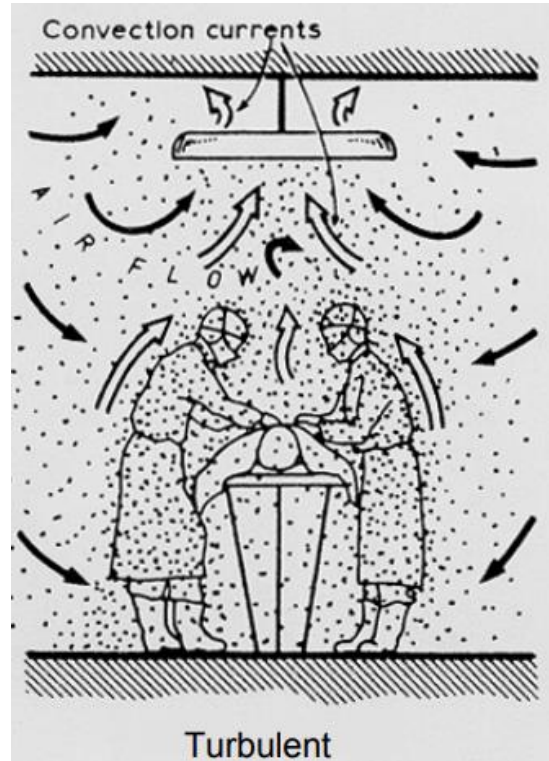
Aseptic technique, Surface cleaning, Air ventilation system, Staff discipline

# Origins of the airborne risk in OR

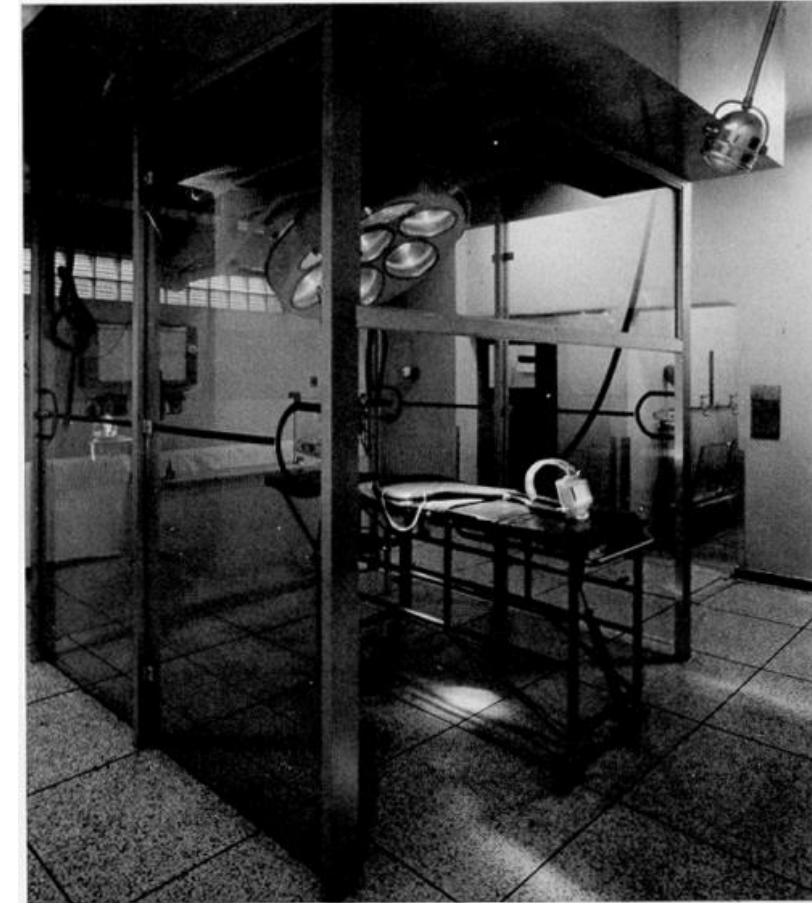


Sir John Charnley

- ↘ SSI rates from **8.9% to 1.3%**, following hip replacement in UDAF vs TV
- Strong correlation between SSI rates and the number of airborne bacteria close to the wound site



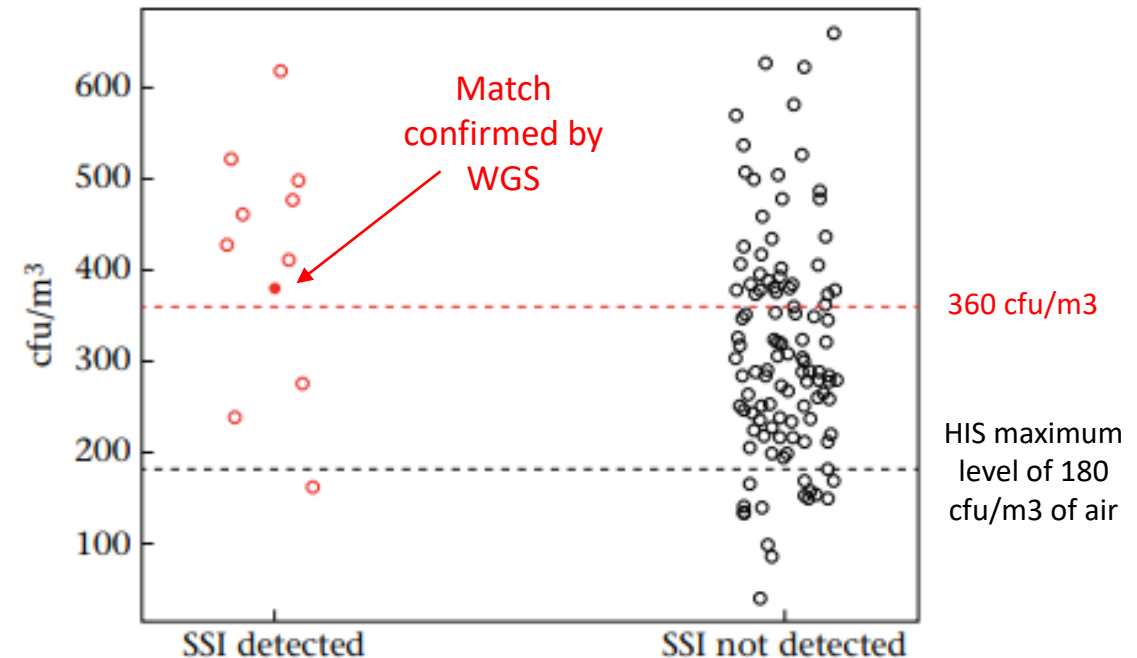
Body Exhaust Gown



Wrightington Clean Air Enclosure (1970)

- Relationship between intraoperative airborne bacteria and bacteria causing SSI in Ghana
- Active air sampling during 116 clean/clean-contaminated elective procedures, TV + HEPA filter

	Nb procedures	SSI
Thyroidectomy and parathyroidectomy	25	0
Non-cosmetic mammary surgery	26	5, 19%
Excision of lipomas or subcutaneous tissue	3	0
Controlled abdominal surgery	7	4, 57%
Repair of Inguinal hernia	25	1, 4%
Non-cosmetic mammary surgery	18	0
Excision of lipomas or subcutaneous tissue	10	1, 10%

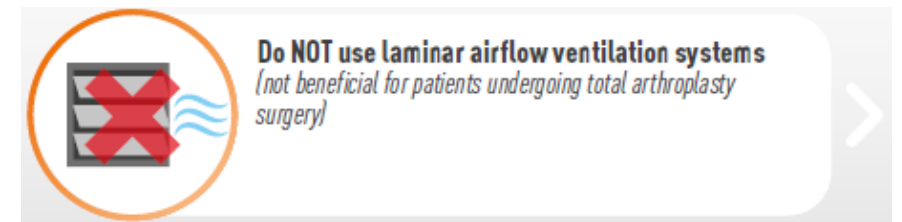


- ASA-score >1, clean-contaminated wounds, airborne bacteria >360 cfu/m<sup>3</sup> significantly associated with SSI after adjustment
- Match between air- and SSI-isolates in 1/ 11 case

- 12 observational cohort studies comparing laminar airflow with conventional ventilation in the operating room

	Laminar airflow	Conventional ventilation	Odds ratio (95% CI)
	Events	Events	Events
<b>Total hip arthroplasty</b>	1544	671	1.29 (0.98–1.71)
<b>Total knee arthroplasty</b>	322	416	1.08 (0.77–1.52)
<b>Abdominal and open vascular surgery</b>	948	469	0.75 (0.43–1.33)

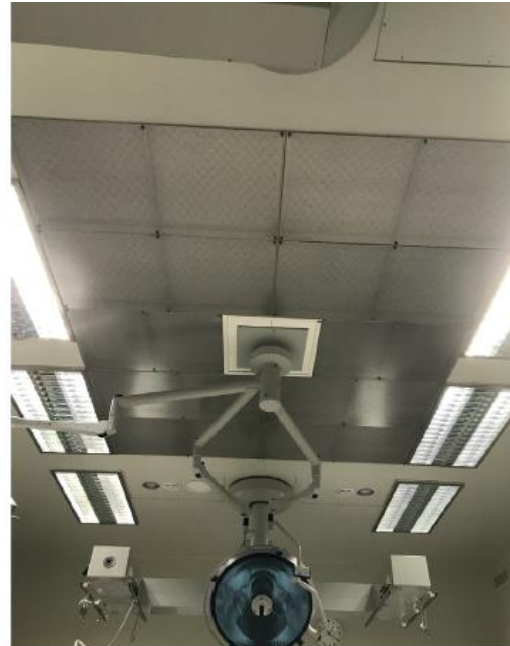
- No LAF system differentiation or definition based on technical specifications,
- No or limited documentation of surgical clothing worn, and validation on the ceiling LAF systems



	Reference	Type	Outcome	Summary
1	Lytsy JHI 2019	Position paper	-	LAF should be used for TJA
2	DGKH, 2019	Position paper	-	LAF reduce particulate and bacterial load
3	Cao AJIC 2019	Experimental, 2 OT	Airflow distribution	LAF greatly affected by <b>thermal plumes</b>
4	Knudsen JHI 2021	17 OTs and 51 TJA	Airborne Bacteria	LAF > TV
5	Marsault JHI 2021	Experimental, 2 OT	Airborne Bacteria	LAF > TV
6	Aganovic, JHI 2021	Syst. Review, 12 studies	Airborne Bacteria	LAF > TV
7	Langvatn JHI 2020	Arthroplasty Register	<b>Revision for SSI</b>	LAF > TV
8	Bao ICHE 2020	Meta-analysis, 14 studies	<b>SSI</b>	LAF or TV not associated with SSI
9	Wang JAMAopen	Retrospective cohort	<b>PJI</b>	LAF not associated with reduced PJI
10	Lu R Coll Surg Engl 2021	Meta-analysis, 14 studies	<b>SSI</b>	LAF or TV not associated with SSI

Many confounding factors; including staff discipline  
 Significant misreporting rate associated with the surgeon reported ventilation data

- **OR ventilation effectiveness depends on:**
  - Location, type, and number of supply diffusers
  - Supply air change rates and temperature
  - Locations and strengths of **heat sources**, including the surgical lights
  - Size and location of **equipment** in the room that can obstruct the flow path of the air and contaminants
  - Size and locations of **room returns**
  - **Human activities**: frequency of opening and closing OR doors





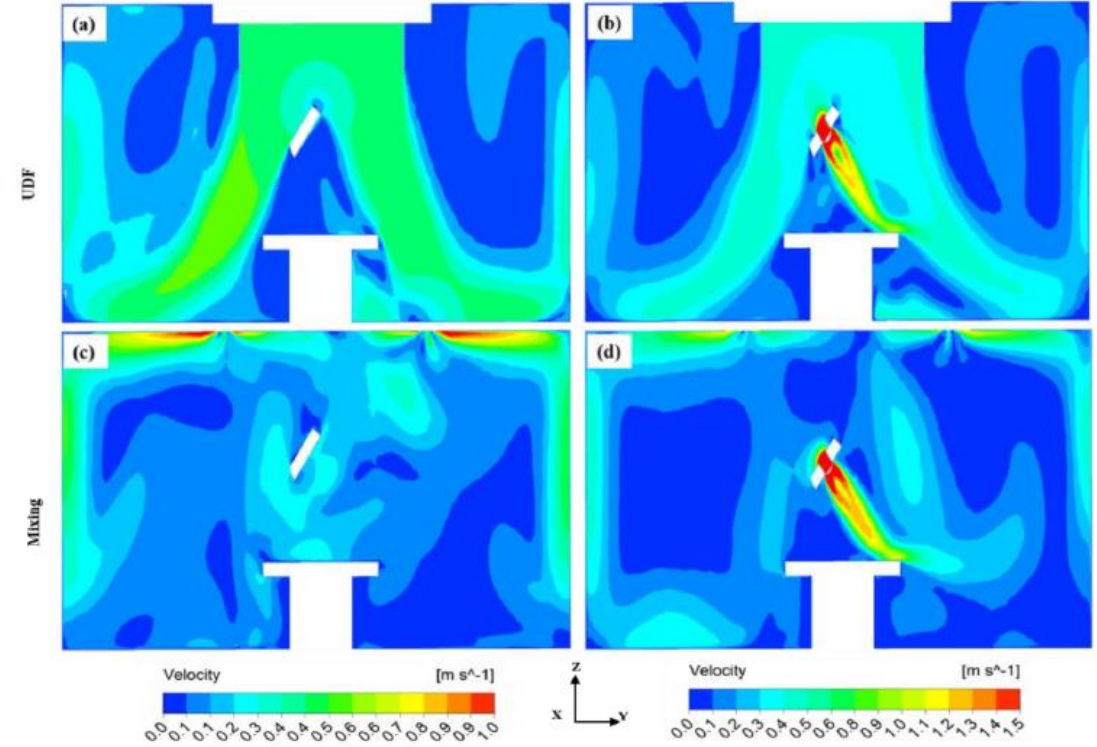
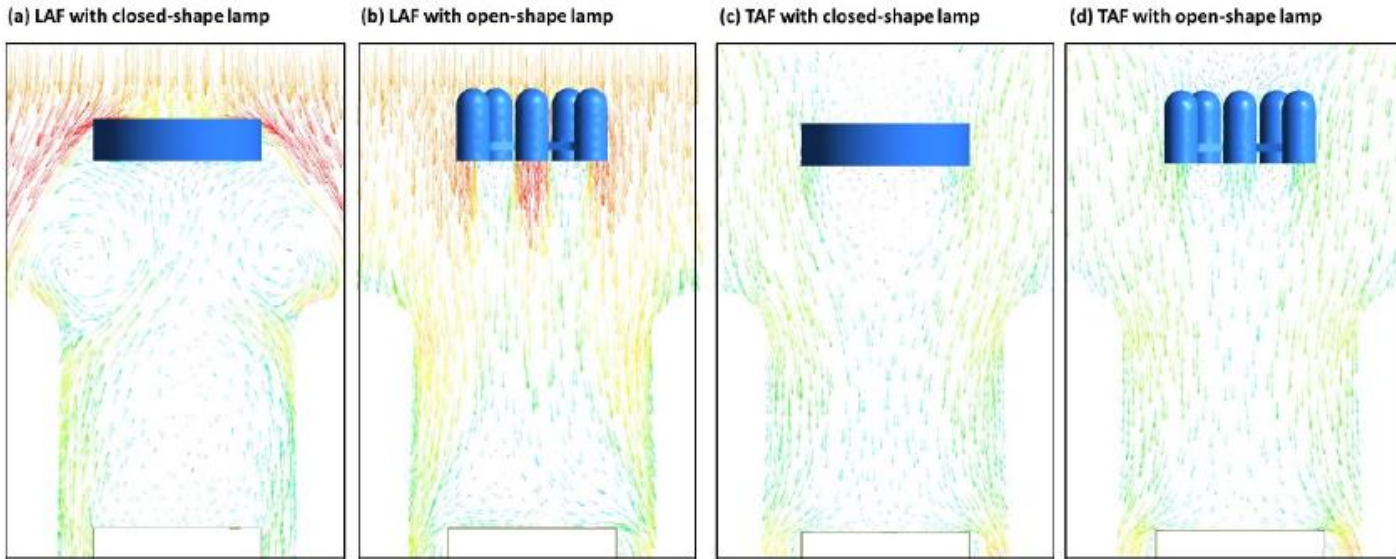
# Are we oversimplifying the problem?



# Influence of surgical lamp design

Velocity vector plot

Velocity contours



Particle/m2/h	LAF	Mixing
Closed-shaped	338	249
45° inclination	310	554
Fan-mounted	<1	183
45° inclination	98	112

Design and inclination of the surgical lamp may influence the velocity area below the lamp and the air contamination

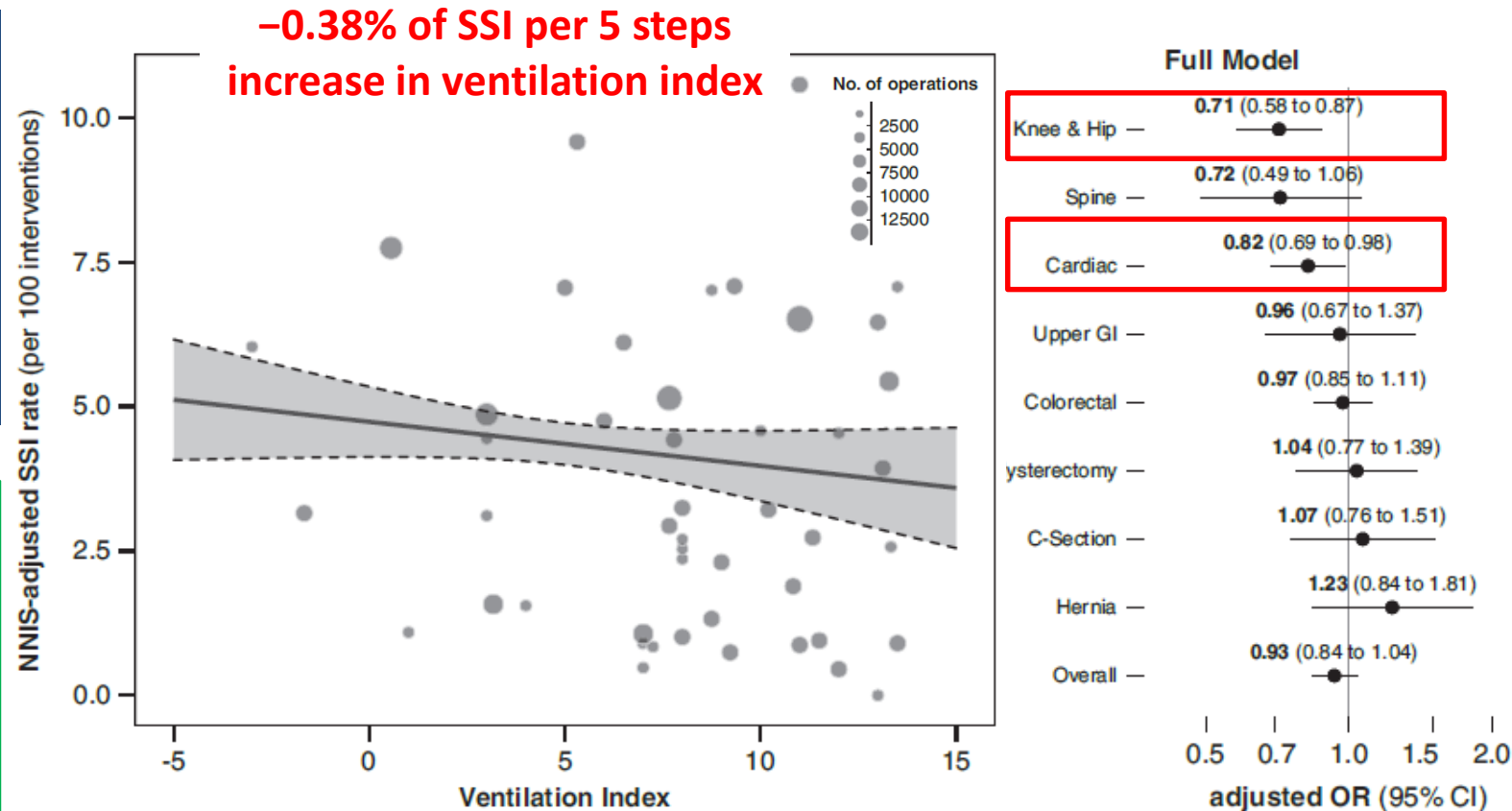
# Are we oversimplifying the problem?

Ventilation quality of 168 Swiss ORs using a ventilation index

## Calculation of the Ventilation Index:

- Air flow (m<sup>3</sup>/h)
- Size of ceiling unit
- Location of air return outlets
- Air guide at ceiling unit
- Operating room lamps
- Patient-table position

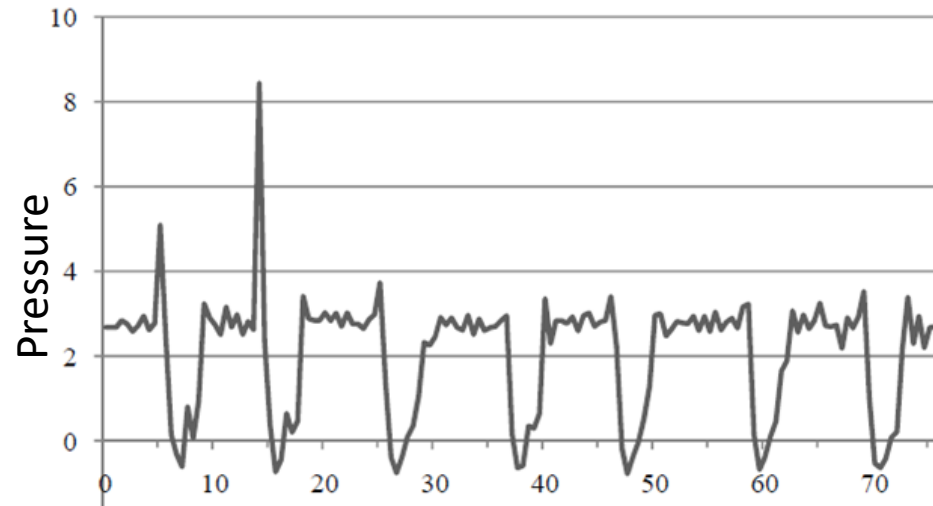
- Performing orthopedic/cardiac interventions in ORs with good ventilation properties associated with lower **superficial/deep** SSIs rates
- Examining the influence of each component of the ventilation index on SSI



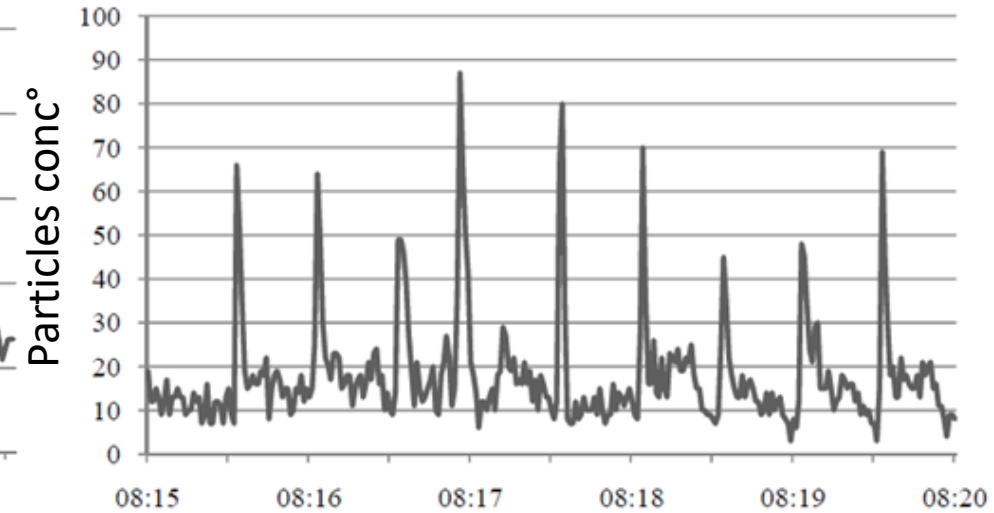
# Door opening and air particles



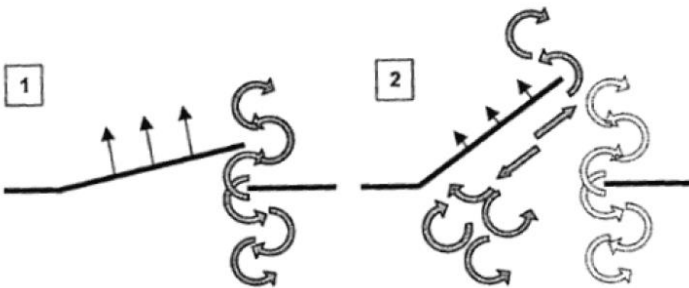
Door opened 45°, 4 seconds



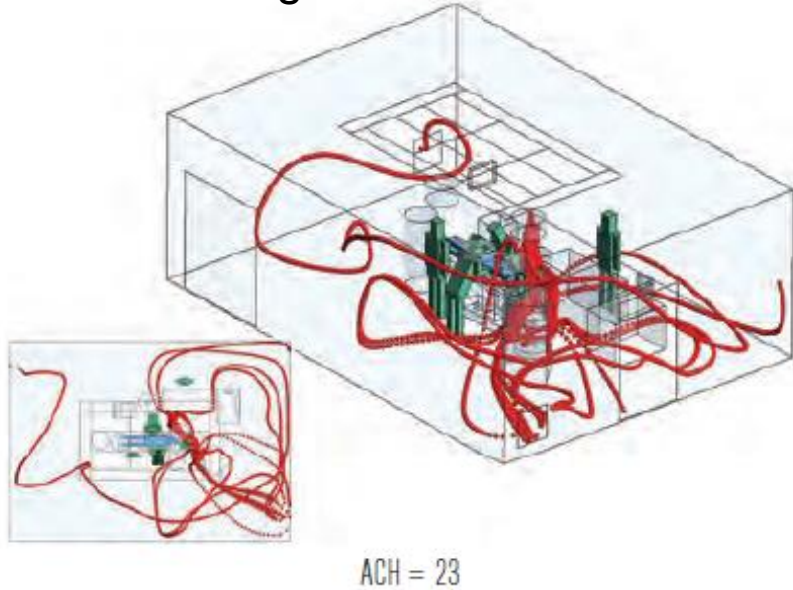
1.m, door openings every 30 sec of 45°



- Most common door opening angle = 45° with a total door opening time = 3.5-5 sec
- **Pressure difference** = dominating driving force
- **Door openings disturb the air flow in the OR**
- **Vortices created by the door swing** → transfer of air from the corridor, even with positive pressure and no temperature difference



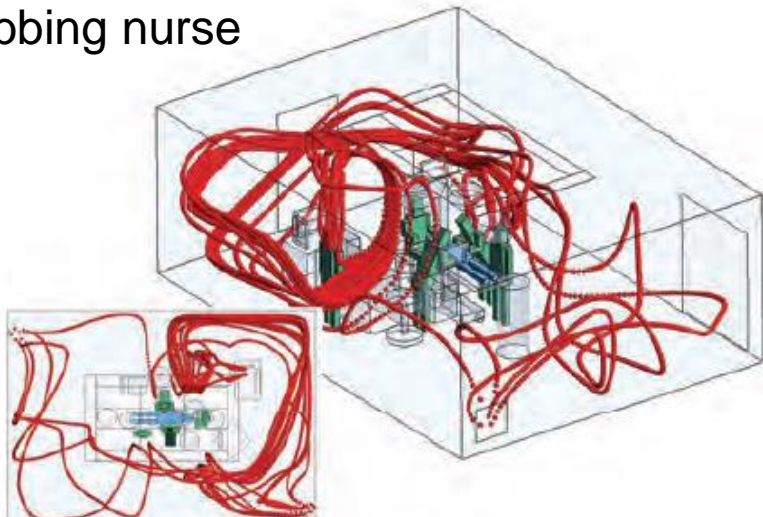
The anesthesiologist



## CFD analyses

- Particulates originated within/edge of sterile zone generally swept away into the non-sterile zone
- **Particulates originate in non-sterile zone** (ie scrubbing nurse) get entrained into the sterile zone.
- Particulates tend to **stay and circulate in the non-sterile zone** before exiting the OR → deposition on the back table
- HVAC configuration (size, number, locations of supply and return) may play a role in determining the flow path of airborne contaminants

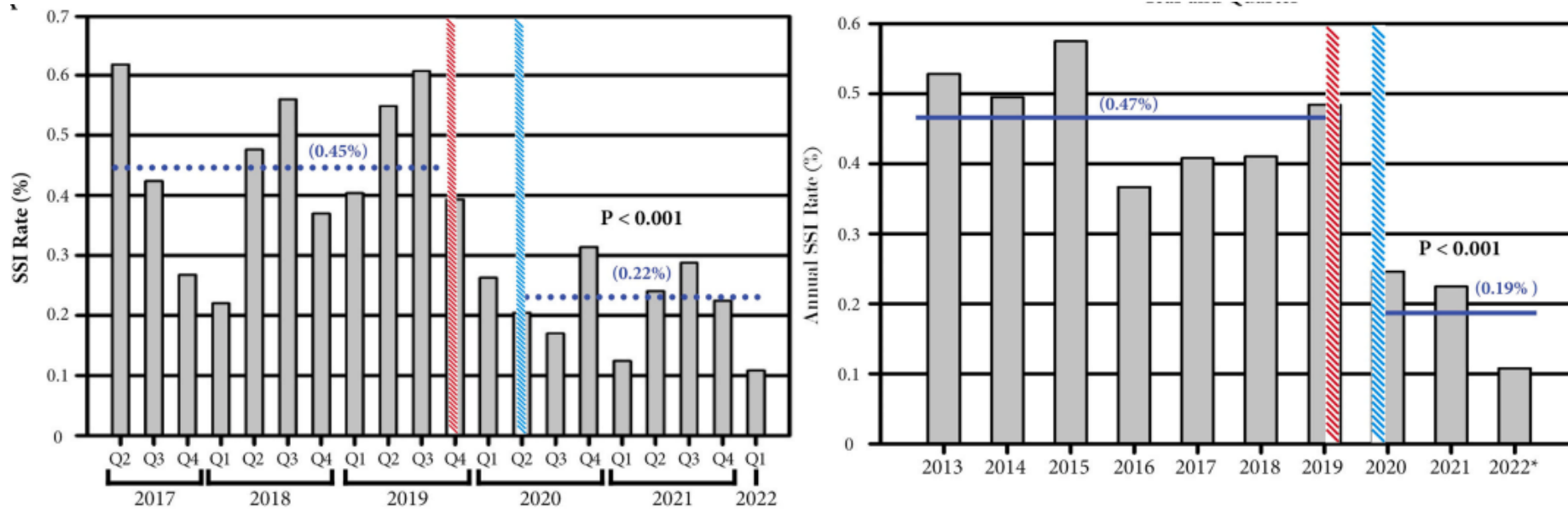
The scrubbing nurse



# Improvement of Operating Room Air Quality and Sustained Reduction of Surgical Site Infections in an Orthopedic Specialty Hospital

- **Objective:** Impact of high-efficiency particulate air and ultraviolet air recirculation system devices on SSI rates when used at an orthopedic specialty hospital
- 30,000 consecutive procedures from 2017 to 2022 for nervous system procedures or for all procedures

Hatched red line indicates when HUAIRS were implemented in all 5 OR used for spinal procedure  
hatched blue line indicates when HUAIRS was implemented in all 10 ORs at the facility



Implementation of HUAIRS devices at an orthopedic specialty hospital is associated with significant reductions in SSI rates and intraoperative air contamination levels.

# Rituals and behaviours in the operating theatre – joint guidelines of The HIS and The ESCMID.

- Objective: to debunk some of the practices
  - Allow **clean beds with fresh, clean linen** brought into OR directly from clinical areas.
  - No need to place patients with suspected/confirmed contact transmissible MDRO infection/colonisation **at the end of an operating list** as long as the OR is cleaned and disinfected to standard between patients and the theatre ventilation is running without interruption.
  - Allow patients with isolation/contact precautions to **recover in the OR** or in a designated section of the recovery area.
  - For all surgical/operative procedures, lay up the instruments and prosthetic materials as close as possible to when they are needed.
  - For ultraclean ventilation OT, lay up the instruments/prosthetic materials **under the canopy** unless there happens to be UCV in the preparation room, which is an alternative.
  - **Minimise non-essential staff movement and hence door openings** during surgical procedures to minimise bacterial air counts.
  - **Change or cover OT attire** (e.g. with a single-use disposable gown) and change footwear if leaving the OT complex with the intention of returning.
  - Refer to current hospital policy for pre-operative patient management, although be aware that **covering patients' hair is not required** for infection prevention reasons

# Surveillance des ISO

Gabriel Birgand

*@gbirgand*

*Guadeloupe 2023*



# Barriers and facilitators for surgical site infection surveillance for adult cardiac surgery in a high-income setting: an in-depth exploration

- Key informant interviews with 16 surveillance staff, infection prevention staff, nurses and surgeons from nine cardiac hospitals in England

Using novel interviews with ‘front-line’ staff, identified opportunities for improving participation in SSI surveillance

Barriers to participating in SSI surveillance	Facilitators for surveillance
<ul style="list-style-type: none"> <li>• Data collection is <u>burdensome</u></li> <li>• Data entry is burdensome</li> <li>• Uploading and submitting data to UKHSA is <u>slow</u></li> <li>• Data is not <u>all in one place</u></li> <li>• Systems not linking with each other</li> <li>• Difficulty finding denominator data</li> <li>• Using postal patient questionnaires is ‘antiquated’</li> <li>• <u>SSI definitions</u> are not relevant</li> <li>• <u>Lack of time</u> to collect and upload data</li> <li>• Lack of surveillance staff</li> <li>• Surveillance is not integrated within routine clinical work</li> <li>• Multiple SSI data reporting schemes</li> <li>• Perceived lack of robust data for benchmarking</li> <li>• <u>Surgeons don’t trust the data</u></li> <li>• Lack of ownership</li> <li>• Lack of engagement</li> <li>• Unsupportive managers</li> <li>• Low priority of SSIs among staff</li> <li>• Low priority of surveillance (primary aim of surveillance is not seen as being for clinical care)</li> <li>• Lack of awareness of SSIs</li> <li>• Blame culture around high SSI rates</li> </ul>	<ul style="list-style-type: none"> <li>• Data systems for downloading/uploading data that link between databases</li> <li>• Digital methods for data collection (remote wound monitoring platforms and Apps)</li> <li>• Relevant SSI definitions</li> <li>• Ownership of data by clinicians</li> <li>• More resources</li> <li>• Increase SSI awareness</li> <li>• Supportive managers</li> <li>• Local and national champions</li> <li>• Mandatory surveillance</li> <li>• Reliable benchmarking data</li> <li>• Integrate surveillance within routine clinical work</li> <li>• Focus on primary care and wider health economy</li> <li>• Demonstrate/strengthen the link between surveillance and reduced SSIs (including current patients)</li> </ul>

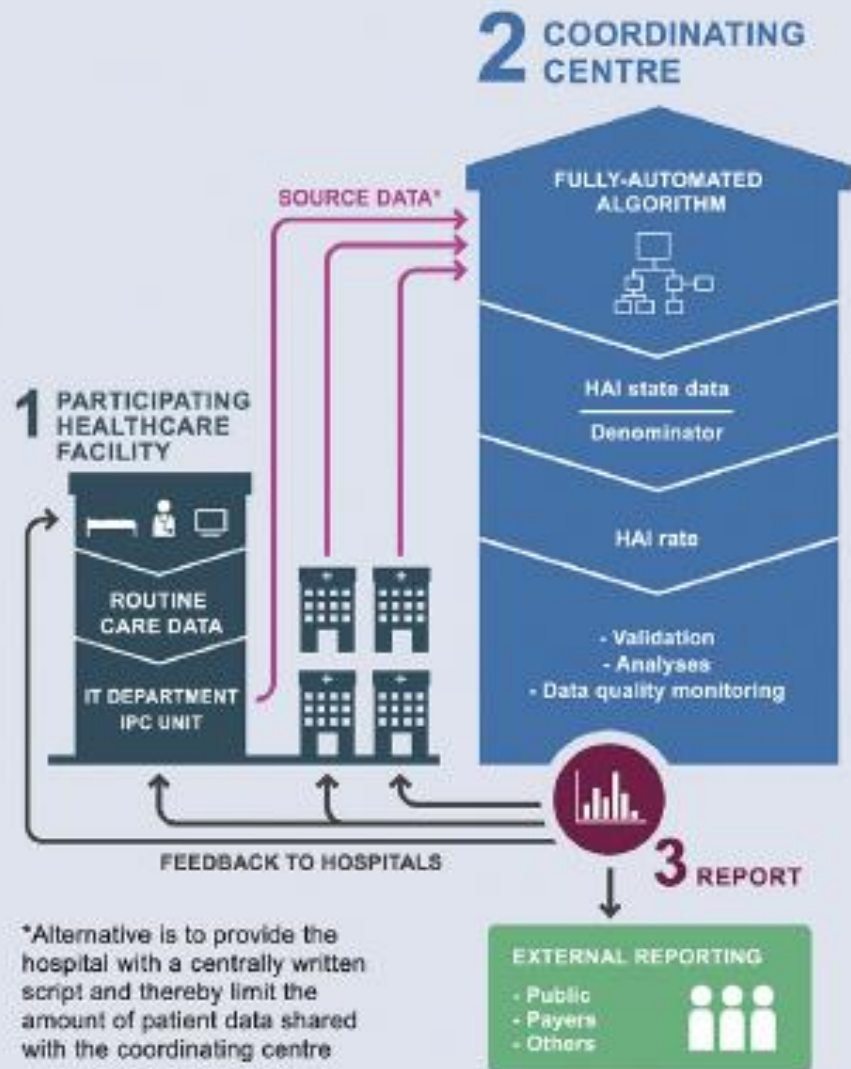
# Surveillance des ISO: Spicmi

Gabriel Birgand

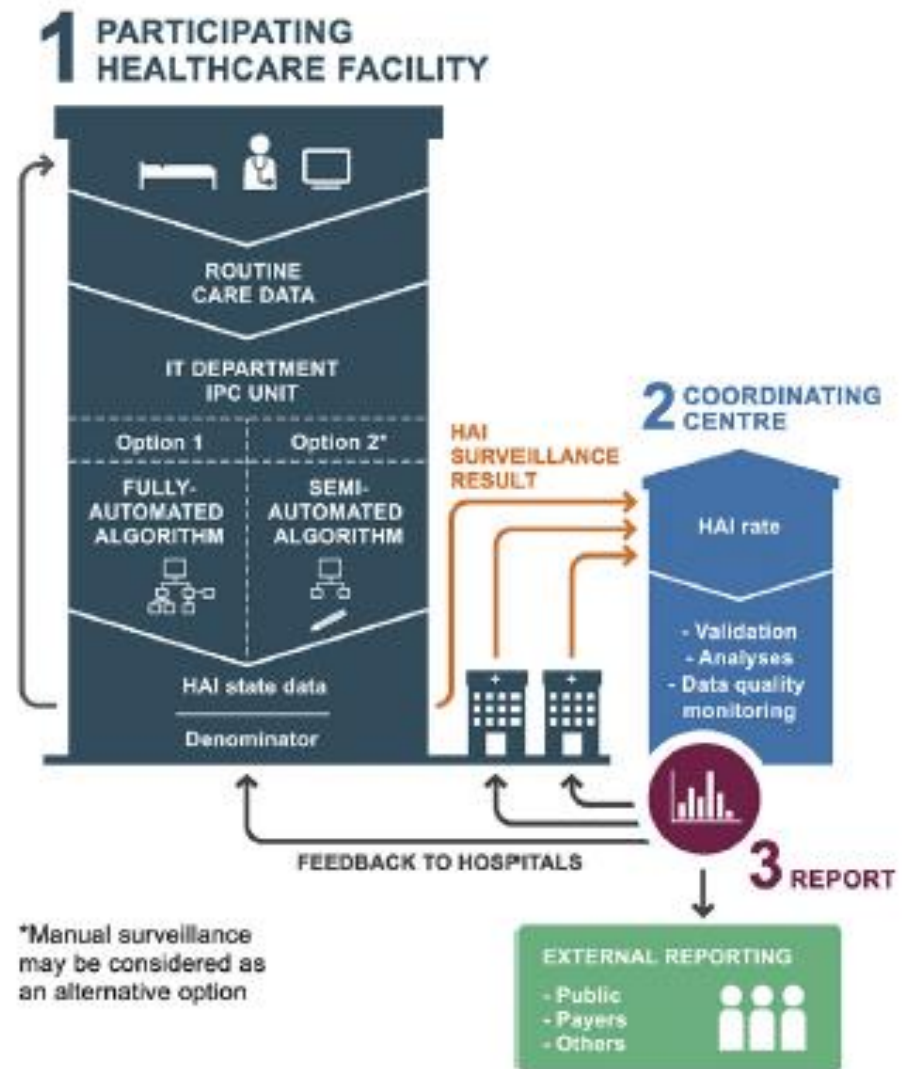
*@gbirgand*

*Guadeloupe 2023*

## Centrally Implemented Surveillance



## Locally Implemented Surveillance



# How to improve the reliability?

## Avoid human interpretation

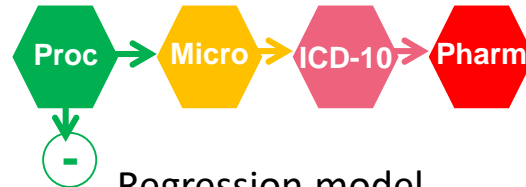
### Manual surveillance

Surveillance datasheet completed for each patient

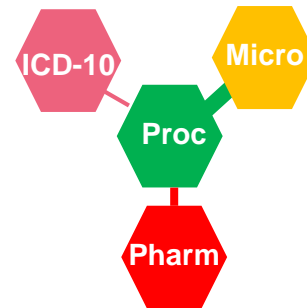
Manual medical record review

### Semi-automated surveillance

Classification algorithm



Regression model



Van Mourik CID 2013



Multidisciplinary assessment



Designated, trained personnel

# Patient Administrative System

# Laboratory information management system

Procedures  
*Codes for procedures*  
*(time lag ~ 1 month)*

Diagnosis  
*ICD-10 codes*

Microbiology  
*Positive & negative specimens*

+	+	+	Strong suspicion
+	+	-	Middle suspicion
+	-	+	Middle suspicion
+	-	-	No suspicion

Validation of strong and middle suspicions  
Surgeons + medical notes + pathology

# How to improve the reliability?

## Avoid human interpretation

### Manual surveillance

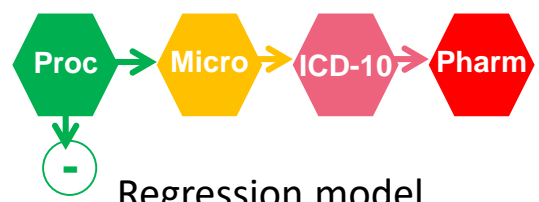
Surveillance datasheet completed for each patient



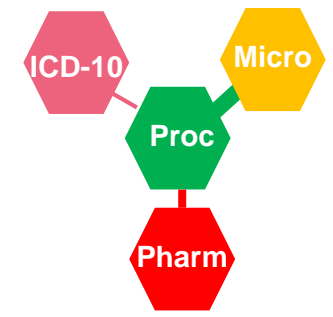
Manual medical record review

### Semi-automated surveillance

Classification algorithm

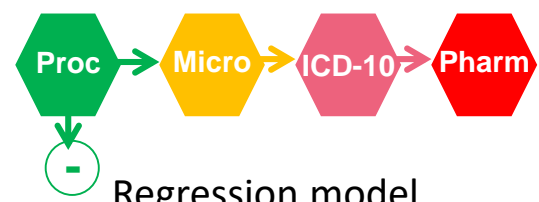


Regression model

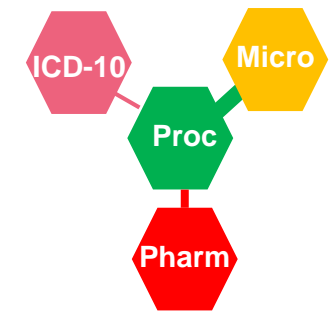


### Automated surveillance

Classification algorithm



Regression model



Van Mourik CID 2013

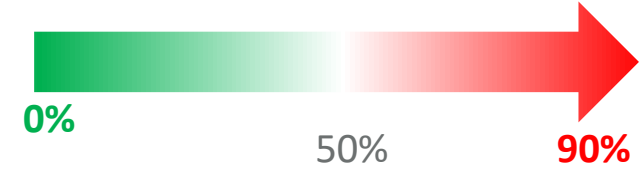


Multidisciplinary assessment



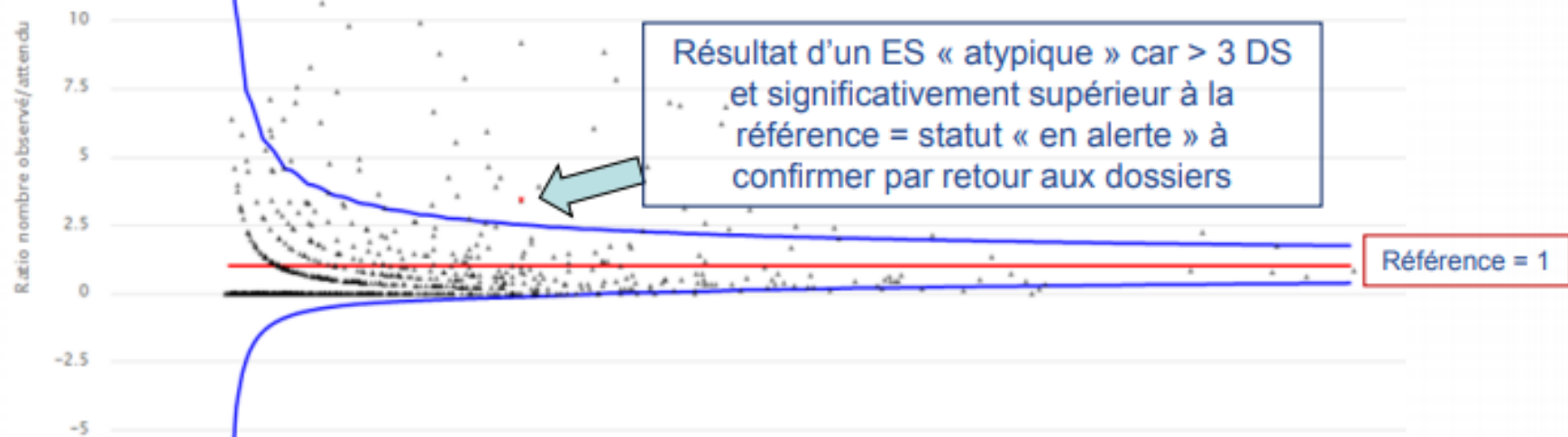
Designated, trained personnel

Probability of HCAI



# ETE-ORTHO : Evènements thrombo-emboliques après pose de prothèse de hanche (PTH) ou de genou (PTG)

Funnel plot : Ratio standardisé du nombre d'ETE observés sur attendus après PTH (hors fracture) ou PTG<sup>5</sup>

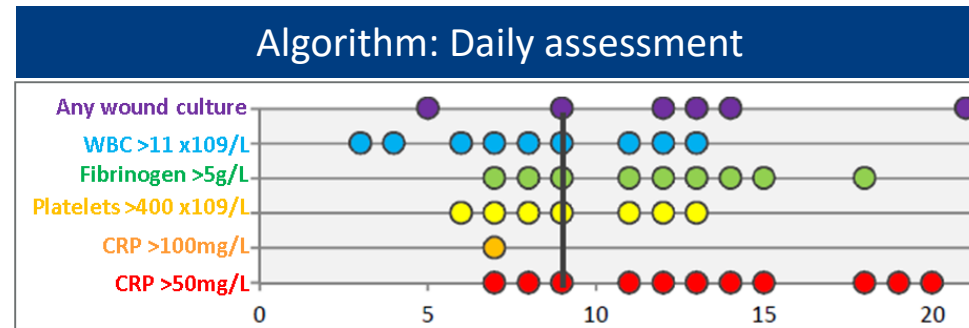


**Information complémentaire par localisation de la prothèse :**

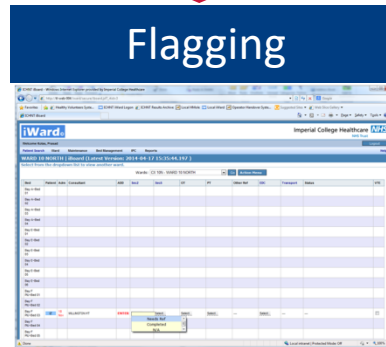
Analyse des causes : Codage ? Thrombo-prophylaxie ? Sur-utilisation de l'échoDoppler des membres inférieurs ?

PTG	Résultat (nombre ou taux)
Nombre de séjours cibles PTG	163
Durée moyenne de séjour pour PTG	9.44
Nombre de TVP codées (observées)	14
Nombre d'EP codées (observées)	3
Taux de séjours PTG avec au moins un code d'échodoppler des membres inférieurs associé(en %)*	63.80
<b>Taux brut dans votre ES de TVP et/ou d'EP après PTG (en %)**</b>	<b>104.29</b>
Taux national brut de TVP et/ou d'EP après PTG (en %)	29.27
Taux intra-hospitalier de TVP et/ou d'EP sous thromboprophylaxie recommandée après PTG***	10 %

# How to improve the reliability? Pragmatic syndromic surveillance



## Flagging



Clinical value:  
Early diagnosis



Multidisciplinary  
assessment



Designated,  
trained personnel

Epidemiological value:  
Inclusion for follow-up  
alert



# How to improve the reliability?

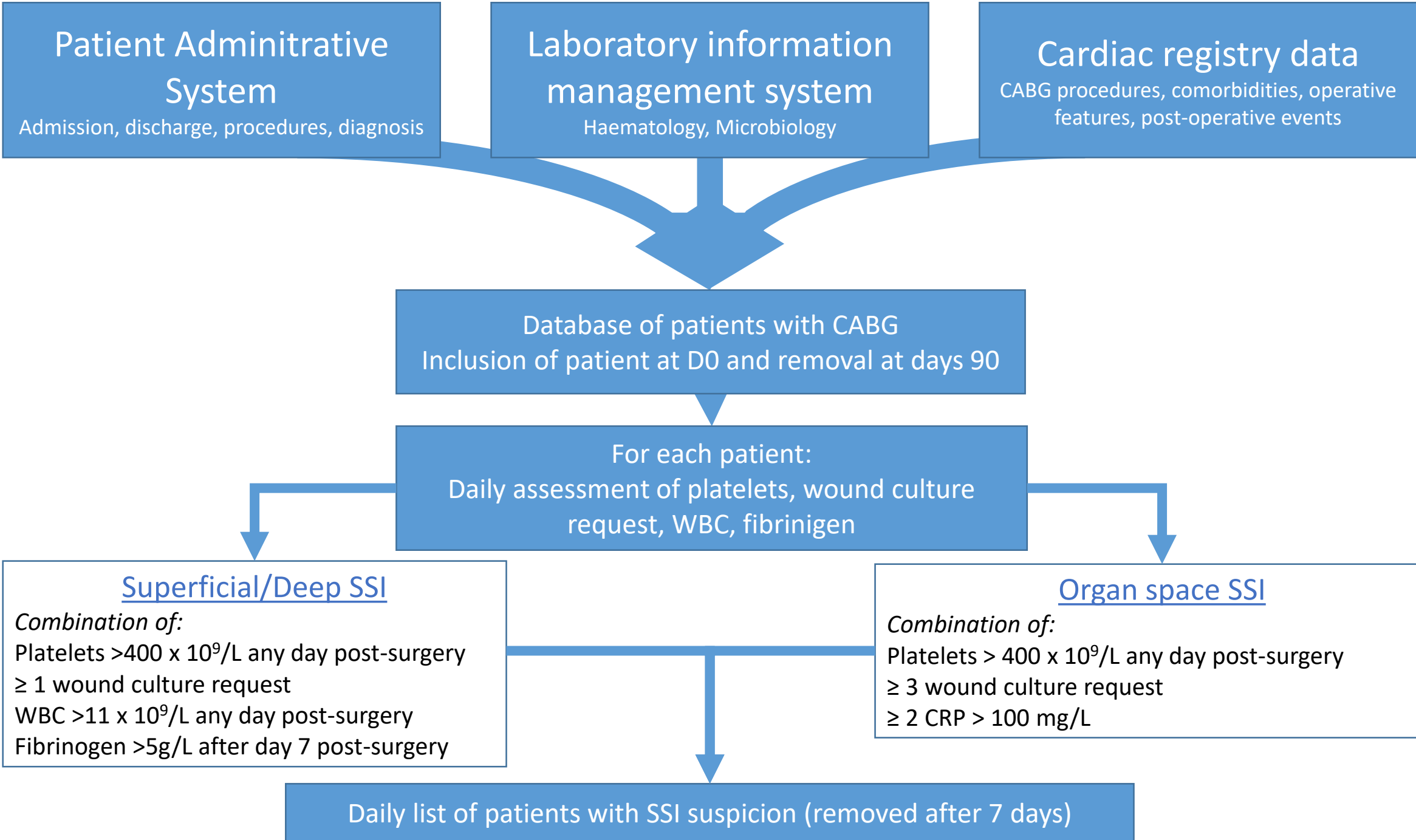
Avoid human interpretation

	Manual	Semi-automated	Syndromic	Automated	
<b>Disadvantages</b>	Affective input, non-blinded assessment	Strong link	Mild link	Mild link	No link
	Intentional underreporting	Strong link	Strong link	Mild link	No link
	Subjectivity in definitions	Strong link	Strong link	Strong link	Mild link
	Dichotomous determination	Strong link	Strong link	Strong link	Mild link
	Attentivity, staffing	Strong link	Mild link	Mild link	No link
	Memory bias	No link	Strong link	No link	Mild link
	Clinical sense	Strong link	Strong link	Strong link	No link
	PPV	Strong link	Strong link	Strong link	No link
	NPV	Mild link	Strong link	Strong link	Strong link

 Strong link

 Mild link

 No link



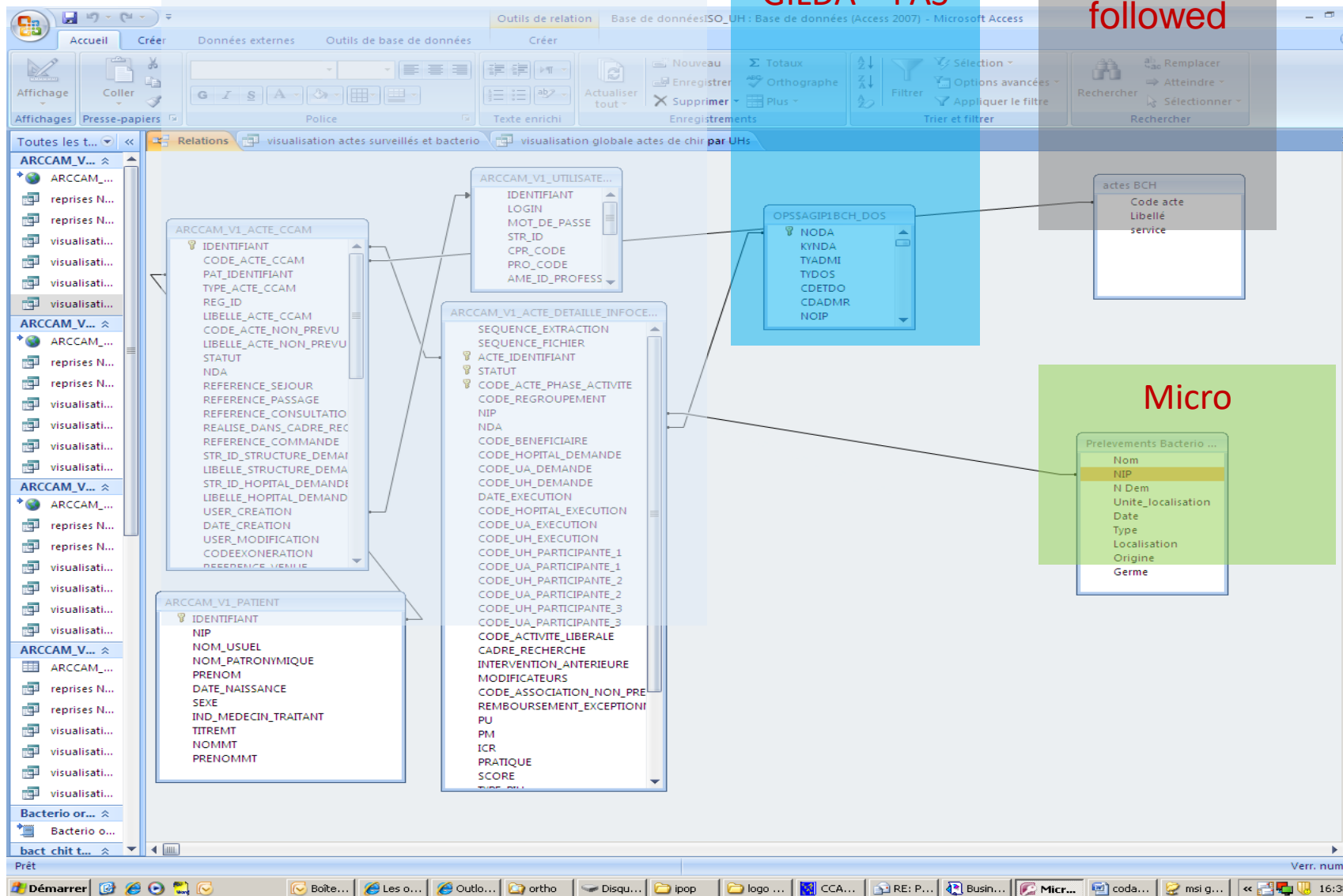
# Results

- List of suspicions on an intranet platform like a spreadsheet with on the same line:
  - Patient informations:
    - patient ID number, fist and last name, gender, DoB, date of admissions and discharges, date of procedure, type of procedure, surgeon, comorbidities, operative features and post-operative events (re-operation with dates...) from procedure to suspicion
  - Haematology:
    - Platelets, fibrinogen, WBC counts
  - Microbiology
    - Wound cultures results with organisms and susceptibility pattern
- **Follow-up** of suspicions with the inclusion of surgical and micro data after suspicion
- List of patients that undergone CABG **without suspicion** but with the same information
- Possibility to **export a spreadsheet** with all patients and variables “SSI suspicion” and “confirmed SSI”

# SAG: procedure informations structure

GILDA = PAS

Procedures followed





Electronic health records



Routine care data



Clinical datawarehouse



datamanager

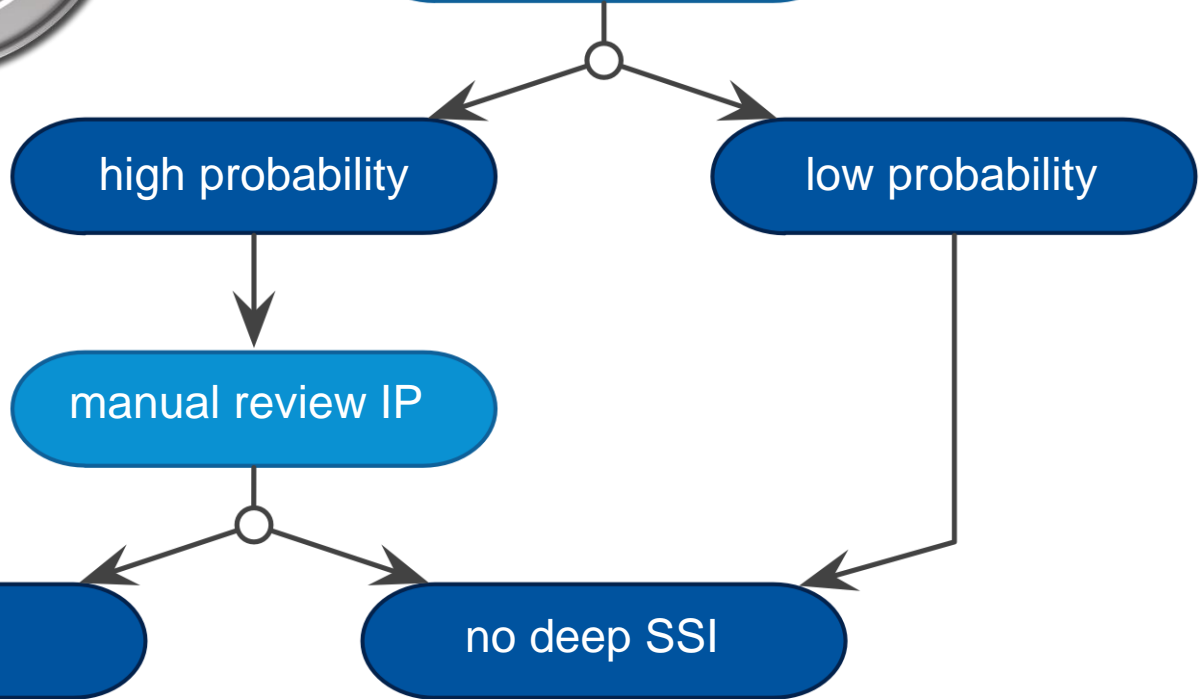
high probability

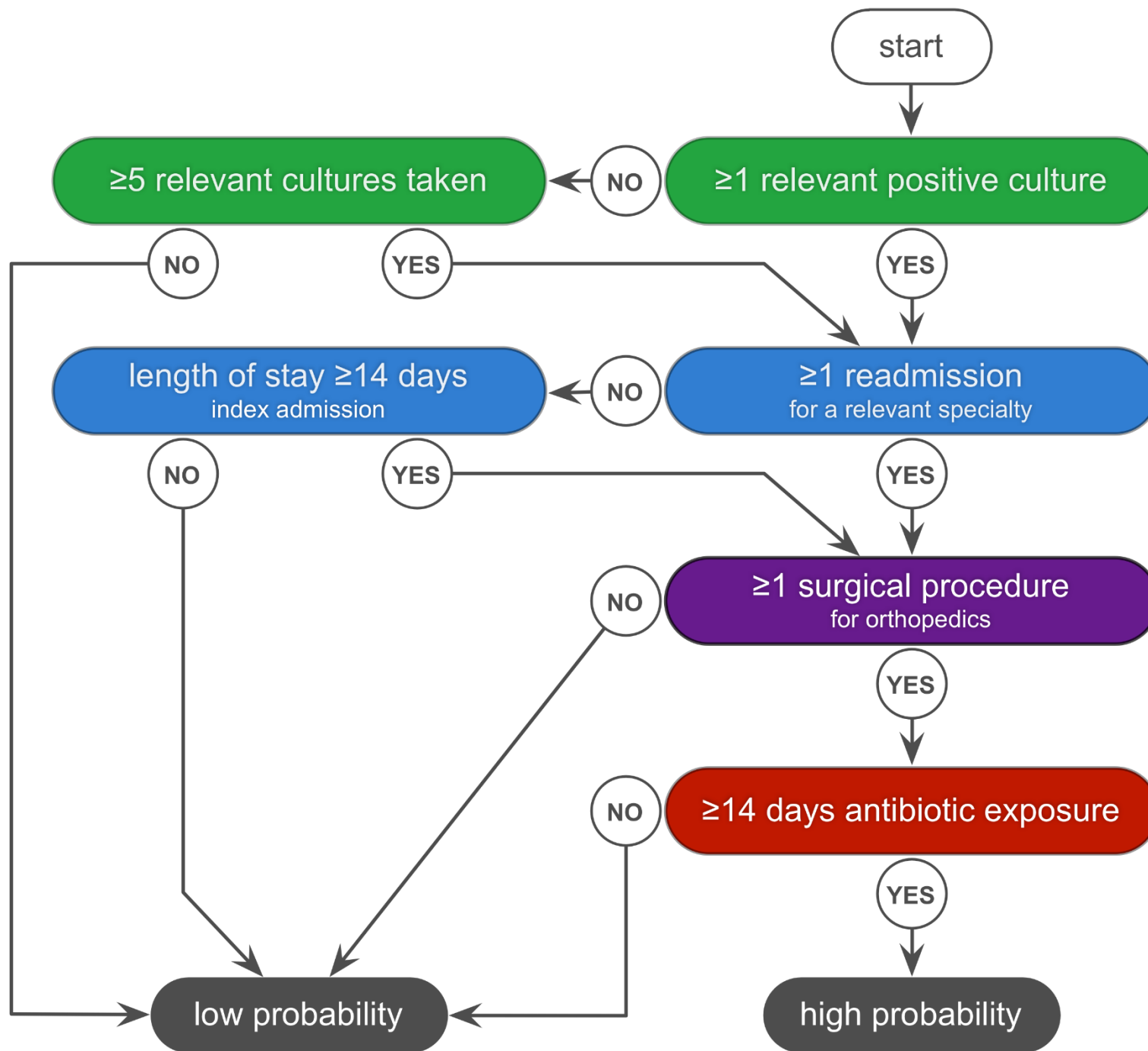
low probability

manual review IP

deep SSI

no deep SSI





**Item 1** microbiology

**Item 2** admission data

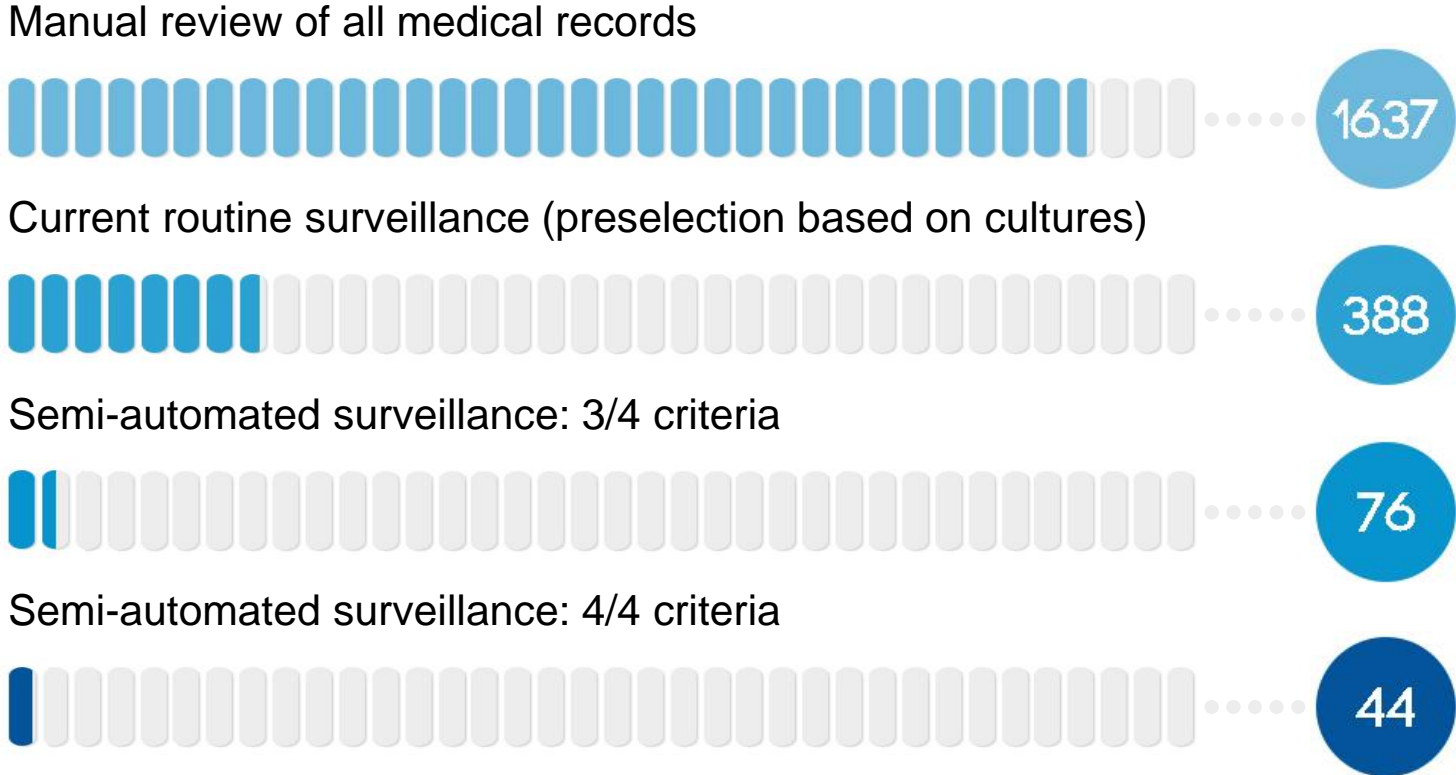
**Item 3** surgical procedures

**Item 4** antibiotics



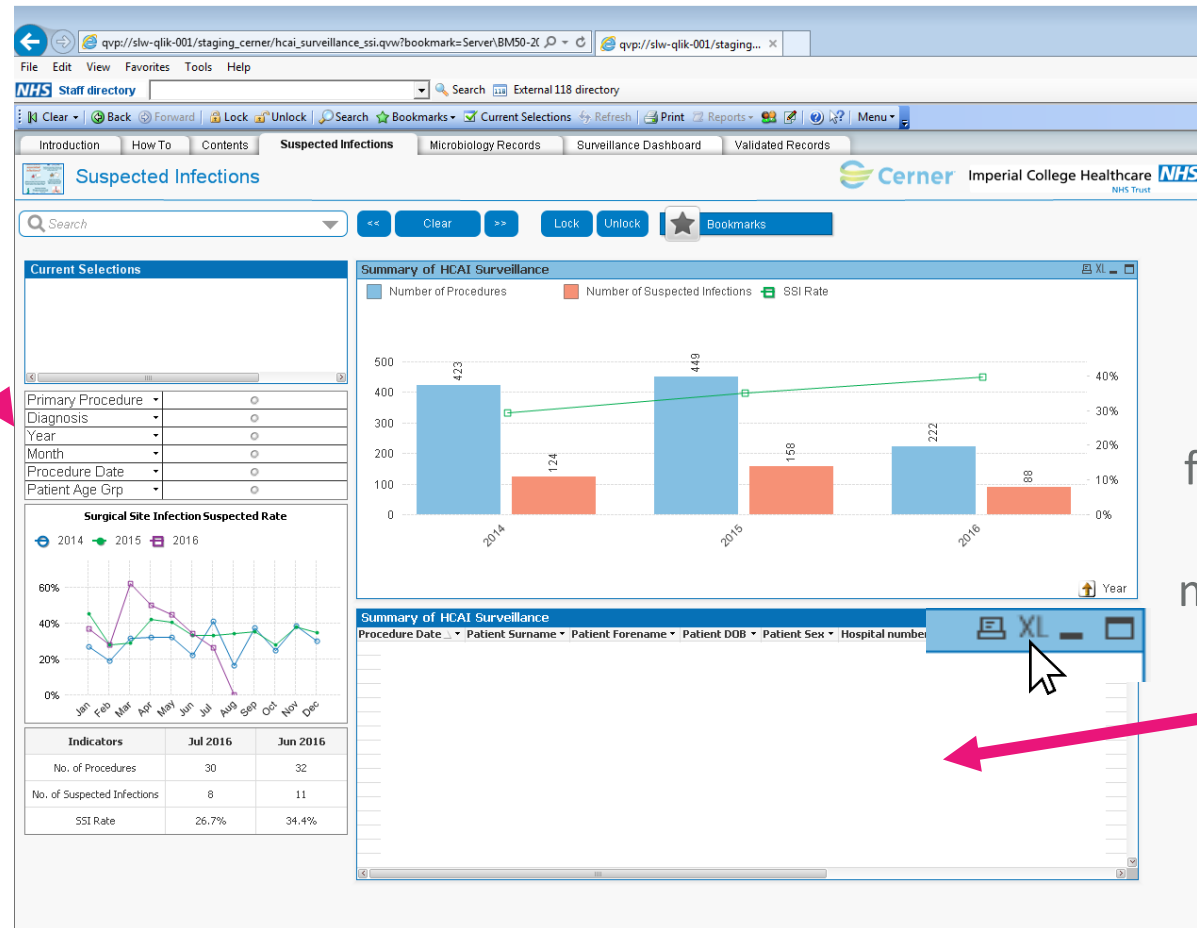
# Workload reduction

Medical records to assess during a 10 year surveillance period (  = 50 medical records)



# Semi-automated surveillance of SSIs

Select time  
period



Patient list with  
flags for patients  
with ICD10 or  
microbiology test  
of interest



# Semi-automated surveillance of SSIs

Microbiology Records

Search

Microbiology Filters

Collect Date	Hospital Number	Order Code	Order Name	Doc Name	Expansion	Hospital Code	Loc Name	Received Date	Result	Result Date	Test Code	Test Name
		BLDCUL	Blood Culture		BLOOD	HX			BLO		SDES	SPECIMEN DESCRIPTION
		BLDCUL	Blood Culture		<<DO NOT REPORT>>	HX			HIDE		SREQ	SPECIAL REQUEST
		BLDCUL	Blood Culture		No Growth at 5 days	HX			NGS		CULT	CULTURE
		BLDCUL	Blood Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		BLDCUL	Blood Culture		;BLOOD	HX			;BLOOD		SDES	SPECIMEN DESCRIPTION
		BLDCUL	Blood Culture		BLOOD	HX			BLO		SDES	SPECIMEN DESCRIPTION
		BLDCUL	Blood Culture		<<DO NOT REPORT>>	HX			HIDE		SREQ	SPECIAL REQUEST
		BLDCUL	Blood Culture		<<DO NOT REPORT>>	HX			HIDE		SREQ	SPECIAL REQUEST
		BLDCUL	Blood Culture		No Growth at 5 days	HX			NGS		CULT	CULTURE
		BLDCUL	Blood Culture		No Growth at 5 days	HX			NGS		CULT	CULTURE
		BLDCUL	Blood Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		BLDCUL	Blood Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		BLDCUL	Blood Culture		REQUEST CREDITED	HX			DEL		SDES	SPECIMEN DESCRIPTION
		BLDCUL	Blood Culture		REQUEST CREDITED	HX			DEL		SREQ	SPECIAL REQUEST
		WOUCL	Wound Culture		Gram stain:	HX			TGRAM		DIRMIC	DIRECT MICROSCOPY
		WOUCL	Wound Culture		Wound swab	HX			WOUS		SDES	SPECIMEN DESCRIPTION
		WOUCL	Wound Culture		;LOWER	HX			;LOWER		SREQ	SPECIAL REQUEST
		WOUCL	Wound Culture		;UPPER SITE	HX			;UPPER SITE		SREQ	SPECIAL REQUEST
		WOUCL	Wound Culture		Coagulase negative staphyloco...	HX			CNS		CULT	CULTURE
		WOUCL	Wound Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		WOUCL	Wound Culture		Coagulase negative staphyloco...	HX			CNS		CULT	CULTURE
		WOUCL	Wound Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		BLDCUL	Blood Culture		;BLOOD	HX			;BLOOD		SDES	SPECIMEN DESCRIPTION
		BLDCUL	Blood Culture		<<DO NOT REPORT>>	HX			HIDE		SREQ	SPECIAL REQUEST
		BLDCUL	Blood Culture		No Growth at 5 days	HX			NGS		CULT	CULTURE
		BLDCUL	Blood Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		WOUCL	Wound Culture		<<DO NOT REPORT>>	HX			HIDE		DIRMIC	DIRECT MICROSCOPY
		WOUCL	Wound Culture			HX					SDES	SPECIMEN DESCRIPTION
		WOUCL	Wound Culture			HX					SDES	SPECIMEN DESCRIPTION
		WOUCL	Wound Culture		<<DO NOT REPORT>>	HX			HIDE		SREQ	SPECIAL REQUEST
		WOUCL	Wound Culture		No Growth at 2 days	HX			NG2		CULT	CULTURE
		WOUCL	Wound Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		WOUCL	Wound Culture		Enterobacter aerogenes	HX			EAER		CULT	CULTURE
		WOUCL	Wound Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		WOUCL	Wound Culture		<<DO NOT REPORT>>	HX			HIDE		DIRMIC	DIRECT MICROSCOPY
		WOUCL	Wound Culture		;STERNUM	HX			;STERNUM		SDES	SPECIMEN DESCRIPTION
		BLDCUL	Blood Culture		Arm - left	HX			ARML		SDES	SPECIMEN DESCRIPTION
		BLDCUL	Blood Culture		BLOOD	HX			BLO		SDES	SPECIMEN DESCRIPTION
		WOUCL	Wound Culture		<<DO NOT REPORT>>	HX			HIDE		SREQ	SPECIAL REQUEST
		BLDCUL	Blood Culture		<<DO NOT REPORT>>	HX			HIDE		SREQ	SPECIAL REQUEST
		WOUCL	Wound Culture		Staphylococcus epidermidis	HX			SEPI		CULT	CULTURE
		WOUCL	Wound Culture		FINAL	HX			FNL		RPT	REPORT STATUS
		BLDCUL	Blood Culture		No Growth at 5 days	HX			NGS		CULT	CULTURE
		BLDCUL	Blood Culture		FINAL	HX			FNL		RPT	REPORT STATUS

Micro data are shown for the patients selected in the previous tab

# Semi-automated surveillance of SSIs

The screenshot displays the NHS Surveillance Dashboard interface. At the top, there are navigation tabs for 'Introduction', 'How To', 'Contents', 'Suspected Infections', 'Microbiology Records', 'Surveillance Dashboard', and 'Validated Records'. The 'Surveillance Dashboard' tab is active, showing a search bar and navigation controls.

The main content area is divided into several sections:

- Current Selections:** A sidebar with dropdown menus for Year, Month, Procedure Date, Age Band, Specimen Desc, Procedure Type, Consultant, Organism, and Gender.
- Summary of Infected Patients by: Month:** A combined bar and line chart showing the number of procedures (blue bars), suspected infections (green bars), confirmed infections (red bars), and infection rate (purple line) from January 2014 to August 2016. The infection rate is highlighted with a purple arrow pointing to the value for May 2015.
- Surgical Site Infection Confirmed Rate:** A line chart comparing the confirmed rate for the years 2014 (blue), 2015 (green), and 2016 (purple) across the months. A purple arrow points to the May 2015 data point.
- Summary Table:** A table providing a monthly breakdown of the data shown in the charts.

Month	Number of Procedures	Number of Suspected Infections	Number of Confirmed Infections	Infection Rate
<b>Total</b>	<b>1094</b>	<b>370</b>	<b>14</b>	<b>1.3%</b>
Jan 2014	41	11	3	7.3%
Feb 2014	32	6	0	0.0%
Mar 2014	41	13	0	0.0%
Apr 2014	28	9	1	3.6%
May 2014	31	10	1	3.2%
Jun 2014	41	9	0	0.0%
Jul 2014	34	14	1	2.9%
Aug 2014	31	5	0	0.0%
Sep 2014	32	12	0	0.0%
Oct 2014	40	10	2	5.0%
Nov 2014	39	15	0	0.0%
Dec 2014	33	10	0	0.0%
Jan 2015	44	20	1	2.3%
Feb 2015	39	11	0	0.0%
Mar 2015	45	13	2	4.4%
Apr 2015	38	16	2	5.3%
May 2015	42	17	0	0.0%

**Validated rates**

# Six grandes spécialités chirurgicales en conformité avec le protocole européen

Chaque ES devra choisir au moins une spécialité chirurgicale et au moins une intervention\*

SPECIALITES CHIRURGICALES	
<b>1 - Chirurgie digestive (DIG)</b> <ul style="list-style-type: none"><li>• Chirurgie colorectale</li><li>• Appendicectomie</li></ul>	<b>4 - Chirurgie coronaire (CAR)</b> <ul style="list-style-type: none"><li>• Pontage aorto-coronarien avec greffon local</li><li>• Pontage aorto-coronarien avec greffon sur un autre site (saphène par exemple)</li><li>• Chirurgie de remplacement des valves cardiaques</li></ul>
<b>2 - Chirurgie gynéco-obstétrique (GYN)</b> <ul style="list-style-type: none"><li>• Chirurgie mammaire</li><li>• Césarienne</li></ul>	<b>5 - Chirurgie orthopédique (ORT)</b> <ul style="list-style-type: none"><li>• Prothèse de hanche (primaire ou de 1<sup>ère</sup> intention)</li><li>• Reprises de prothèse de hanche (reprise de PTH, totalisation ou PTH après arthrodèse)</li><li>• Prothèse de genou (primaire ou de 1<sup>ère</sup> intention)</li><li>• Reprise de prothèse de genou</li></ul>
<b>3 - Neurochirurgie (NEU)</b> <ul style="list-style-type: none"><li>• Laminectomie et intervention sur le rachis</li><li>• Chirurgie de hernie discale à l'étage lombaire</li></ul>	<b>6 - Chirurgie urologique (URO)</b> <ul style="list-style-type: none"><li>• Résection trans-urétrale de prostate</li><li>• Prostatectomie</li><li>• Urétéroscopie (diagnostique, pour calcul, pour tumeur)</li></ul>

La détection des ISO dans cette spécialité fait l'objet d'une méthodologie spécifique

\* Sélection des codes CCAM concernés par la surveillance réalisée dans la continuité du réseau ISO-Raisin

**Etape 1 :** Recherche des critères de suspicion des ISO\* au cours du séjour hospitalier index ou lors d'une ré-hospitalisation dans les 30j (ou 90j) suivant l'acte cible

### CRITÈRES PRINCIPAUX :

- **Reprise chirurgicale non programmée** (ou en urgence)
- **Prélèvement microbiologique positif** (PM superficiel ou profond au niveau du site opératoire et effectué à visée diagnostique)

### CRITÈRES SECONDAIRES :

- **Signes cliniques d'infection**
  - ✓ Signes cliniques généraux (i.e. : fièvre  $\geq 38,5^{\circ}\text{C}$ ), ET/OU
  - ✓ Signes locaux d'infection (i.e. : écoulement purulent, douleurs, rougeurs, ou sensibilité localisée au niveau de la plaie chirurgicale, etc.), ET/OU
  - ✓ Signes radiologiques (i.e. : évidence d'un abcès en cavité abdominale)
- **Prescription d'antibiotiques de plus de 48h** (hors antibioprophylaxie)

\* (1) critères définis par consensus d'experts ; (2) Majoritairement cités lors de l'état des lieux 2019

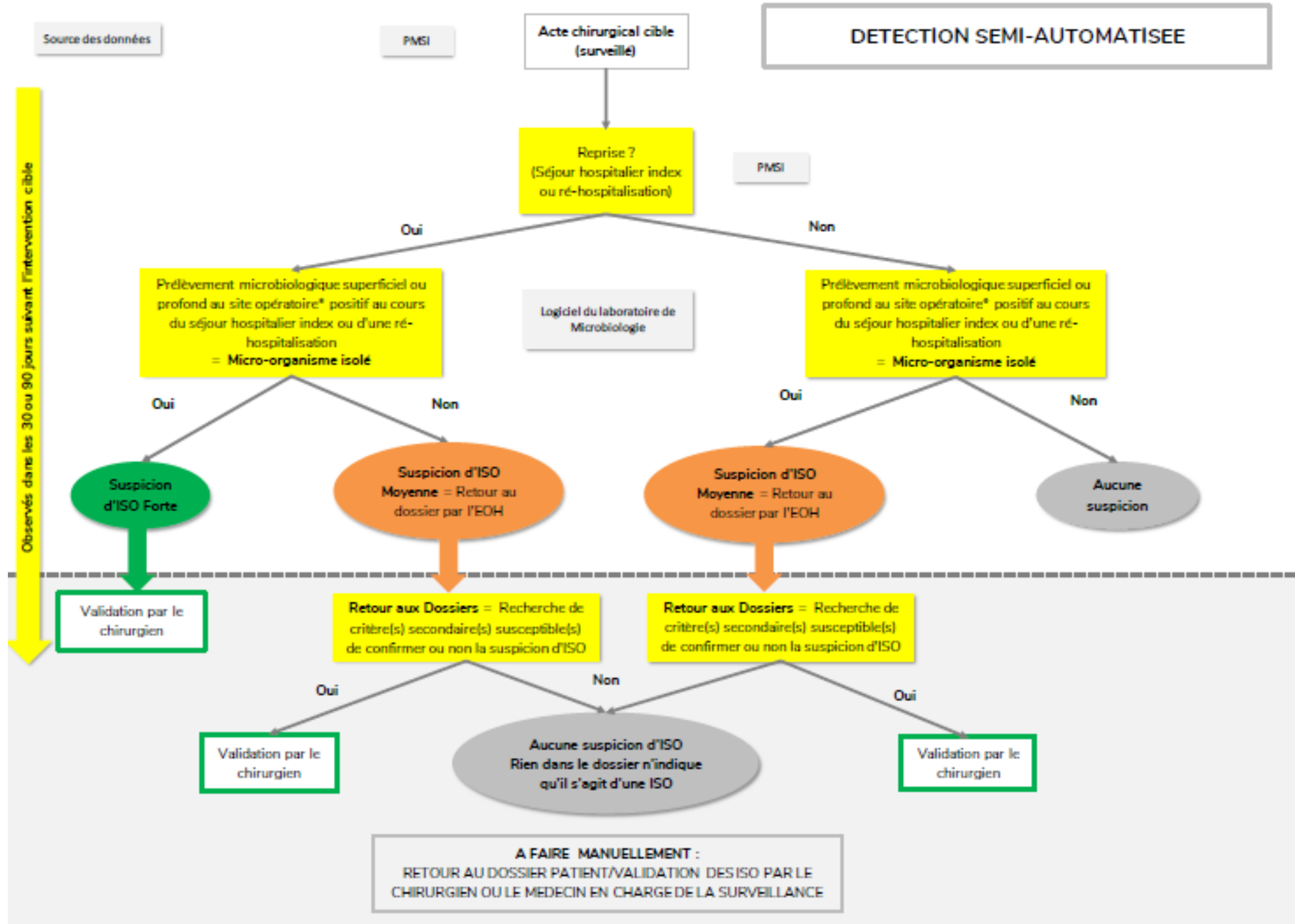
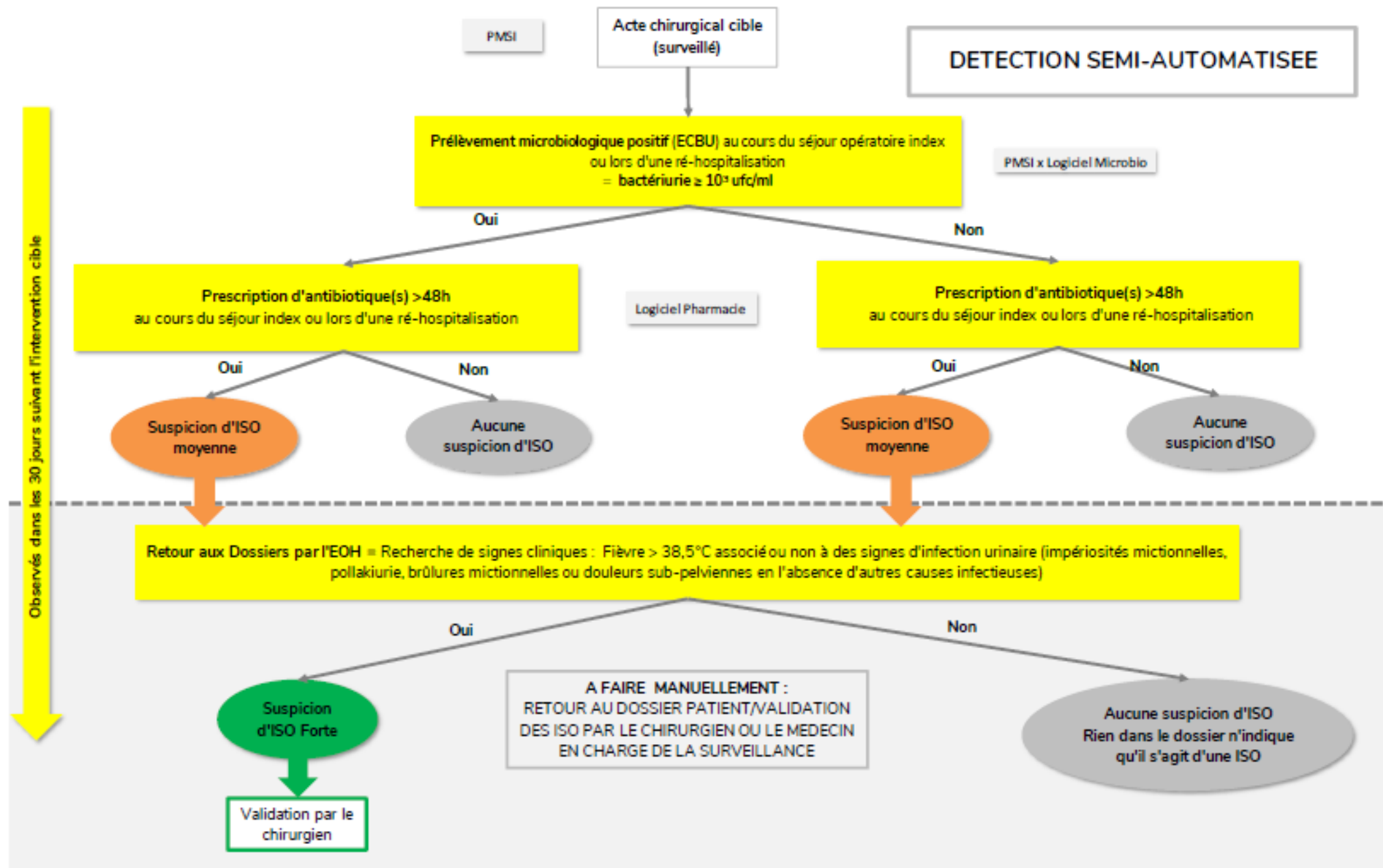
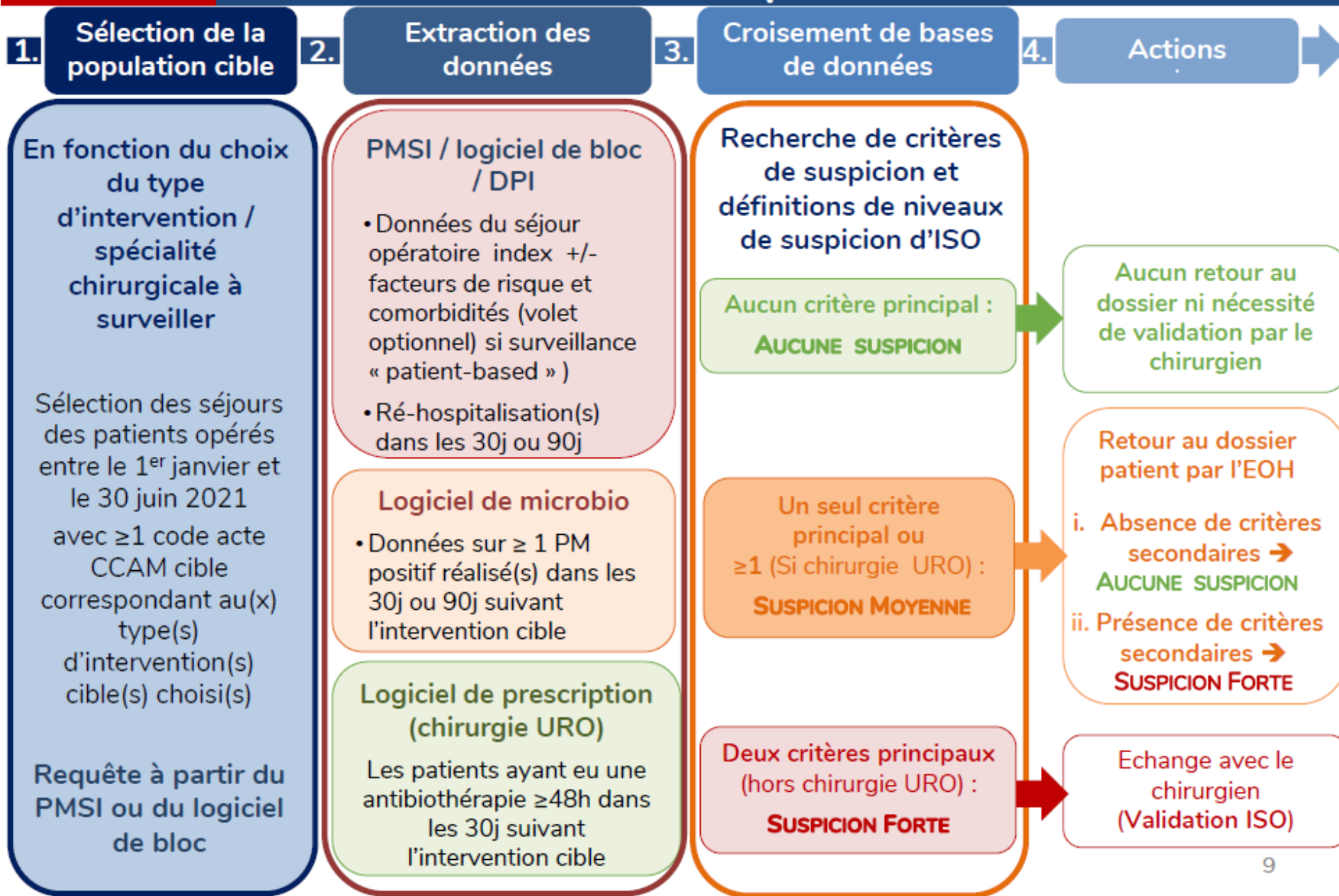
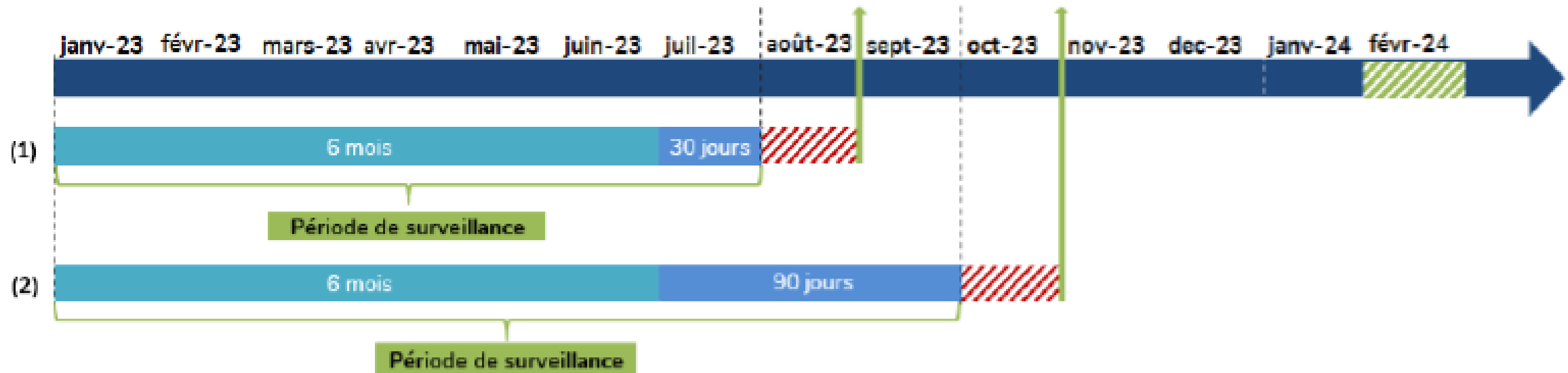


Figure 2 : Arbre de décision – Détection des ISO en chirurgie urologique



# En pratique, une méthodologie de détection en 4 phases





(1) Toutes spécialités (hors orthopédique et cardiaque)

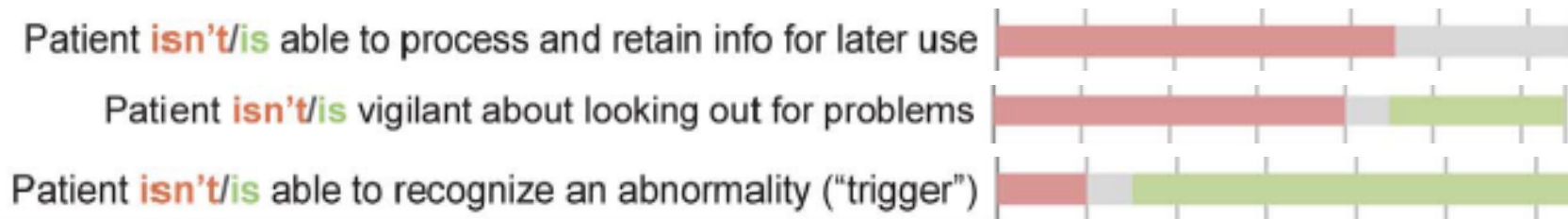
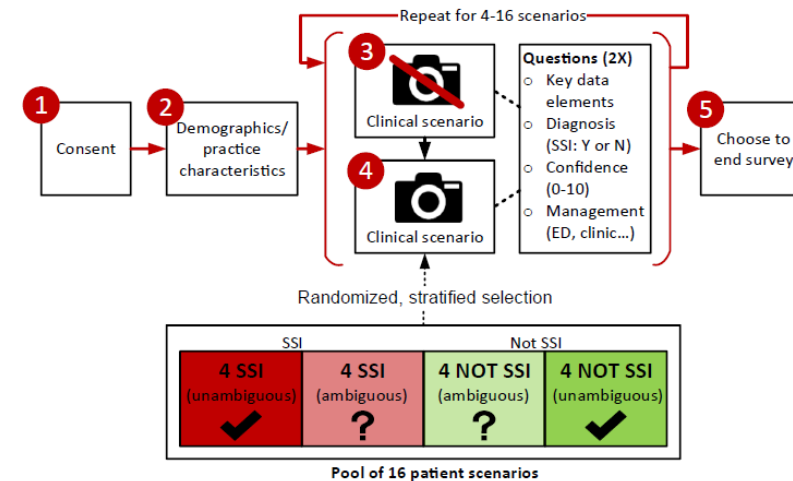
(2) Chirurgies orthopédique et cardiaque

- Inclusion de l'acte chirurgical surveillé
- Délai nécessaire à la détection d'ISO
- ▨ Délai nécessaire pour la validation des données du PMSI (1 mois)
- ▨ Période d'importation des données dans la plateforme SPICMI
- ↑ Date à partir de laquelle les extractions des données et les validations des ISO par le chirurgien peuvent être réalisées

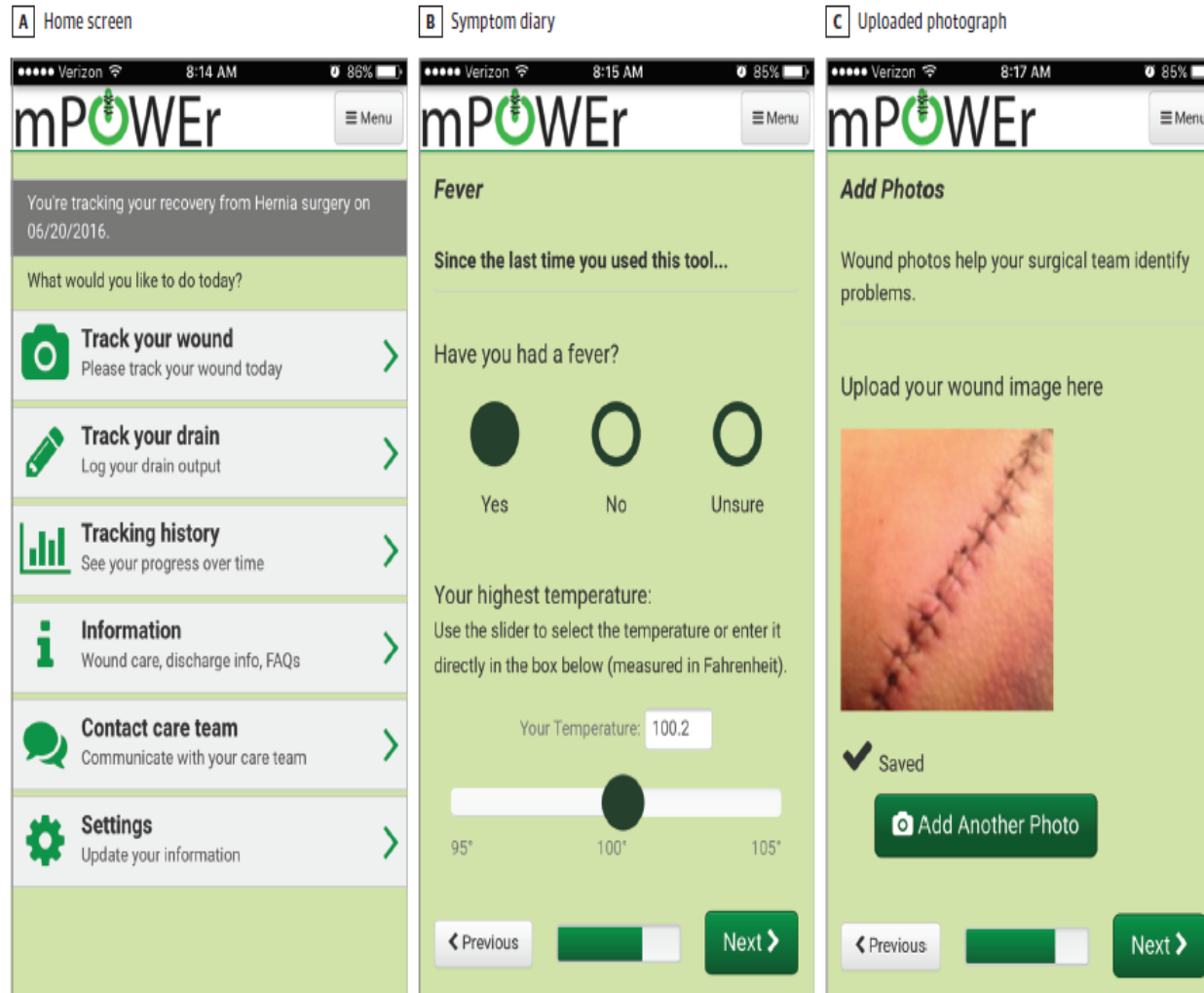
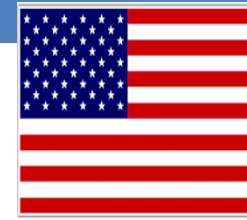


# How to improve the reliability?

- Improving SSI diagnostic using wound photography?
- By Improving the post-discharge surveillance?
  - Many PDS methods, stakeholder engagement issues
    - High variability → unreliability?
- By involving patients?



# Implication des patients dans la surveillance



# Reporting

- **Timely**—given soon after the target behavior has occurred
- **Respectful**—focus on behaviors, not personal attributes
- **Specific**—be specific about what behaviors need correcting
- **Directed toward improvement**—provide directions for future improvement
- **Considerate**—consider a team member's feelings and deliver negative information with fairness and respect

Complete

Clear

Brief

Timely

# Preoperative prediction of postoperative infections using machine learning and electronic health record data

Preoperative EHR data from 30,639 patients (2013-2019) linked to ACS-NSQIP preoperative data and postoperative infection outcomes data from 5 hospitals in the University of Colorado Health System

- Lasso and the knockoff filter to perform controlled variable selection.
- Outcomes : SSI, UTI, sepsis/septic shock, and pneumonia up to 30 days post-operatively.

Breast lumpectomy:

- clean wound class, operation outpatient, no other preoperative risk factors.

- preoperative risk of SSI = 1.5%.

Open pancreaticoduodenectomy:

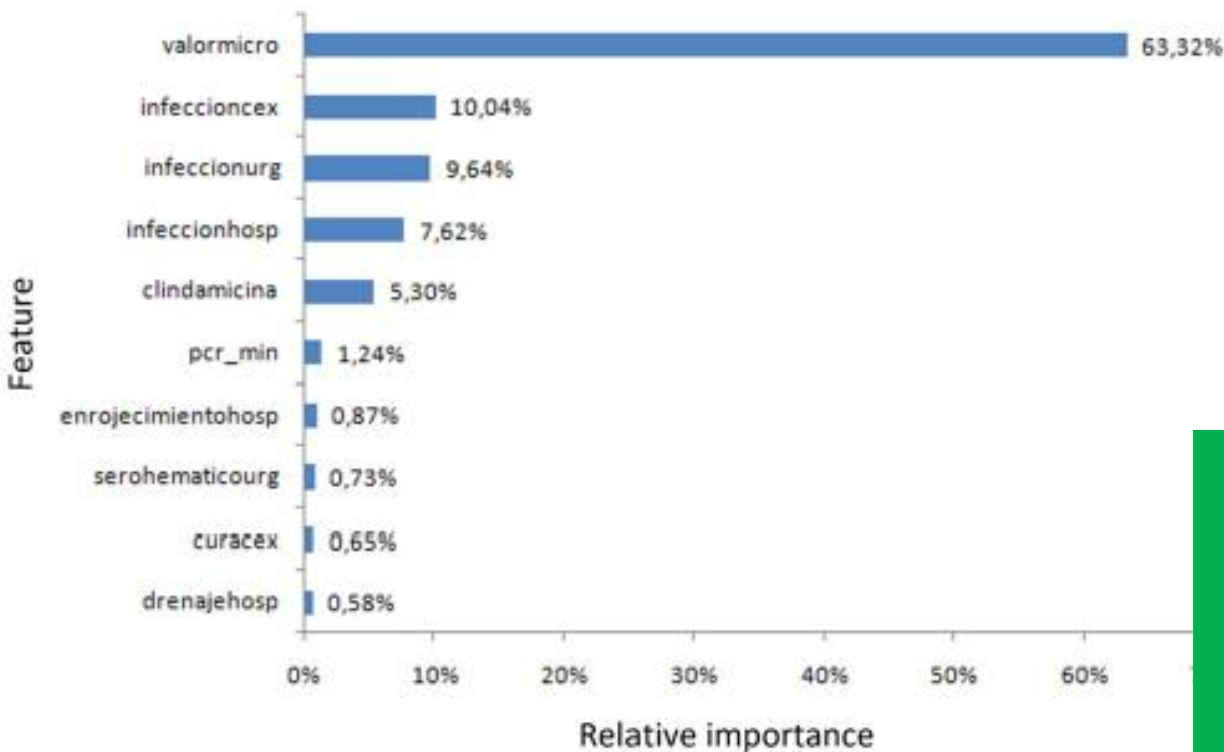
- inpatient procedure, clean contaminated wound class, outside CT scan.
- Preoperative risk of SSI = 11.3%.

Outcome variable	Number of variables selected	ASPIN AUC N = 30,603		ACS-NSQIP AUC N = 30,603		Pearson correlation
		Training	Testing	Training	Testing	
Surgical site infection	7	0.74 (0.73, 0.76)	0.73 (0.70, 0.76)	0.77 (0.75, 0.79)	0.75 (0.72, 0.78)	0.51
Urinary tract infection	6	0.76 (0.74, 0.79)	0.76 (0.73, 0.80)	0.78 (0.76, 0.81)	0.76 (0.72, 0.80)	0.55
Sepsis/septic shock	6	0.88 (0.86, 0.89)	0.89 (0.87, 0.91)	0.91 (0.90, 0.93)	0.90 (0.87, 0.92)	0.58
Pneumonia	6	0.84 (0.81, 0.87)	0.84 (0.78, 0.89)	0.89 (0.87, 0.91)	0.81 (0.74, 0.87)	0.37

EHR data showed comparable performance to existing ACS-NSQIP risk models that use manual chart review. Can be used to estimate risk-adjusted postoperative infection rates applied to large volumes of EHR data in a timely manner

# Using artificial intelligence to reduce orthopedic surgical site infection surveillance workload

- Multivariable algorithm, AI-HPRO, using natural language processing (NLP) and extreme gradient boosting to screen for SSI in patients undergoing hip replacement surgery.
- 19,661 health care episodes from 4 hospitals in Madrid, Spain.

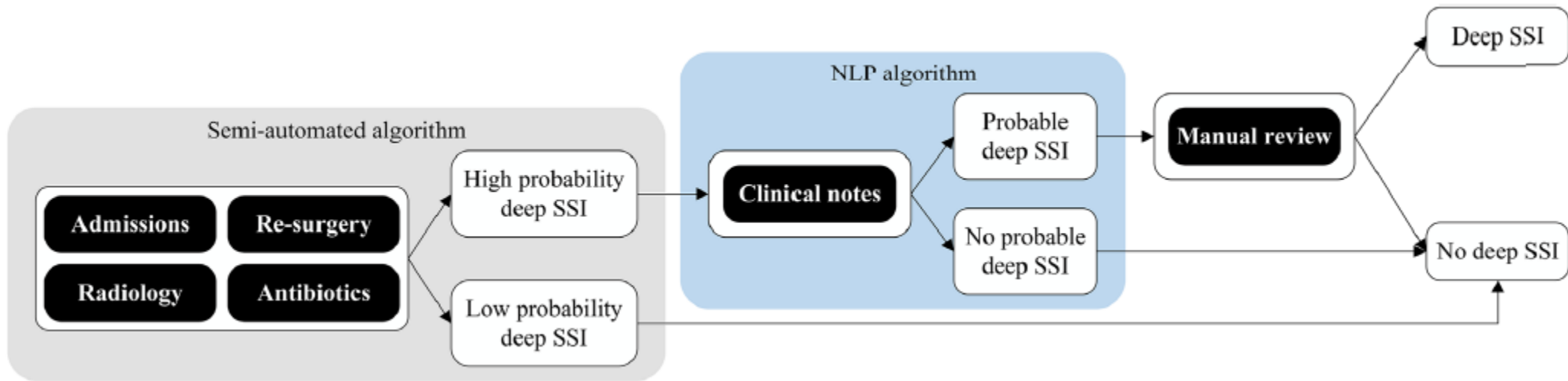


Feature type	Features
Free text	Infection, suspicion of infection drain, edema, suppuration, swelling, erythema, pus, serosanguinous, serous, hematic, pain, cellulitis, dressing
Antibiotic prescriptions	Cloxacillin, clindamycin, clotrimazole, amoxicillin-clavulanic acid, quinolones, rifampin, doxycycline, linezolid
Blood tests	Leukocytosis, C-reactive protein, ESR
Microbiological	Positive cultures (prosthetic joints, synovial fluid, synovial biopsies, abscesses), polymerase chain reaction results, blood cultures
Clinical	Body temperature

This is the first report of an algorithm combining NLP and extreme gradient-boosting to permit accurate, real-time orthopedic SSI surveillance.

# The augmented value of using clinical notes in semi-automated surveillance of deep surgical site infections after colorectal surgery

- Retrospective, observational cohort study in patients who underwent colorectal surgery from January 1, 2015, through September 30, 2020. NLP was used to detect keyword counts in clinical notes

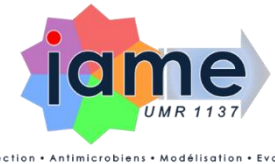


Decision tree models with discretized counts or binary counts had the best performance (sensitivity 95.1% (95%CI 83.5–99.4%), WR 60.9%) and improved PPV and WR by only 2.6% and 3.6%, respectively, compared to the original algorithm.

The addition of an NLP component to the existing algorithm had modest effect on WR (decrease of 1.4–12.5%), at the cost of sensitivity

# Acknowledgments

- ARIBO team:
  - T. Haudebourg, N. Jacquet, J.C. Lucet, D. Lepelletier
- Engineering:
  - C. Azevedo, R. Pissard-Gibollet, E. Fleury, Sequanta
- Statistics:
  - S. Rukly, J.F. Timsit, B. Giraudeau, E. Tavernier, L. Grammatico-Guillon
- Participating centers:
  - CHU de Nantes; CHU de Rennes; CH Saint Nazaire; CHU d'Angers; CH Le Mans; Hopital Bichat et Beaujon; Hopital Lariboisière; Institut Mutualiste Montsouris (IMM); CHD Vendée; Centre hospitalier privé Saint Grégoire; Hopital Privé du confluent; Clinique Saint Léonard; CHU de Tours; CH de Vannes; Clinique chirurgicale du Pré; CHU d'Amiens; CHU de Poitiers; Clinique Saint Charles; Polyclinique du Kerio; Clinique Porte Océane (Sables d'Olonne); CH Yves Le Foll (Saint Briec); ELSAN - Santé atlantique; CHU Bordeaux; Clinique Saint Martin; CH Cholet; CHU de Rouen; Clinique de Cesson Sévigné; Clinique de l'Anjou; Clinique porte de Lorient; Hopital Privé Cote d'Armor; Hopital Cochin; Polyclinique Europe





Thank you for your attention

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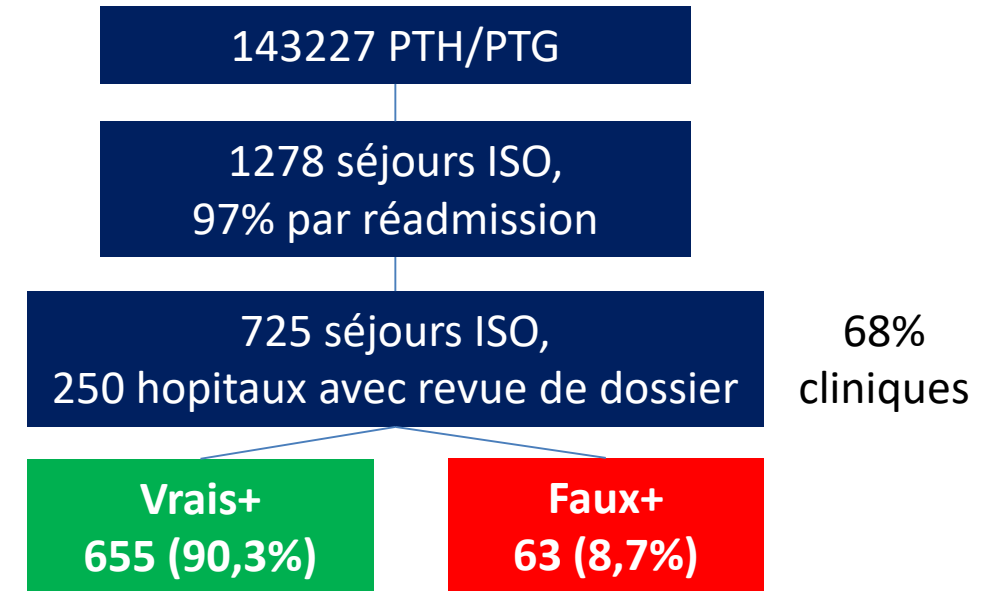


# Validation d'ISO-Ortho

- Tout patient avec **PTH/PTG**, Jan et Sept 2018, PMSI
- Exclusion des patients à haut risque d'ISO
- ISO à 90 jrs par code CIM-10 codes ou CCAM
- Analyse des dossier des patients avec ISO sur plateforme sécurisée par le DIM
- Vrai + = ISO + algorithme / + dossier
- Faux + = ISO + algorithme / - dossier
- Valeur prédictive positive = probabilité d'ISO si algo+

**Taux d'ISO = 0.89%**, PTH = 0.98%, PTG = 0.80%

Probabilité qu'il n'y ait pas d'ISO si l'aglo répond négatif ?  
 Manque-t-on des ISO?  
 Effectifs nécessaires trop importants.



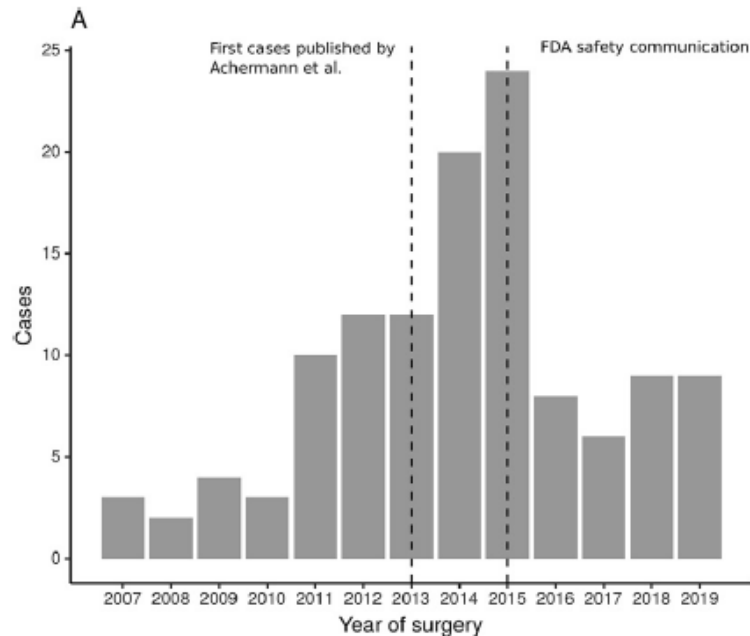
	ISO confirmée	Faux +	Vrai +	VPP
PTH	427	39	384	89.9% [87-93%]
PTG	298	24	271	90.9% [88-94%]
Total	725	63	655	90.3% [88-92%]

# Clinical characteristics and outcome of *Mycobacterium chimaera* infections after cardiac surgery: systematic review of 180 heater-cooler unit-associated cases

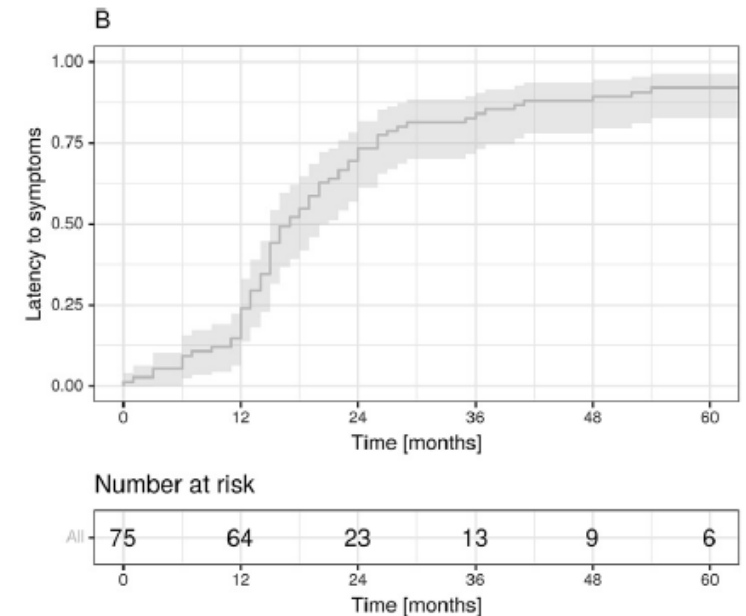
- Searched PubMed and the Web of Science until 15 June 2022 for case reports, case series, and cohort studies

	All cases (n = 180)		
	N	Data available	[%]
<b>Sex</b>			
Male	142	179	79.3
<b>Country of treatment</b>			
United States	85	180	47.2
UK	32	180	17.8
Italy	16	180	8.9
Switzerland	13	180	7.2
Canada	9	180	5.0
Australia	8	180	4.4
Germany	6	180	3.3
Netherlands	3	180	1.7
Spain	3	180	1.7
France	2	180	1.1
Denmark	1	180	0.6
Saudi Arabia	1	180	0.6
China	1	180	0.6
<b>Cardio-surgical procedure</b>			
Surgical aortic valve replacement	118	176	67.0
Aortic valve and root replacement	27	176	15.3
Ascending aortic replacement with graft	17	176	9.7
Mitral valve replacement	5	176	2.8
Mitral valve repair	19	176	10.8
Tricuspid valve repair	3	176	1.7
Coronary artery bypass grafting	19	176	10.8
Pacemaker implantation	2	176	1.1
Left ventricular assist device	4	176	2.3
Others	9	176	5.1
Heart transplantation	2	176	1.1
Lung transplantation	2	176	1.1
Ventriculomyotomy	1	176	0.6
Pericardial fenestration	1	176	0.6
Left atrial appendage occlusion	1	176	0.6
Cardiac valve replacement not specified	1	176	0.6
Ductal closure graft	1	176	0.6
<b>Overall outcome</b>			
Reoperation	92	171	53.8
Removal of foreign material	63	146	43.2
Deceased	80	176	45.5

Number of patients suffering from heater-cooler unit-associated *M. chimaera* infection



Latency to the first clinical symptoms



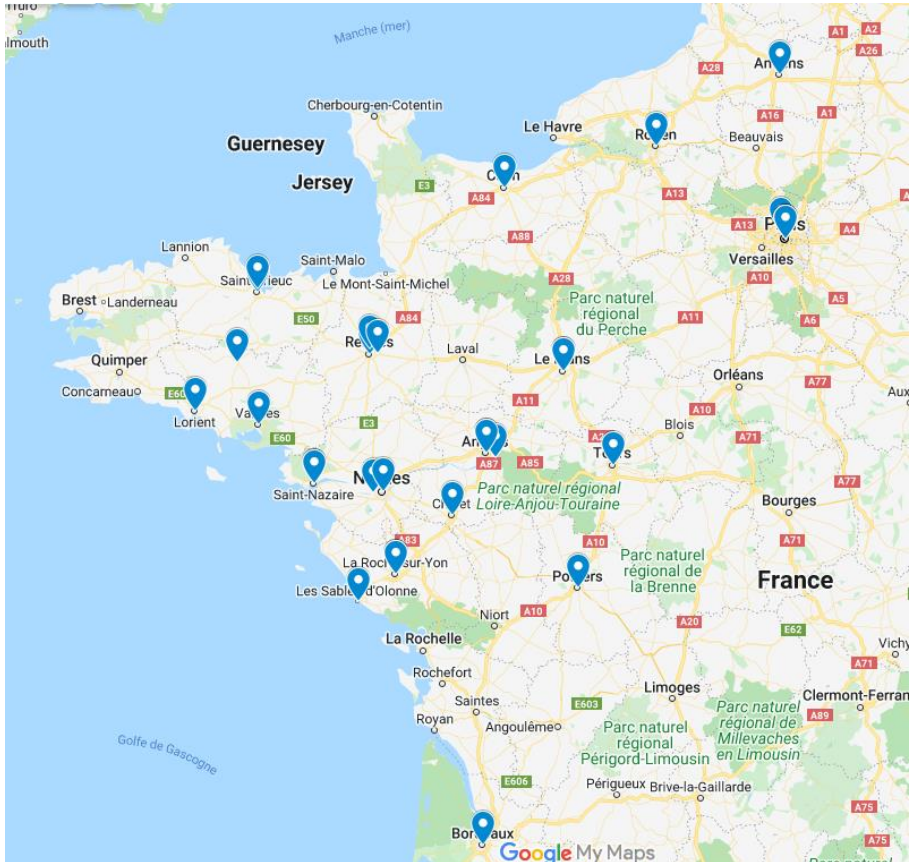
Reoperation seems to be associated with better survival. Physicians have to stay aware of this infection, as patients might still be present today due to the long latency period.

# How can we improve OR behaviours?

- All but 2 were bundle
- Decrease from **5 to 78%** of door openings
- Various (often non-rigorous) methods of analysis and measurement used
- Need to assess the effect of individual interventions on OR traffic

	1	2	3	4	5	6	7	8	9	10	11	12	
<b>Overall result</b>	↓	↓	↓	↓	↓	↓	↓	↓	↓				
<b>Intervention</b>													
Education													4/5
Guideline													1/2
Door sign													4/4
Door alarms													1/1
Door counters													1/2
Locked door policy													
Video observation decks													
Verbal interventions													
Surgeon leadership													
Telephone													2/2
Rule on breaks													1/1
Anticipation of supplies													1/1
Retractable tape													
Pull shades													

# How can we improve OR behaviours?

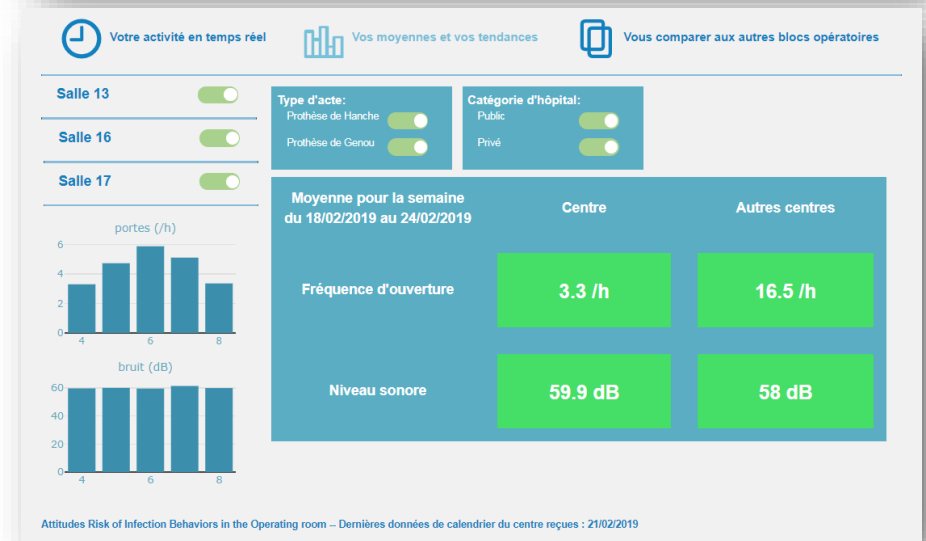
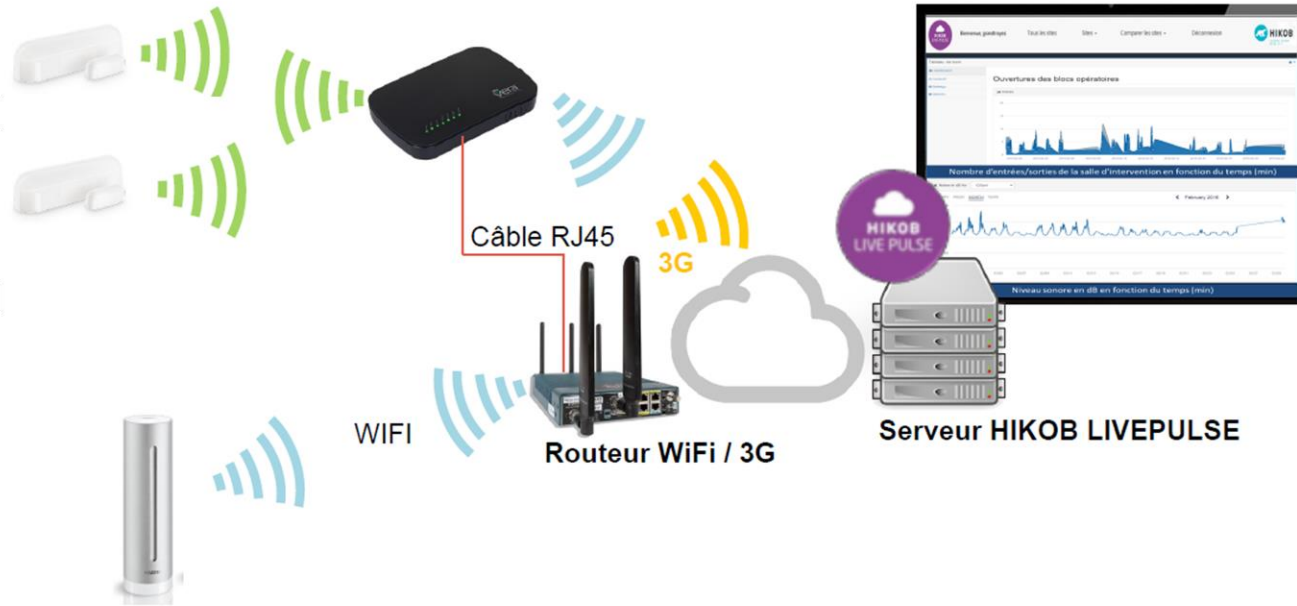


- Cluster randomised control trial
  - 16 centers control harm
  - 16 centers intervention
- Intervention to improve intraoperative behaviours
  - Door openings, noise level
  - Monitoring, feedback and benchmarking process
  - Adaptive approach
- Endpoint: All post-operative complications

10000 operations Hip and knee replacement

# Methods

## Monitoring and feedback



# Methods

## Awareness tools







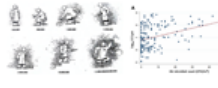
### Target of 100% HCP trained

- Ventilation
- Impact of door opening and noise
- Use of monitoring system
- Methods to improve behaviors



ARIBO<sup>2</sup>  
Amélioration des comportements peropératoires des personnels pour prévenir les complications post-opératoires.

Présentation de la thématique – Notes facilitatrices

Titre de diapositive et commentaires	Numéro de diapositive
<p><b>Titre de la diapositive</b> <b>Impact des comportements sur le risque de complications post-opératoire</b></p> <p>Dire: Le projet ARIBO<sup>2</sup> est une opportunité d'explorer et d'optimiser nos comportements au bloc opératoire. Cette présentation a pour objectif de vous expliquer pourquoi.</p>	<p><b>Diapo 1</b></p>  <p>Impact des comportements sur le risque de complications post-opératoire</p>
<p><b>Surveillance ISO - RAISIN</b></p> <p>Dire: Voici les résultats de la surveillance ISO raisin 2012-2016. Vous pouvez constater une augmentation des taux d'infections du site opératoire pour les prothèses de genou primaire ou de première intention entre 2013 et 2016. Ce constat est également partagé pour les prothèses de hanche cette même période. Ces résultats tendent à prouver que la tendance des taux d'ISO en orthopédie est à la hausse.</p>	<p><b>Diapo 2</b></p>  <p>ISO - RAISIN</p> 
<p><b>Contamination de l'air</b></p> <p>Dire: L'air dans lequel nous vivons contient des particules. Tout individu produit des particules ou des squames. Au repos, nous produisons environ 100 000 particules par minute, alors qu'en activité nous pouvons produire jusqu'à 15 à 30 million de particules par minute. Il existe une corrélation entre le nombre de particules trouvées dans l'air est la quantité de bactéries tendant à prouver qu'une partie de ces particules sont des bactéries.</p>	<p><b>Diapo 3</b></p>  <p>Contamination de l'air</p> 

# Methods

## Adaptative approach

Search for root causes of door opening/high noise levels → **Tailored action plan**

- Lean methods based on plan-do-check-act (PDCA)
  - Designation of:
    - Local project liaison (IPC/quality specialist)  
+
    - Local project champion (member of the OR staff with strong leadership skills)
  - Multidisciplinary team in each centre:
    - Ortho surg, anaesth, surg nurses and quality coordinators, mentored by a lean coach

Adaptive method in 7 successive phases:

1. Clarifying the problem: baseline data
2. Specifying the current situation
3. Multidisciplinary analysis of data
4. Determining the target condition:
5. Analysing the root cause(s)
6. Action plan: taking countermeasures.
7. Evaluating the impact of the action plan using the monitoring system.

# Methods

## Adaptative approach

- Key elements for the implementation of intervention
  - Leadership and engagement of the project team
    - Clarity of the roles: Local project liaison/champion, multidisciplinary team members
    - Planification of project meetings
    - Engagement of a surgeon as champion
  - Engage OR staff
    - Organise a friendly kick off meeting
    - Accurate feedback of data/efficient communication: simple, timely, accessible
    - Reward successes: HARIBO delivered throughout the study period
  - Engage managers
    - Credits for education and training
    - Validation as practice evaluation for quality report

Implementation guide  
+  
Online folder shared





# What to take from all of it?

- SSI **may occur** from staff or environment **through the air, but %?**
- We are **oversimplifying** the problem of air ventilation
  - Multiple influencing factors including human behaviours
- Ventilation effectiveness **variable according structural factors**
  - Location of lights, equipments...
  - Need for more collaborative works: engineering (CFD)
- **Staff behaviours associated with air contamination**
  - Proof of concept still needed, impact of DO, movements on SSI
  - Simple actions improve DO (signs, supplies, communication, anticipation)
    - Need for tangible rules/risk assessment + leadership from surgeons
  - Perspective: Assessment of organization and sociologic evaluation in OR

### Study of determinants of the adoption, implementation and sustainability

#### FACILITATORS

- **Leadership** from surgeons and involvement of OR Nurses
- **Local safety culture** and quality of care
- **Cohesion and communication** between professionals in the OR

#### BARRIERS

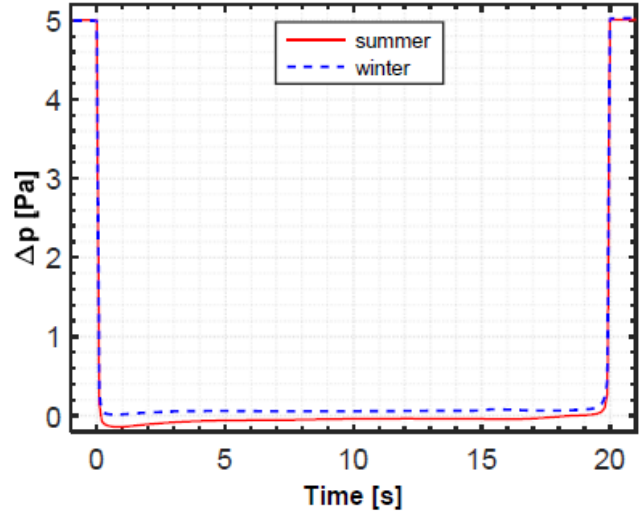
- **Professional fragmentation** between anesthesia and surgery
- **Turnover** of staff
- **Work conditions** and infrastructures dégradées
- Lack of time generated by staff cut/low resources



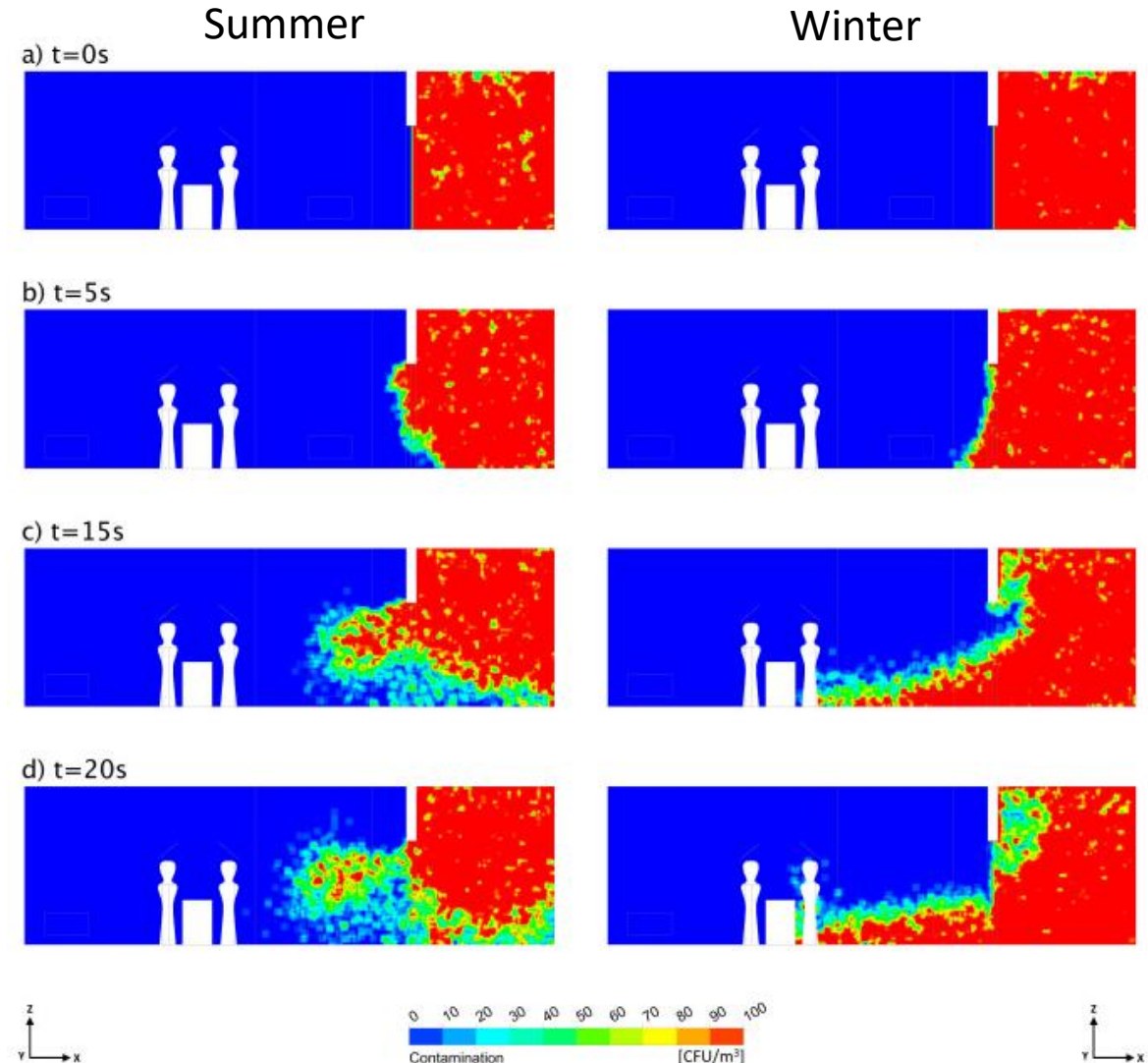
**PROTHÈSE EN COURS !**

# Door opening and air flow

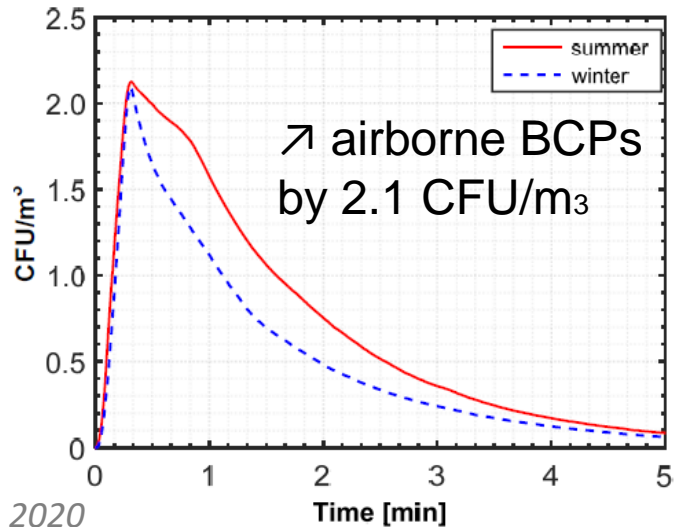
OR/corridor pressure  $\neq$  during the door opening



Airborne BCPs concentration at center-plane of sliding door



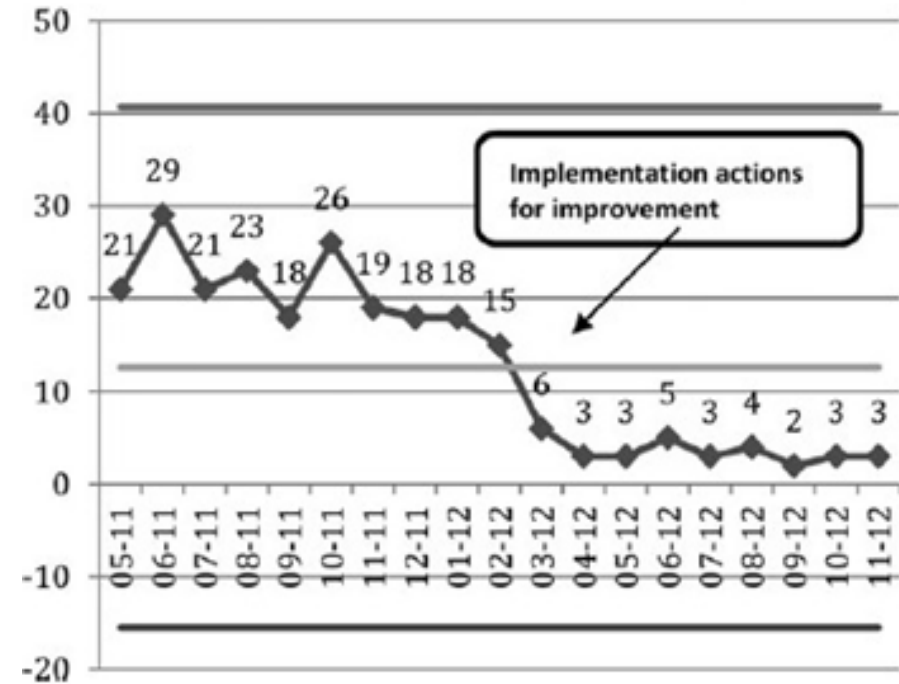
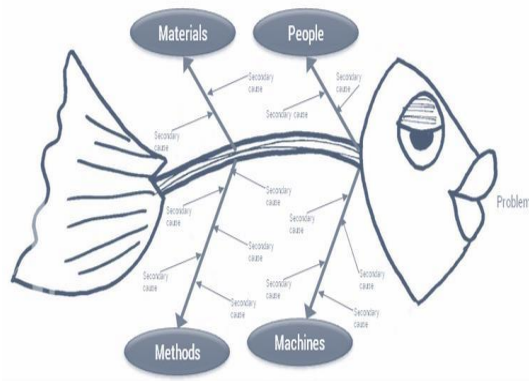
Contamination in OR within 5-minute



# Methods

## Adaptative approach

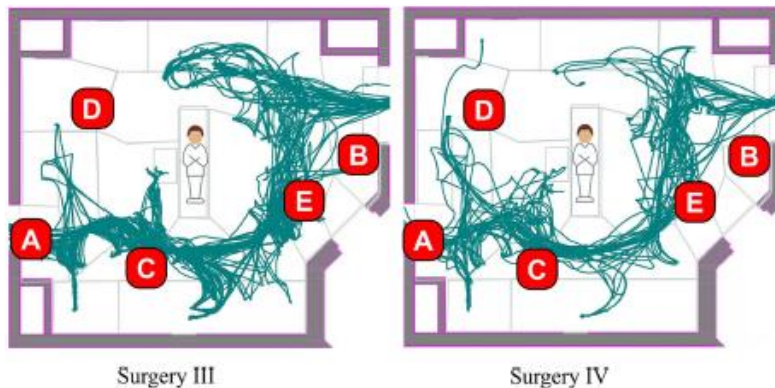
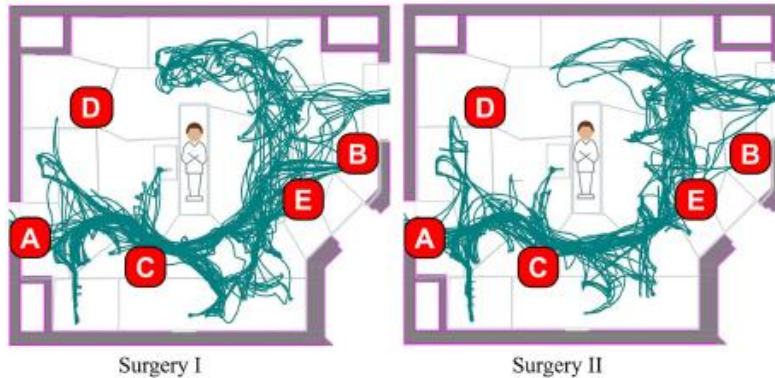
- **Target: 0(zero) door movements**
  - Need for X-rays, Unexpected material, Instruments or blood products, Breaks or service shifts of employees, Emergencies, Supervision for the orthopaedics or anaesthetist
- **13 root causes, 3 with biggest impact:**
  - Visible phone number
  - Leadership of surgeon
  - Revised warning sign



- ✓ In-depth understanding root causes = effective countermeasures
- ✓ Collaboration, sharing, dialogue
- ✓ Direct feedback loop by a metric (door counter)
- ✓ Setting staff own countermeasures

## 27 videotaped procedures in orthopaedic surgery

### Traffic, Area Location



High microbial load correlated with:

- Physical movement of people in the same area
  - **Passage away from the operating site**
  - Internal storage points
  - **Bring high traffic areas closer together**
    - Consider visual and auditory constraints
- Hygrometrie > en septembre

### Conclusions:

- Informed workflow design could potentially reduce the amount of movement which would ultimately reduce microbial loads, and thereby lessen SSI risk

# Discipline in the OR

	Particle Log <sub>10</sub> 0.3 μm		Air microbial count	
	Univariate analysis	Multivariate analysis	Univariate analysis	Multivariate analysis
<b>Surgical specialty</b>				
Cardiac surgery	0.11	-	0.04	-
<b>Procedure type</b>				
Total knee replacement	0.93	-	0.07	-
Total hip replacement	0.41	-	0.03	-
CABG	0.01	-	0.20	-
CABG + valve	0.32	-	0.28	-
Valve				
<b>Ventilation system and OR architecture</b>				
Conventional airflow	<b>0.05</b>	-	0.03	<b>0.04</b>
Volume of the OR, m3	0.85	-	0.79	-
<b>Behaviors per period</b>				
No. of door openings	0.01	<b>0.01</b>	0.02	<b>0.03</b>
Duration of door openings	0.05	-	0.06	-
Cumulated distance	<0.001	<b>&lt;0.001</b>		

Controlling the movements  
of staff members

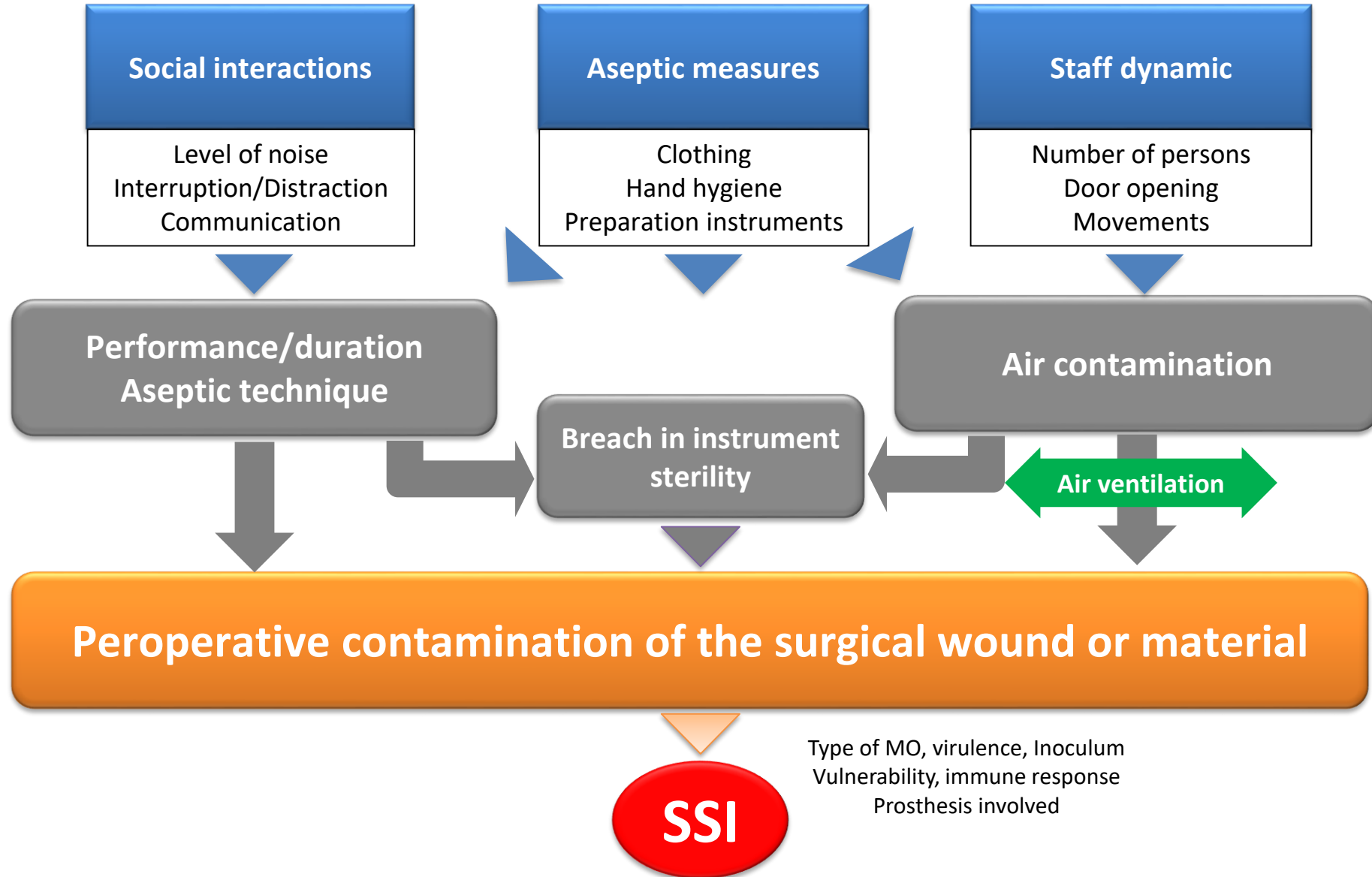
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Restricting their  
number

# How can we improve OR behaviours?

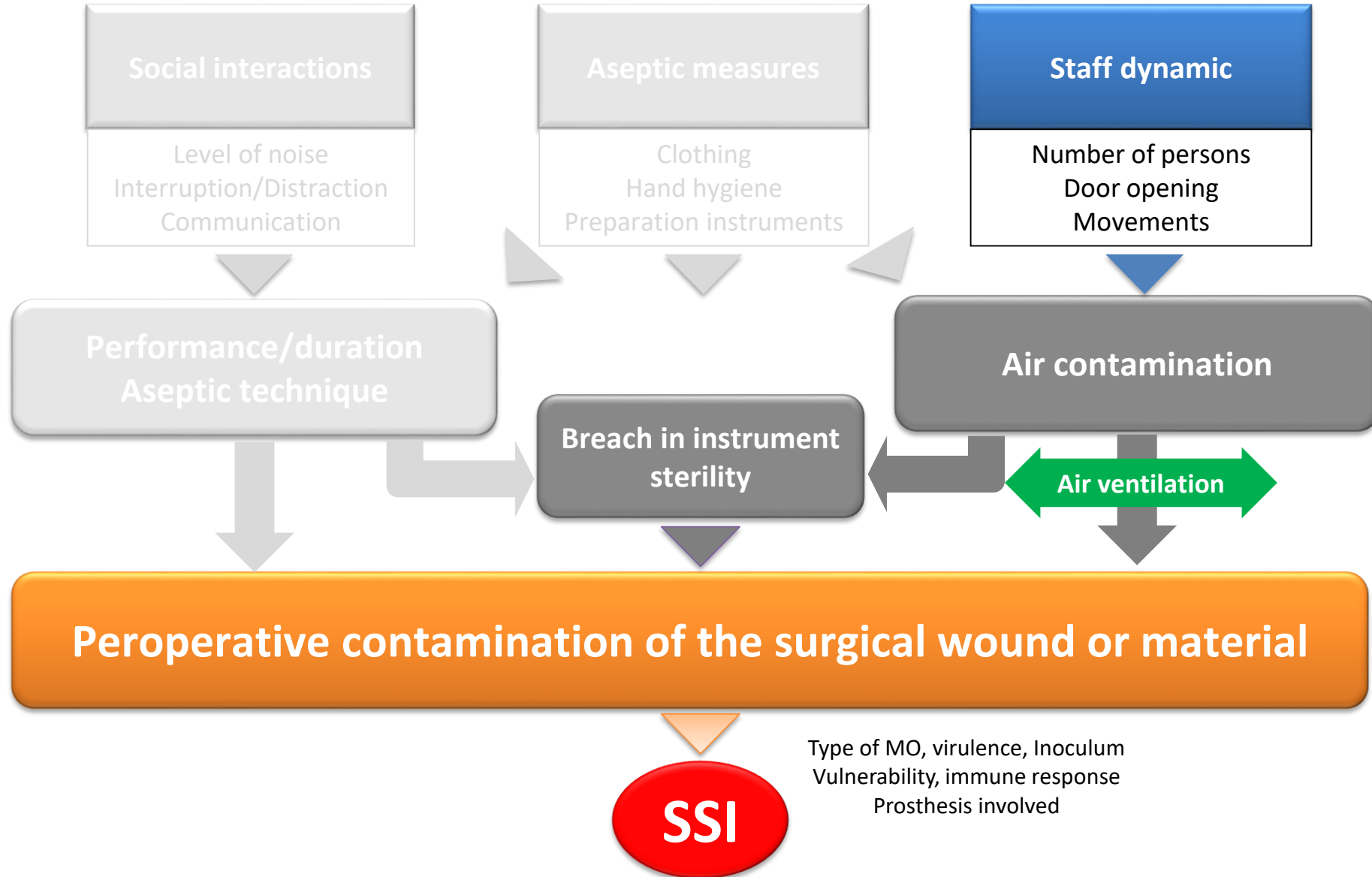
Studies	Specialties	Interventions	Results
DiBartola	Ortho	Guideline, education, rules on OR breaks, door sign, door counters	
Elliott		Education, standardization of OR supplies, procedure carts on nursing traffic and OR door swings	23 to 17%
Eskildsen	Ortho	Door alarm	
Yinnon 2012	General	Checklist including monthly report traffic flow	CFU
Van der Slegt 2013 Crolla 2012	Vascular, Digestive	Bundle compliance on team behaviours	↘30 to 80% compliance
Bohl 2016	Neurosurg	Signs with instructions, reduction of student access	SSI
Simons 2014	Ortho	Lean A3 intervention, dialogical learning	↘78% of traffic
Esser 2016	Pediactic	Education, clinical process changes (signs, wireless phone, video observation)	↘13% of traffic
Rovaldi 2015	Ortho	DO deterrents and changes in traffic process	↘50% of traffic
Prager 2015		Needed equipment, door signs, discouraging breaks during procedures	
Ralte 2015	Ortho	Bundle including a locked door policy	↘50% in SSI rates

# OR behaviours and SSI





# OR behaviours and SSI



# Air contamination in the OR

- OR staff disseminating MRSE in the air  
25% among women 43% among men
- Identical *S. aureus* strains (PFGE) found in the air and in the wound

*Tammelin et al JHI 2000 & ICHE 2001*

- Heater-Coolers devices in cardiac surgery
  - *M. chimaera* produced up to 5 m
  - 156-282 SSI cases/year

*Sommerstein EID 2016 & 2018*



# Physiopathology of SSI

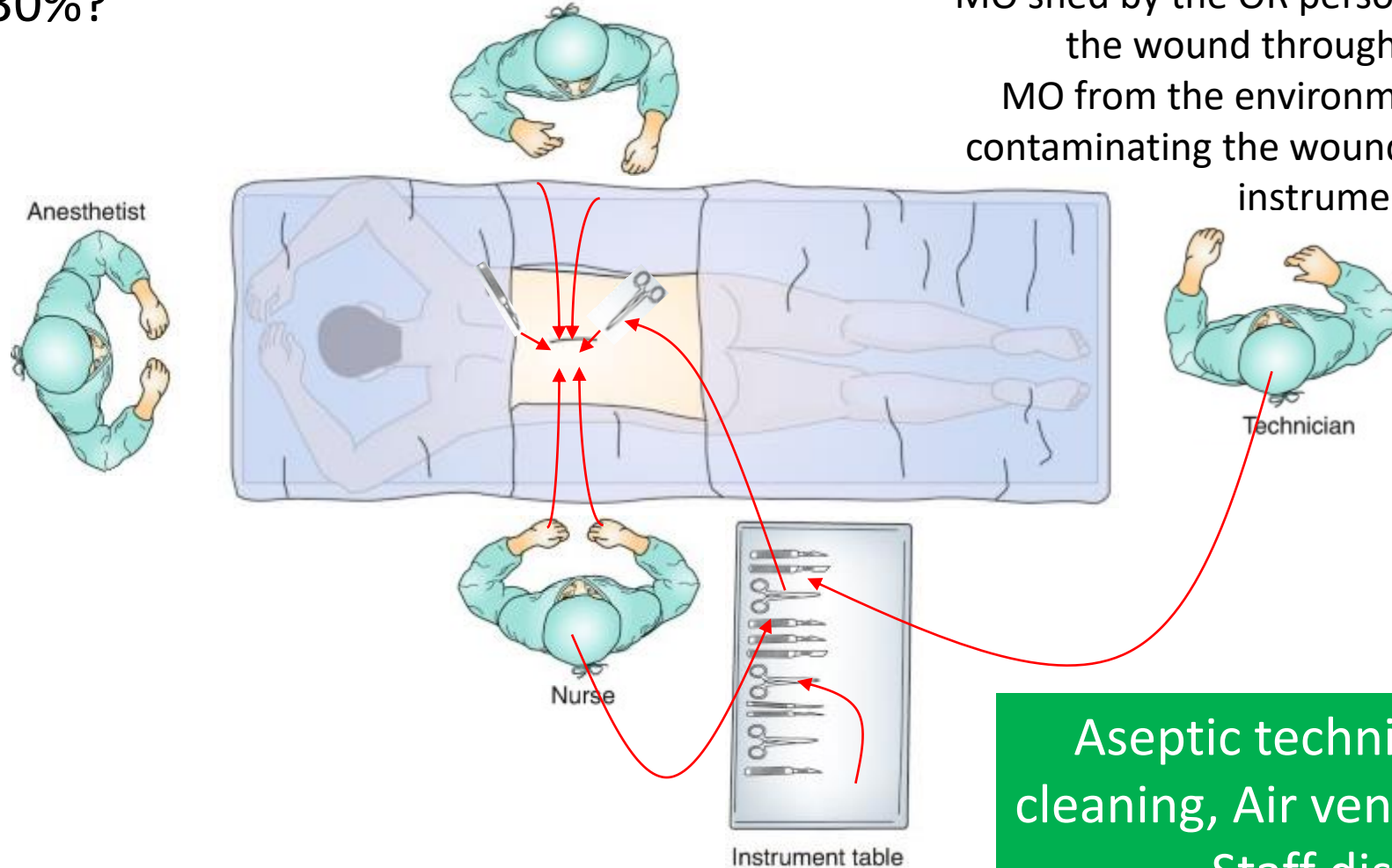
## Intraoperative contaminations

### Exogenous flora

≈ 5% to 30%?

### Indirect contact

MO shed by the OR personnel contaminating the wound through instruments  
MO from the environment (surface, air) contaminating the wound through hands or instruments



Aseptic technique, Surface cleaning, Air ventilation system, Staff discipline



# Epidémie d'endophtalmies

Sept–Nov 2020 : **hausse soudaine** avec 100 cas d'endophtalmies

## 1. Affirmer existence de l'épidémie

2018-2020: 1,614,961 cataractes, 702 (0.04%) endophtalmies, 25 (0.002%) cas présumés fongiques

2. Suspicion contamination implants visco-élastiques, 6 fabriq

3. **Documentation** 182 cas d'endophtalmie depuis Sept 2020 dans 101 centres

4. **Définition de cas** confirmé:  $\geq 1$  prlvt perop + fongique; probable si traitement ATF

5. Collecte de données de **vente d'implants**

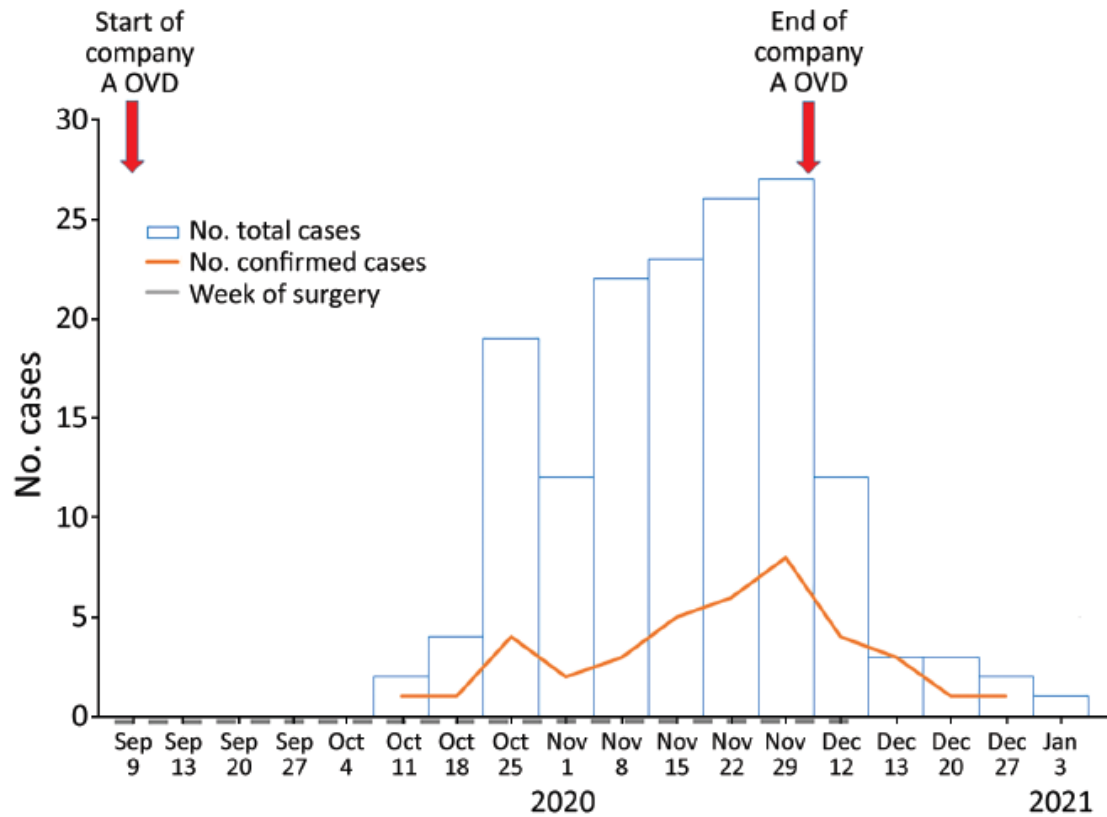
6. 52 souches patient de *fusarium* id+ATFG+Seq.+ 12 en MLST / souches isolé d'implant

Characteristics	No. (%), n = 156	Mean ( $\pm$ SD)
Sex		
M	59 (37.8)	
F	97 (62.2)	
Age range, y		66.3 (10.9)
$\leq 59$	44 (28.2)	
60–69	55 (35.2)	
70–79	41 (26.3)	
$\geq 80$	16 (10.3)	
Underlying conditions*		
None	70 (44.9)	
$\geq 1$	86 (55.1)	
Involved eye		
Left	65 (41.7)	
Right	91 (58.3)	
Date of symptom onset		
October 2020	35 (22.4)	
November 2020	92 (59.0)	
December 2020	27 (17.3)	
January 1–11, 2021	2 (1.3)	
Latent period, d†		24.3 (14.8)
0–14	42 (26.9)	
15–28	60 (38.5)	
29–42	38 (24.4)	
43–56	11 (7.1)	
57–70	4 (2.6)	
70–84	1 (0.6)	

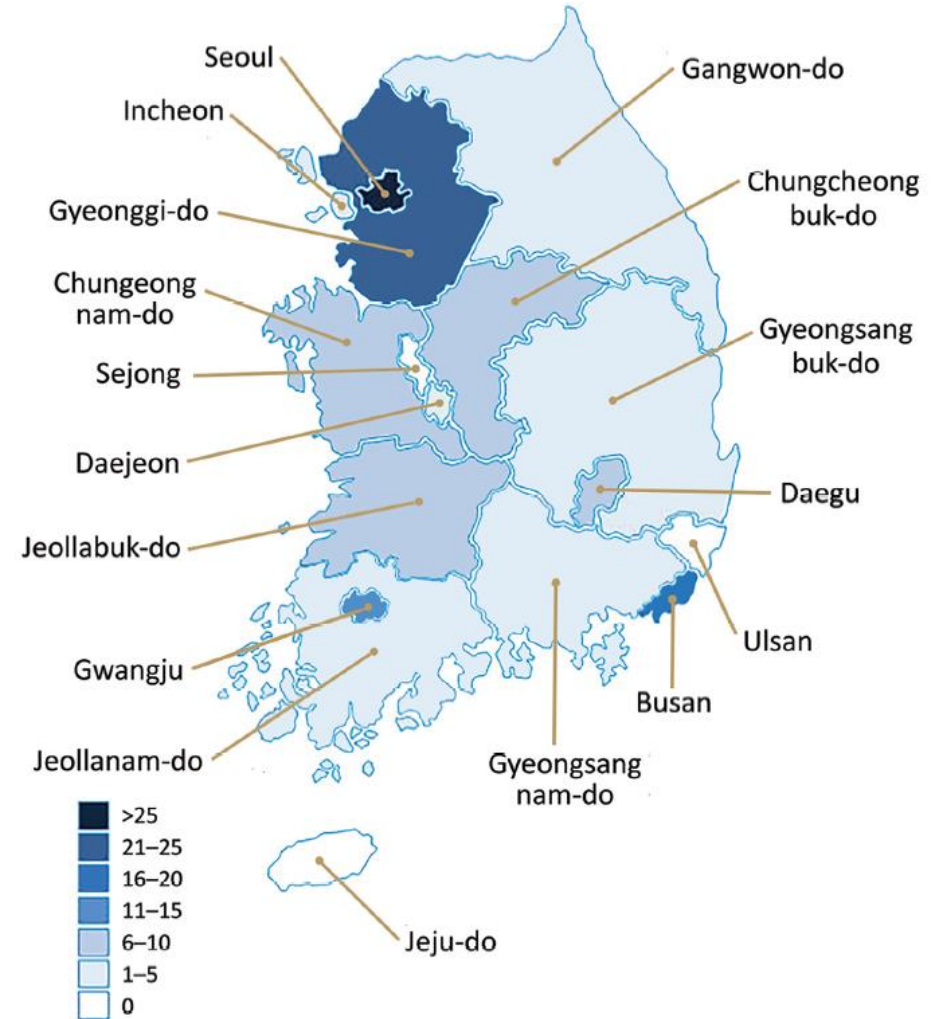


# Epidémie d'endophtalmies

156 cas d'endophtalmies fongiques après chir. de cataracte



## Cas dans 14 villes et provinces





# Epidémie d'endophtalmies

## Marque de dispositif utilisé et microbiologie pour 156 cas d'endophtalmie fongique

Brand of OVD	No. (%) cases	<i>Fusarium</i> spp.	Other fungus	Culture-negative
A	152 (97.4)	50	11	90
B	2 (1.4)	NA	1	1
C	1 (0.6)	NA	NA	1
D	1 (0.6)	NA	NA	1
E	0	NA	NA	NA
F	0	NA	NA	NA
Total	156 (100)	50	12	93

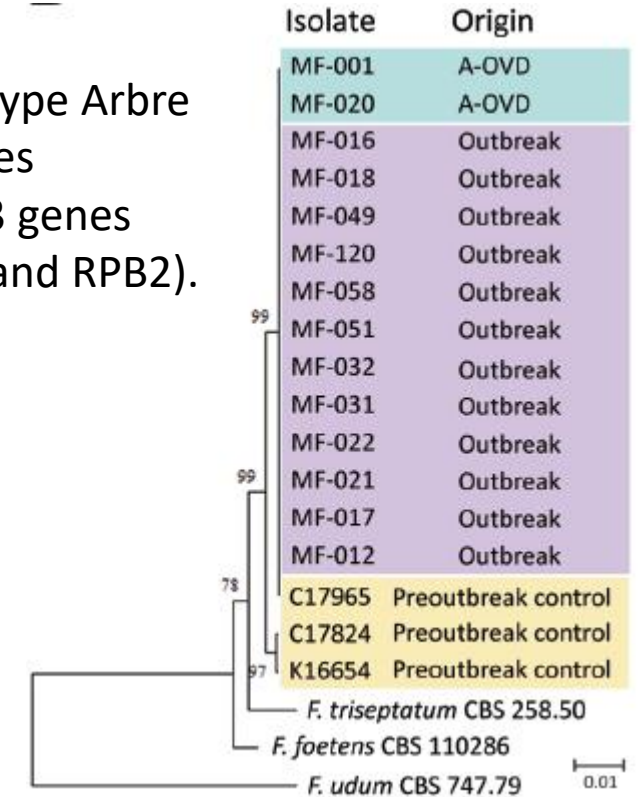
## Risque relatif d'endophtalmie fongique lors d'implantation du dispositif de marque A vs autres

Type de matériel	Cas	Témoins	RR
Fabriquant A	152	49,193	86.0 (27–270)
Autres fabricants, ref	3	83,554	

13 types de prélèvements environnementaux de matériels et dispositifs dans les centres de chirurgie (eau, frigo) tous négatifs

MLST, clade A type Arbre phylogenetic des sequences de 3 genes (TEF1 $\alpha$ , RPB1, and RPB2).

23 Nov 2020, recommandation d'arrêt d'utilisation des dispositifs, rappel de lots et arrêt de production 11 Décembre 2020



- 70-95% des endophtalmie = Gram+
- Fongique <5%, *Aspergillus*, *Candida*, *Acremonium*, and *Fusarium* spp



# L'habit fait-il le moine ?

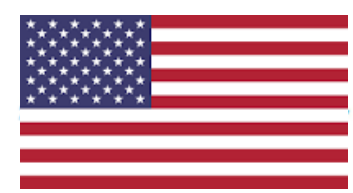
Veillez sélectionner le médecin  
que **vous identifiez le plus comme chirurgien**

- Questionnaire en ligne Juin Juil 2019
- **113 Patients/Visiteurs**
- University of North Carolina Medical Center in Chapel Hill
- Homme et la femme qu'ils identifient à la profession de chirurgien
- Classer les + et les - bien informés, compétents, dignes de confiance et attentionnés



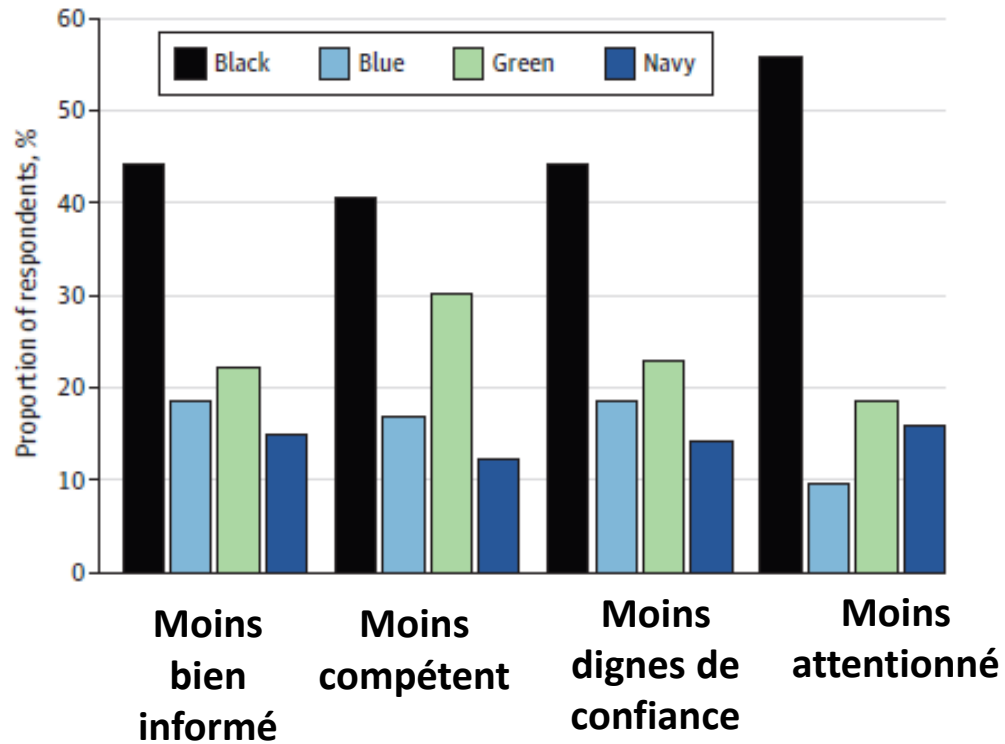
Lequel pensez-vous **être le plus qualifié ?**



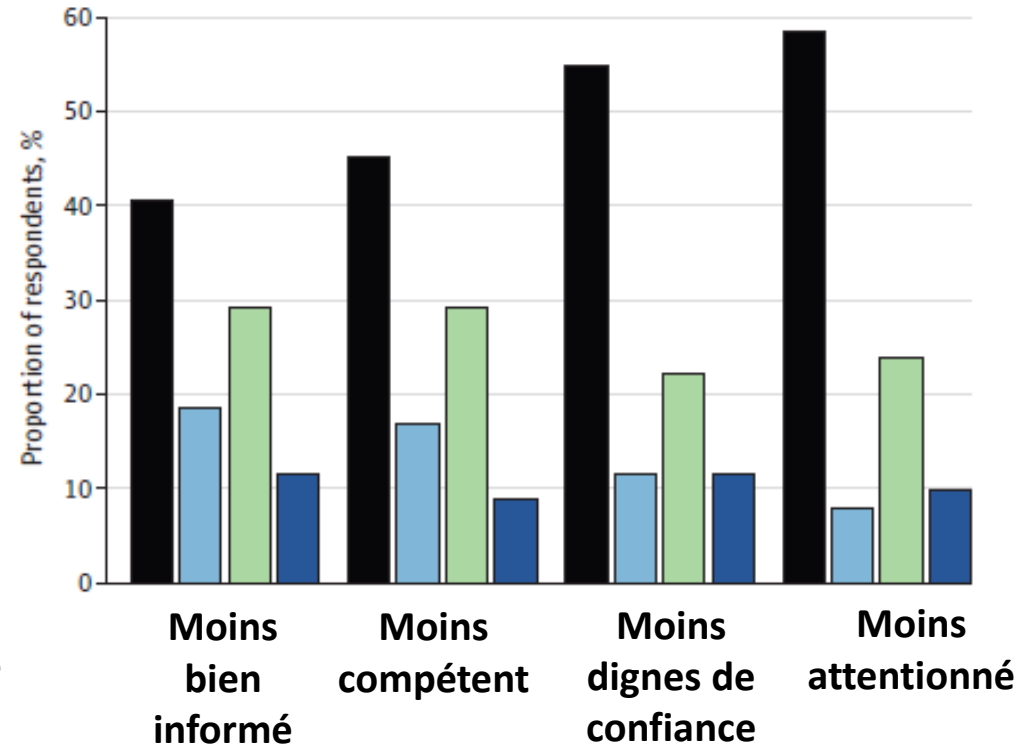


# L'habit fait-il le moine ?

## Si le clinicien est un homme



## Si le clinicien est une femme



= Chirurgien



= Performant



= Attentionné



# Questions en suspens

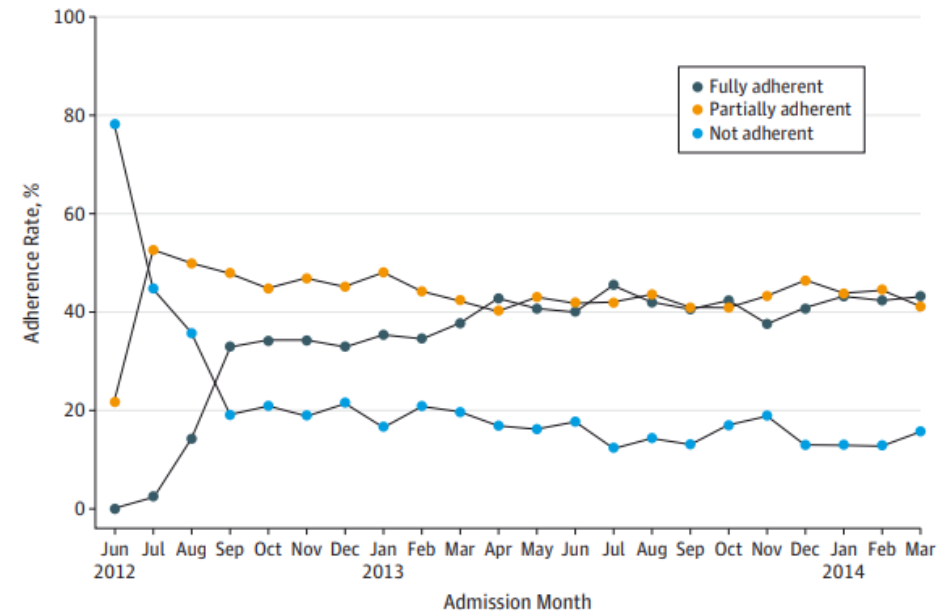
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- **Aucune recommandation SF2H 2013 concernant :**
  - La décolonisation du portage de *S. aureus* diminue-t-elle le taux d'ISO à *S. aureus* :
    - En chirurgie orthopédique prothétique programmée ?
    - En chirurgie de classe de contamination 1 ?
  - **Dépistage nasal de *Staphylococcus aureus* est-il un préalable indispensable à la décolonisation ?**
  - Quelle stratégie de décolonisation du portage de *S. aureus* ?
  - Quels produits pour la décolonisation nasale en alternative à la mupirocine ?

# Quelle stratégie adopter ?

- *US, Etude quasi-exp, 20 hôpitaux, chirurgie cardiaque et orthopédique*
  1. **Prescription** du dépistage
  2. **Prélèvement** durant la consultation préopératoire (10-14 jours avant l'intervention)
  3. Prélèvement **envoyé** au laboratoire pour recherché de *S. aureus*
  4. **Si +, prescription** de mupirocine + CHG jusqu'à 5 jours avant l'intervention
  5. **Si -**, CHG la nuit et matin précédent l'intervention

**En résumé, 4 actions et 1 prise de décision impliquant 4 à 5 acteurs**



≈ 20% non dépistés

22% de SARM+ à 52% SASM+ ont reçu plus de 3 jours de mupirocine

# Quelle stratégie adopter ?

- Modélisation médico-économique NHS, UK : decision-tree model

- Courville (2012) : Ortho → Stratégie dominante Décolonisation Universelle

- Wassenberg (2011) : (Universelle

- 99.6% de probabilité d'être **cout-efficace** pour une valeur de QALYs à £20,000

- Young (2006) : toutes

- Exceptions: sénologie et crânien

Strategy	Total cost	Total QALYs	Incremental cost	Incremental QALYs	ICER
Universal mupirocin	£43	8.9233			
Mupirocin if screened positive	£55	8.9232	£12	-0.0001	Dominated by universal mupirocin
Standard care only	£56	8.9229	£13	-0.0003	Dominated by universal mupirocin

Key: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life year.

# Que faisons nous en pratique ?

- Marc Bonten, Pays-Bas 2018 :
  - *Quelles sont les pratiques actuelles pour les patients bénéficiant de chirurgie orthopédique ou cardiaque? Et que pensez vous de la meilleure*

	Pratiques actuelles	Stratégie préférée
Rien	n=27, 40%	n=3, 4%
Dépister et décolo	n=27, 40%	n=34, 51%
Décolo univ	n=13, 20%	n=30, 45%

*Note: Blue arrows in the original image point from the 'Pratiques actuelles' column to the 'Stratégie préférée' column. One arrow points from 'Rien' to 'Décolo univ' (N=11), and another points from 'Décolo univ' to 'Décolo univ' (N=13).*

*Donc, si ces personnes sont representative du monde, il y a donc un énorme potentiel en prevention de l'infection (avec 40% qui ne font rien).*

*Et également en terme de cout-efficacité avec un nombre equivalent dépistage/décolo et décolonisation universelle.*

# Que faisons nous en pratique ?

- Enquête SF2H juin à septembre 2018, 70 hôpitaux
  - **40%** (N = 28) déclaraient avoir mis en place une procédure de décolonisation
  - Tous utilisaient la mupirocine 2x/jour mais 8/12 J-1/J+3
  - Mupirocine : 28/28 Cutanée : 26/28

	Chir ortho	Chir card
Décolonisation	15	13
Dépistage et décolo	14/15	8/13
Décolonisation universelle	1/15	5/13

- 12/28 hôpitaux ont observés une diminution significative des ISO à *S. aureus*
- 2 des hôpitaux ont observé une augmentation de l'ISO causée par le BGN

# Questions en suspens

---

- **Aucune recommandation SF2H 2013 concernant :**
  - La décolonisation du portage de *S. aureus* diminue-t-elle le taux d'ISO à *S. aureus* :
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  - Quels **produits** pour la décolonisation nasale en alternative à la mupirocine ?

# Alternatives à la mupirocine

---

- PVP-I, antiseptiques alcooliques, thérapie photodynamique
  - Alternatives prometteuses pour la décolonisation temporaire avant intervention chirurgicale
    - Efficacité rapide
    - Activité à large spectre contre de multiples pathogènes opportunistes,
    - Absence de développement de la résistance aux antimicrobiens,
    - Facilité d'utilisation: 1 application pour la PVPI
- Nécessité d'études cliniques complémentaires
  - Confirmation d'efficacité intrinsèque (et non en bundle)
  - Dosage, durée, répétition de l'application nasale ?
  - Association avec une douche ou un bain antiseptique ? Autres sites ?

# Résultats Spicmi 2020-2021

	Unit-Based	Patient-Based
2020		
Etablissements	89	22
Interventions	31 958	8 041
2021		
Etablissements	177	45
Interventions	73 247	22 246

En 2021, 80,3% des interventions étaient en chirurgie orthopédique, chirurgie gynéco-obstétrique et chirurgie digestive



# Résultats Spicmi 2020-2021

Spécialité/ Intervention	UNIT-BASED		PATIENT-BASED	
	2020	2021	2020	2021
	Nb (%) interventions	Nb (%) interventions	Nb (%) interventions	Nb (%) interventions
<b>Chirurgie orthopédique</b>	<b>12 262 (38,4)</b>	<b>26 604 (36,3)</b>	<b>2 348 (29,2)</b>	<b>6 757 (29,8)</b>
Prothèse de hanche (primaire ou de première intention)	7 336 (23,0)	14 435 (19,7)	1 462 (18,2)	3 815 (16,8)
Prothèse de genou (primaire ou de première intention)	4 032 (12,6)	10 077 (13,8)	567 (7,1)	2 378 (10,5)
Reprises de prothèse de hanche	620 (1,9)	1 419 (1,9)	263 (3,3)	420 (1,9)
Reprise de prothèse de genou	274 (0,9)	673 (0,9)	56 (0,7)	144 (0,6)
<b>Chirurgie digestive</b>	<b>4 408 (13,8)</b>	<b>10 483 (14,3)</b>	<b>1 450 (18,0)</b>	<b>3 311 (14,6)</b>
Chirurgie colorectale	2 689 (8,4)	7 193 (9,8)	798 (9,9)	2 193 (9,7)
Appendicectomie	1 719 (5,4)	3 290 (4,5)	652 (8,1)	1 118 (4,9)
<b>Chirurgie gynéco-obstétrique</b>	<b>8 758 (27,4)</b>	<b>21 743 (29,7)</b>	<b>2 880 (35,8)</b>	<b>7 571 (33,4)</b>
Césarienne	5 357 (16,8)	11 054 (15,1)	2 092 (26,0)	4 032 (17,8)
Chirurgie mammaire	3 401 (10,6)	10 689 (14,6)	788 (9,8)	3 539 (15,6)
<b>Chirurgie urologique</b>	<b>3 472 (10,9)</b>	<b>7 672 (10,5)</b>	<b>530 (6,6)</b>	<b>2 900 (12,8)</b>
Urétéroscopie	1 628 (5,1)	3 299 (4,5)	-	1 208 (5,3)
Prostatectomie	565 (1,8)	1 128 (1,5)	124 (1,5)	433 (1,9)
Résection <i>trans-urétrale</i> de la prostate	1 279 (4,0)	3 245 (4,4)	406 (5,0)	1 259 (5,6)
<b>Neurochirurgie</b>	<b>2 024 (6,3)</b>	<b>4 970 (6,8)</b>	<b>271 (3,4)</b>	<b>835 (3,7)</b>
Chirurgie de hernie discale à l'étage lombaire	921 (2,9)	1 916 (2,6)	143 (1,8)	324 (1,4)
Laminectomie et intervention sur le rachis	1 103 (3,5)	3 054 (4,2)	128 (1,6)	511 (2,3)
<b>Chirurgie cardiaque</b>	<b>1 034 (3,2)</b>	<b>1 775 (2,4)</b>	<b>562 (7,0)</b>	<b>1 272 (5,6)</b>
Pontage aorto-coronarien avec greffon local	681 (2,1)	838 (1,1)	196 (2,4)	551 (2,4)
Pontage aorto-coronarien avec greffon sur un autre site	30 (0,1)	15 (<0,1)	4 (<0,1)	15 (0,1)
Chirurgie de remplacement des valves cardiaques	323 (1,0)	922 (1,3)	362 (4,5)	706 (3,1)
<b>Total</b>	<b>31 958 (100)</b>	<b>73 247 (100)</b>	<b>8 041 (100)</b>	<b>22 646 (100)</b>

# Résultats Spicmi 2021

- Sexe-ratio H/F= 0,6, 14 395 femmes, 8 250
- Age moyen :  $58,5 \pm 19,6$  ans
- Durée moyen de séjours hors ambulatoire
  - Préopératoire :  $1 \pm 3$ ; 0 – 101 jours
    - Délai <2 jours: 75,3%
  - Postopératoire :  $6 \pm 7$ ; 0 – 197 jours

# Résultats Spicmi 2021

## Unit-based

2021				
Intervention	Nb interventions	Nb ISO	TI [IC95%]	DI [95%]
Global	73 247	806	1,10 [1,02 – 1,18]	0,57 [0,53 – 0,60]

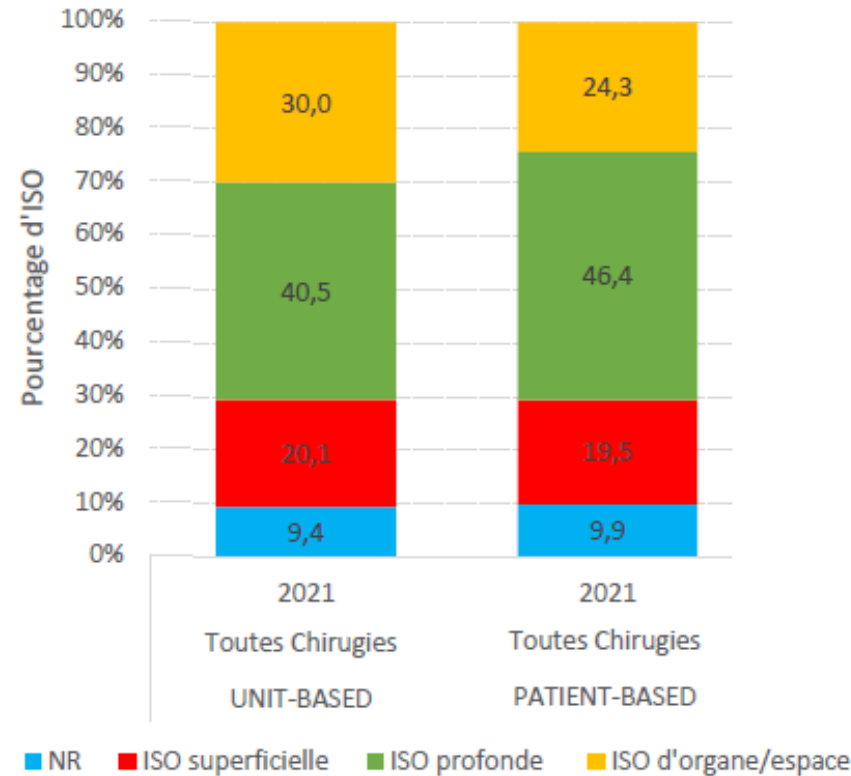
## Patient-based

2021				
Intervention	Nb interventions	Nb ISO	TI [IC95%]	DI [95%]
Global	22 646	416	1,84 [1,66 – 2,01]	0,36 [0,33 – 0,40]
NNIS-0	4 850	104	2,14 [1,73 – 2,56]	0,44 [0,35 – 0,52]
NNIS-1	3 648	150	4,11 [3,45 – 4,77]	0,73 [0,61 – 0,84]
NNIS-2,3	886	52	5,87 [4,27 – 7,46]	1,01 [0,74 – 1,29]

# Résultats Spicmi 2021

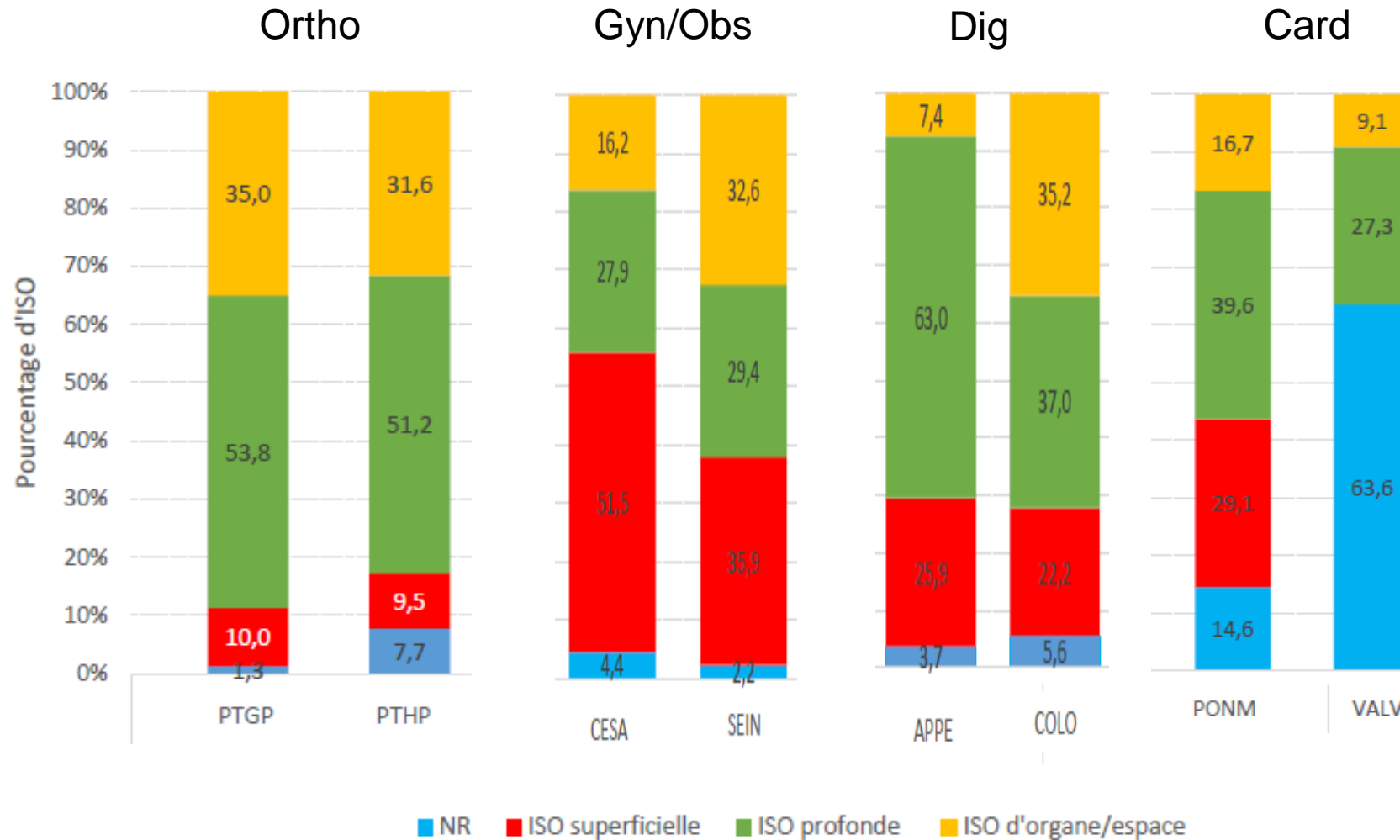
	Nb interv	Nb ISO	TI	DI
PTG	10077	80	0,79	0,23
PTH	14435	168	1,16	0,58
Cesar	11054	68	<b>0,62</b>	0,50
Chir mam	10689	92	0,86	0,75
Chir colo	7193	162	2,25	1,81
Append	3290	27	0,82	0,49
PAC-M	838	48	<b>5,73</b>	4,75
Valve	922	11	1,19	0,29

# Résultats Spicmi 2021

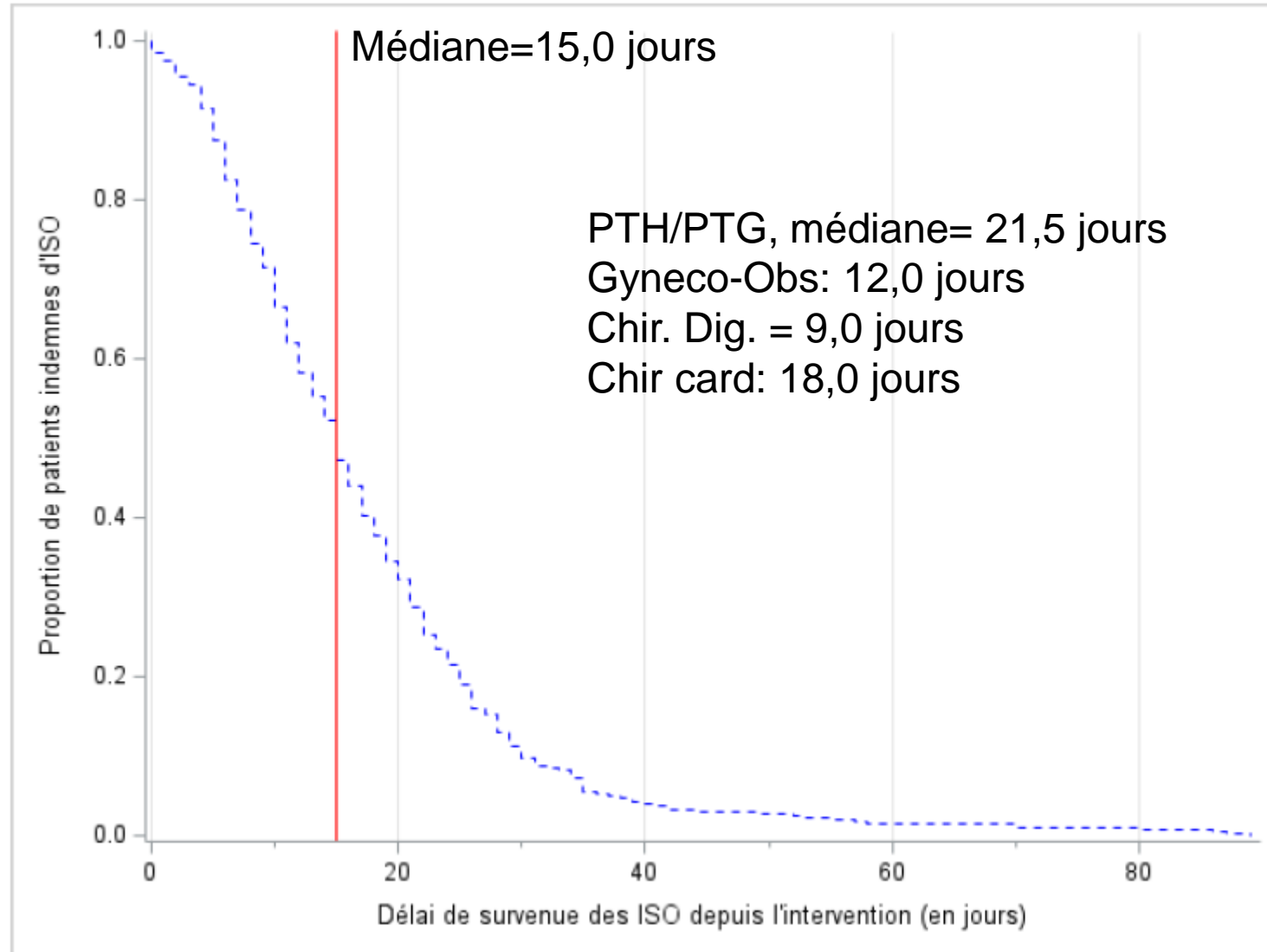


	UNIT-BASED	PATIENT-BASED
	2021	2021
Critère diagnostique des ISO	N (%)	N (%)
Reprise chirurgicale avec prélèvement microbiologique positif	473 (58,7)	215 (51,6)
Reprise chirurgicale avec signes cliniques d'infection	53 (6,6)	27 (6,5)
Prélèvement microbiologique positif avec signes cliniques d'infection	216 (26,8)	165 (39,7)
Prescription d'ATB > 48h et signes cliniques d'infection	64 (7,9)	9 (2,2)
<b>Total</b>	<b>806 (100)</b>	<b>416 (100)</b>

# Résultats Spicmi 2021

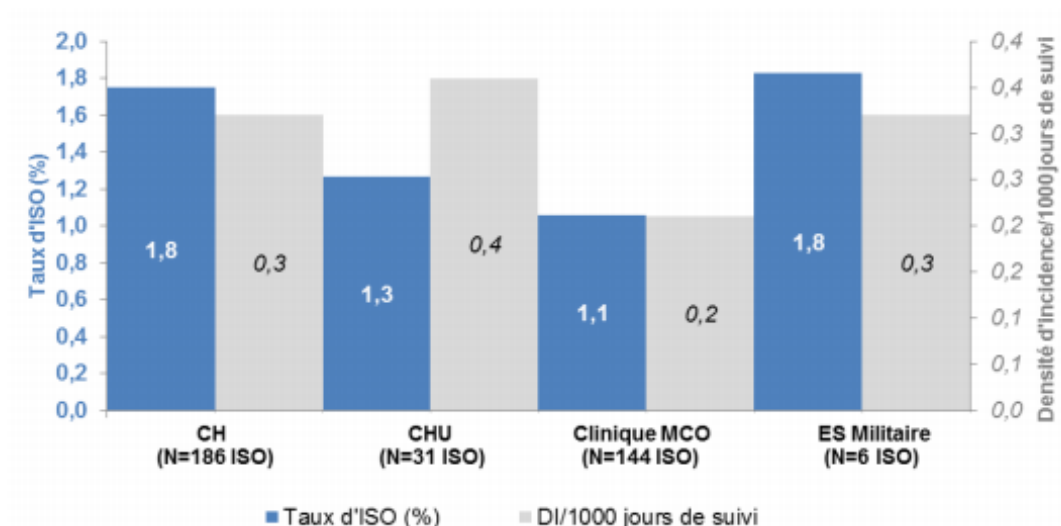


# Résultats Spicmi 2021

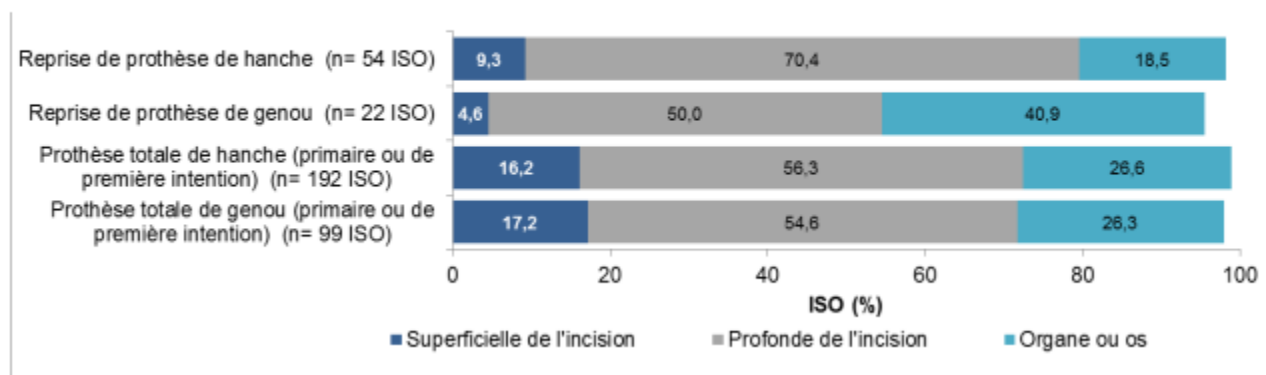


# Résultats ISO-RAISIN 2018

Taux d'incidence et densité d'incidence des ISO selon catégorie d'établissement en chirurgie orthopédique - ISO Raisin 2018



Répartition des ISO selon le site infectieux et le type d'intervention en chirurgie orthopédique - ISO Raisin 2018





# Résultats Spicmi 2021

## Microbiologie des ISO

	Total	Ortho	Gyneco/Obs	Dig	Card
Cocci Gram+	56%				
<i>S. aureus</i>	25%	<b>44%</b>	<b>31%</b>	2%	14%
SCN	12%	<b>17%</b>	<b>18%</b>	-	<b>30%</b>
<i>Enterococcus</i>	10%	6%	9%	<b>20%</b>	7%
Enterobactéries	30%			<b>40%</b>	<b>30%</b>
<i>E. coli</i>	14%	4%	10%	<b>28%</b>	6%
Anaérobies	5%			3%	
<i>P. aeruginosa</i>	4%	3%	3%	6%	4%

# Épidémiologie bactérienne

## *En chirurgie cardiaque*

Reg. Paris., 97-98 Trouillet, 1988 BCB 96-2002  
(7 sces, 198 med) (130 med) (123 med)

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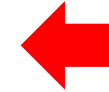
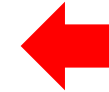
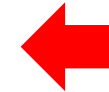
- <i>S. aureus</i>	34%	36%	59%
- <i>S. coagulase neg.</i>	19%	26%	9%
- Autres cocci Gram+	20%	7%	9%
- BGN (Eb, aérobies stricts)	26%	26%	21%
- Autre	1%	4%	2%
- Culture négative	7%	5%	4%

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# Résultats Spicmi 2021

- Durée moyenne d'intervention : 90,2 ± 74,0 minutes
  - min : 8 ; quartile 25% :41 ; médiane : 67 ; quartile 75% : 115 ; max : 1398

Variable	Codage	Nb ISO	Nb interv	Taux d'ISO (%)	OR	IC95%	p
Score ASA	1, 2	214	10 091	2,12	Réf		
	3, 4, 5	144	3 339	4,31	2,08	[1,68-2,58]	<0,0001
Classe de contamination	1, 2	340	15 727	2,16	Réf		
	3, 4	29	792	3,66	1,72	[1,17-2,53]	0,005
Durée d'intervention *	≤ 75è percentile	211	10 313	2,05	Réf		
	> 75è percentile	159	4 751	3,35	1,66	[1,35-2,04]	<0,0001
Intervention non programmée	Non	235	8 839	2,66	Réf		
	Oui	114	3 920	2,91	1,10	[0,87-1,38]	0,43
Vidéo-endoscopie chirurgicale	Non	175	6 845	2,56	Réf		
	Oui	67	2 448	2,74	1,07	[0,81-1,43]	0,63
Procédures multiples	Non	137	6 195	2,21	Réf		
	Oui	125	2 355	5,31	2,48	[1,94-3,17]	<0,0001
Implant	Non	130	4 737	2,74	Réf		
	Oui	121	4 288	2,82	1,03	[0,80-1,32]	0,82

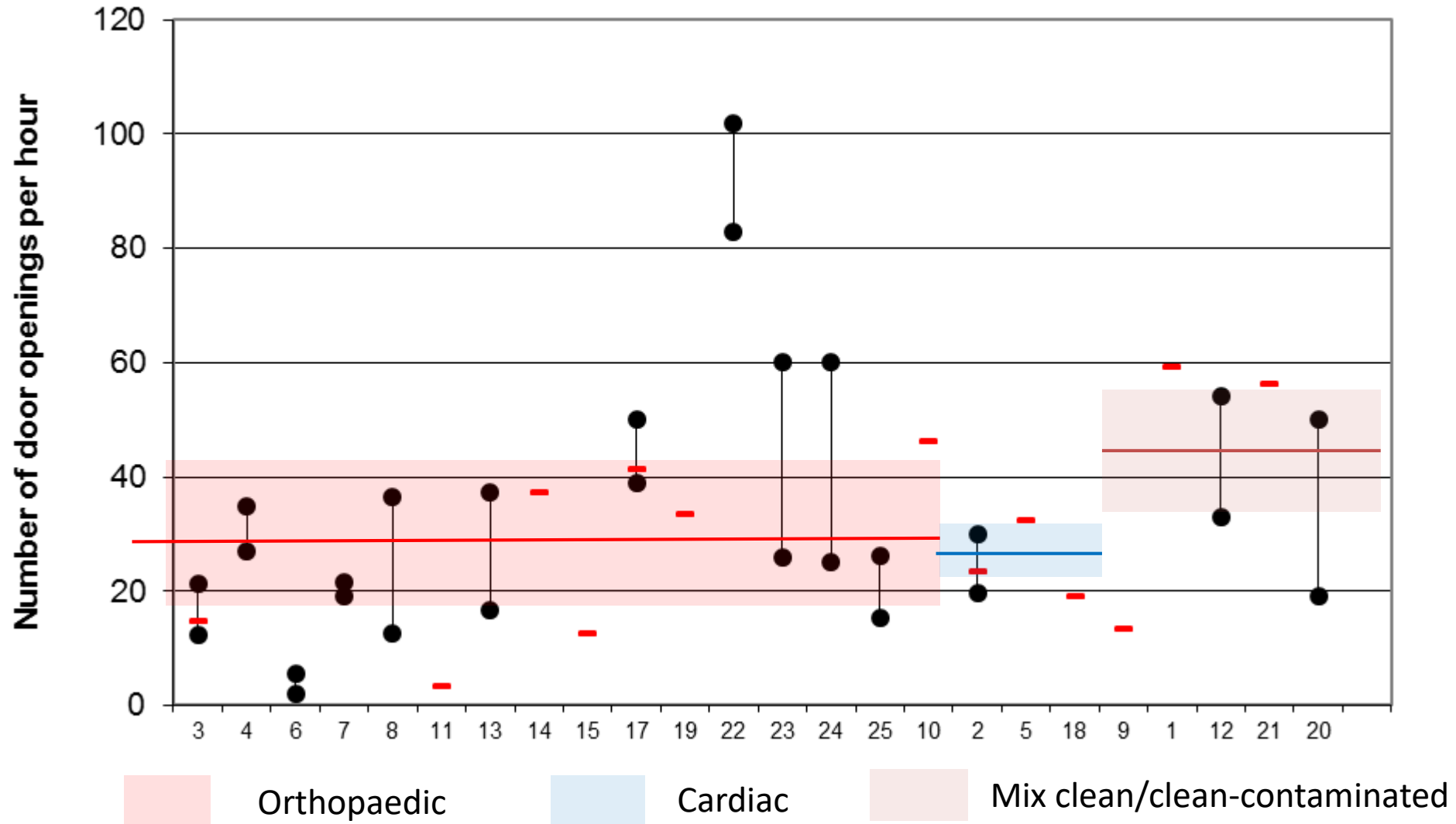


# Résultats Spicmi 2021

Variable	Codage	Nb ISO	Nb interv	Taux d'ISO (%)	OR	IC95%	p
Diabète	Non	227	12 094	1,88	Réf		
	Oui	47	1 197	3,93	2,14	[1,55-2,94]	<0,0001
Hypertension artérielle	Non	191	10 429	1,83	Réf		
	Oui	91	3 141	2,90	1,60	[1,24-2,06]	0,0002
Immunodépression	Non	242	12 233	1,98	Réf		
	Oui	18	266	6,77	3,60	[2,19-5,9]	<0,0001
Malnutrition	Non	220	11 989	1,84	Réf		
	Oui	41	548	7,48	4,33	[3,06-6,11]	<0,0001
Obésité	Non	224	11 758	1,91	Réf		
	Oui	64	2 104	3,04	1,62	[1,22-2,14]	0,0008
Tumeur maligne	Non	192	11 363	1,69	Réf		
	Oui	92	2 648	3,47	2,09	[1,63-2,69]	<0,0001

# Door opening frequency

25 studies identified

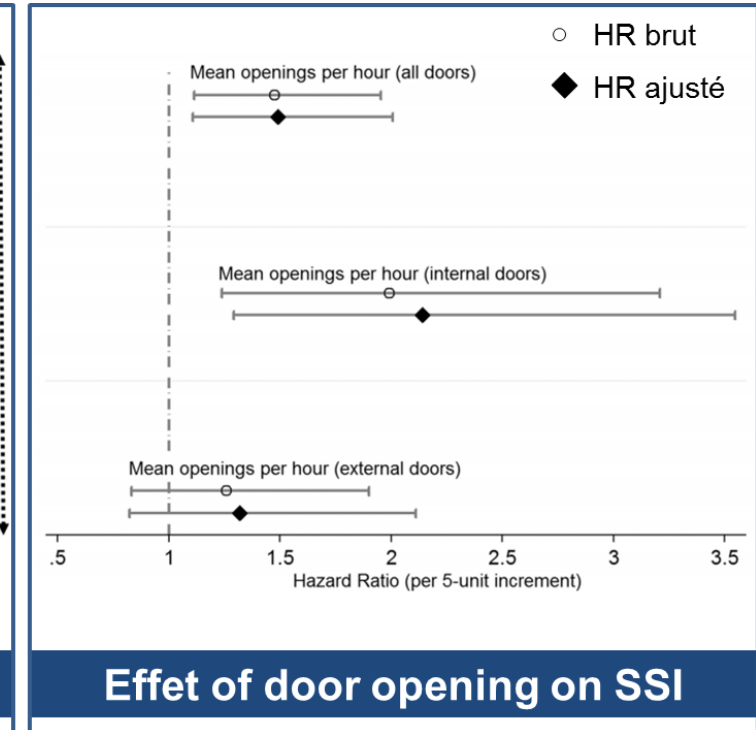
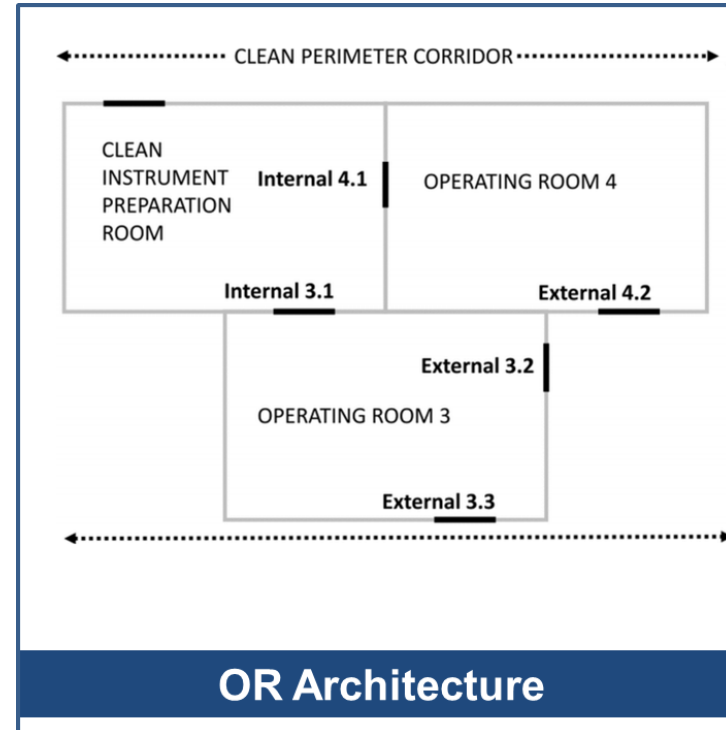


# Association between door openings and Particles/CFU?

Authors (year)	Type of surgery	Ventilation type	Association
Birgand et al. (2019)	Orthopaedic	LAF	Yes
Alsved et al. (2018)	Orthopedic	LAF/Mixing/	No
Perez et al. (2018)	Orthopaedic/general	LAF	Yes
Mathijssen et al. (2916)	Hip revision	Mixing	Yes
Smith et al. (2013)	Orthopaedic	LAF	Yes
Andersson et al. (2012)	Orthopaedic	Displacement	Yes
Stocks et al. (2010)	Joint Arthroplasty	Mixing	-/No
Tjade (1980)	Orthopaedic		No
Birgand et al. (2019)	Cardiac	LAF/Mixing	Yes
Teter et al. (2017)	Plastic surgery	Unknown	Yes
Scaltriti et al. (2007)	Orthopaedic/urology/general	Mixing	No/Yes

# Association between door openings and SSI rate?

- Retrospective cohort, cardiac surg
  - 2 OR, 688 patients, 24 SSI
- SSI at 30 days associated with internal OR door openings
  - Poor coordination among surgical teams
  - differences in air pressure
  - internal OR door openings could be more disturbing for cardiac surgeons



Need to clarify the role of OR door openings as a marker or independent risk factor for SSI.

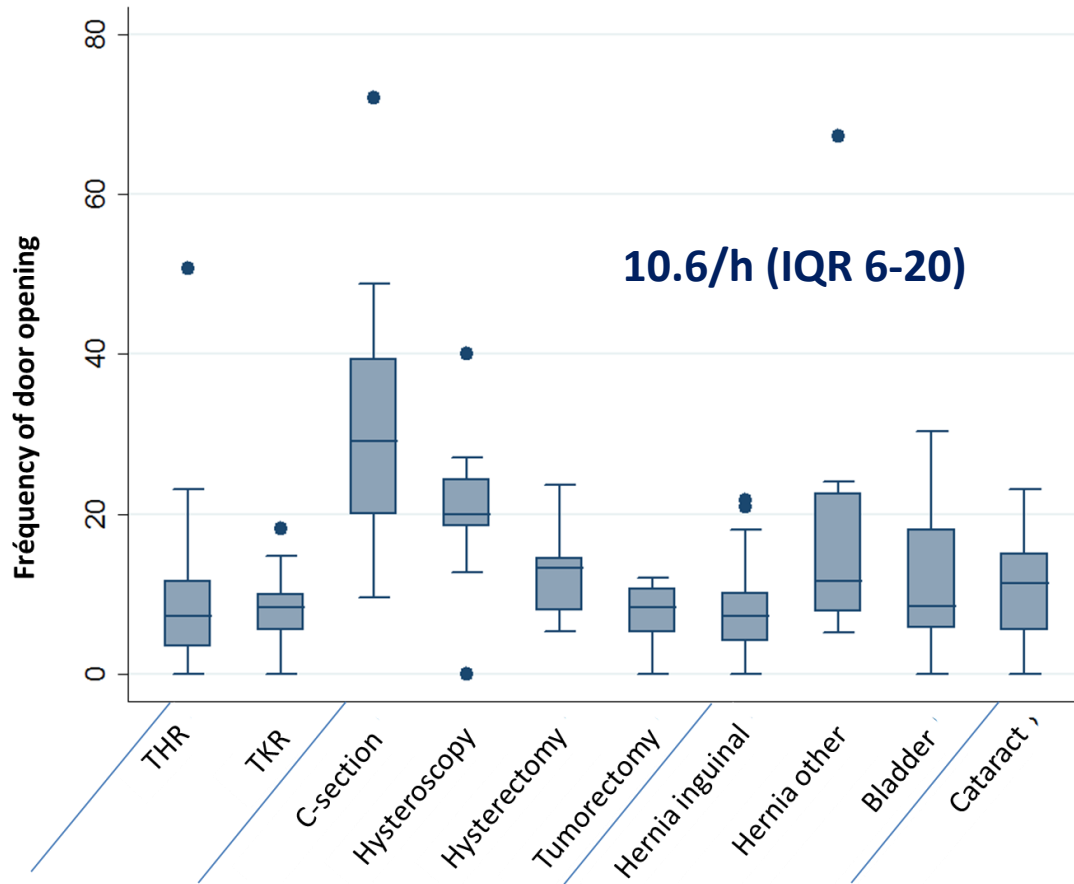
# Association between door openings and SSI rate?

Authors (year)	Type of surgery	Ventilation type	Association
Mears et al. (2015)	Joint Arthroplasty	Mixing	Unclear
Pryor (1998)	Orthopaedic	Unknown	Yes
Bohl et al. (2016)	Neurosurgery	LAF	No
Roth et al. (2019)	Cardiac	LAF	Yes
Young and O'Regan (2010)	Cardiac	Unknown	Yes
Bediako-Bowan (2020)	Abdominal	Mixing	Yes
Crolla et al. (2012)	Colorectal	Unknown	Yes



# Door opening frequency

- 2015, 15 HCFs and 43 surgical teams, 212 operations
  - Direct observations of number, reasons, entries to/exits from incision closure



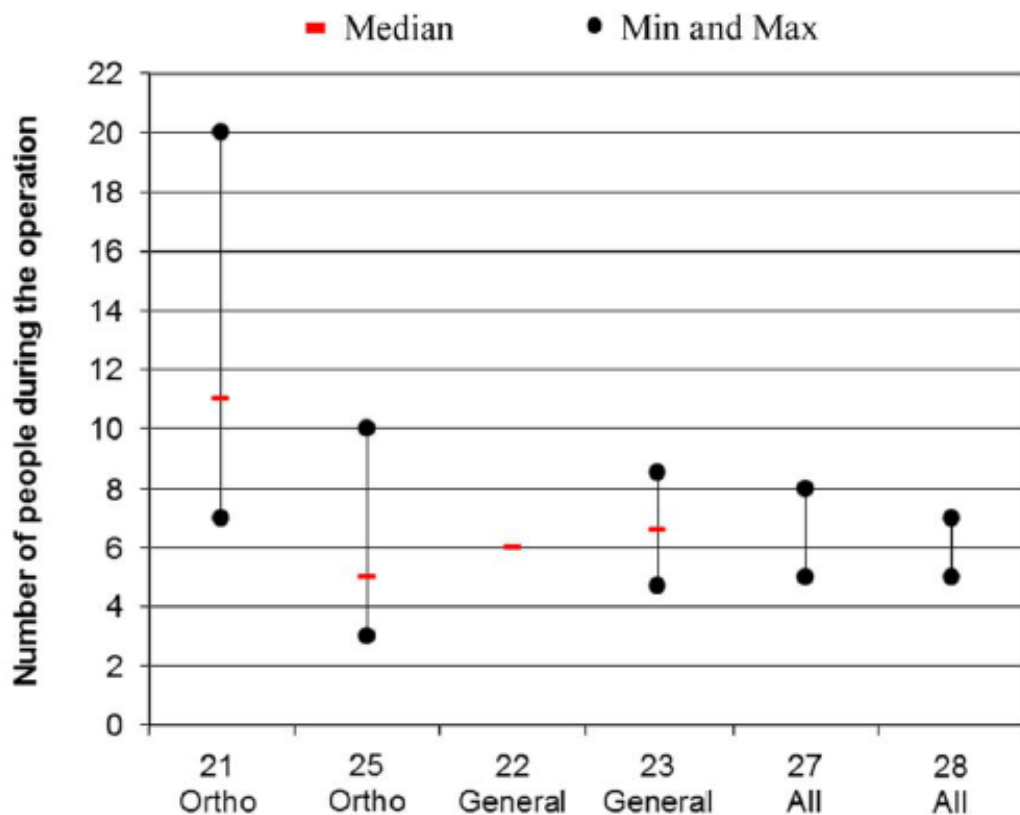
the OR without opening door?

43% Nurses > 24% Other HCWs  
> 21% Anaesthesia team > 11% Surgeons

Why?

≈60% avoidable

44.5% for equipment > 13.8% for communication  
> 13.1% linked to staffing (switch, break)  
Remaining reasons not classifiable.



- 212 procedures: Median: 5 Min-Max: 2-10
- Difference according to specialties (i.e. C-section)
- No difference elective/urgent, Public/private

Study	Type surg	Endpoint	Nb proc.	Assoc.
Scaltitri	All	ABC	12	Yes
Wan	Clean	ABC/APC	33	Yes
Agodi	Ortho	ABC	1228	Yes
Andersson	Ortho	ABC	82	Yes
Durando	All	APC	23	No
Pryor	Clean	SSI	3259	Yes
Wanta	Clean	SSI	1277	Yes

But poor quality, not considering confunders..