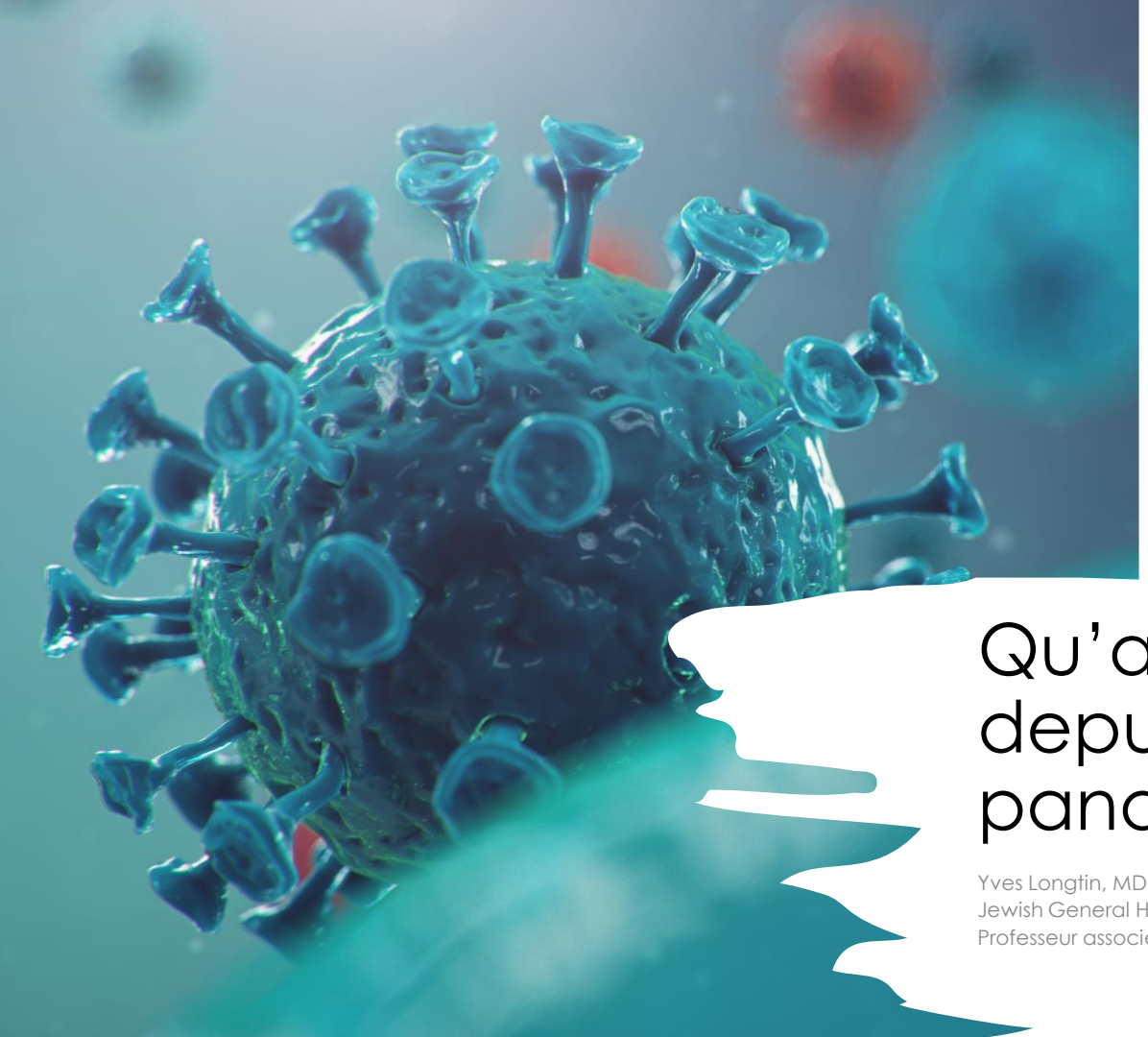


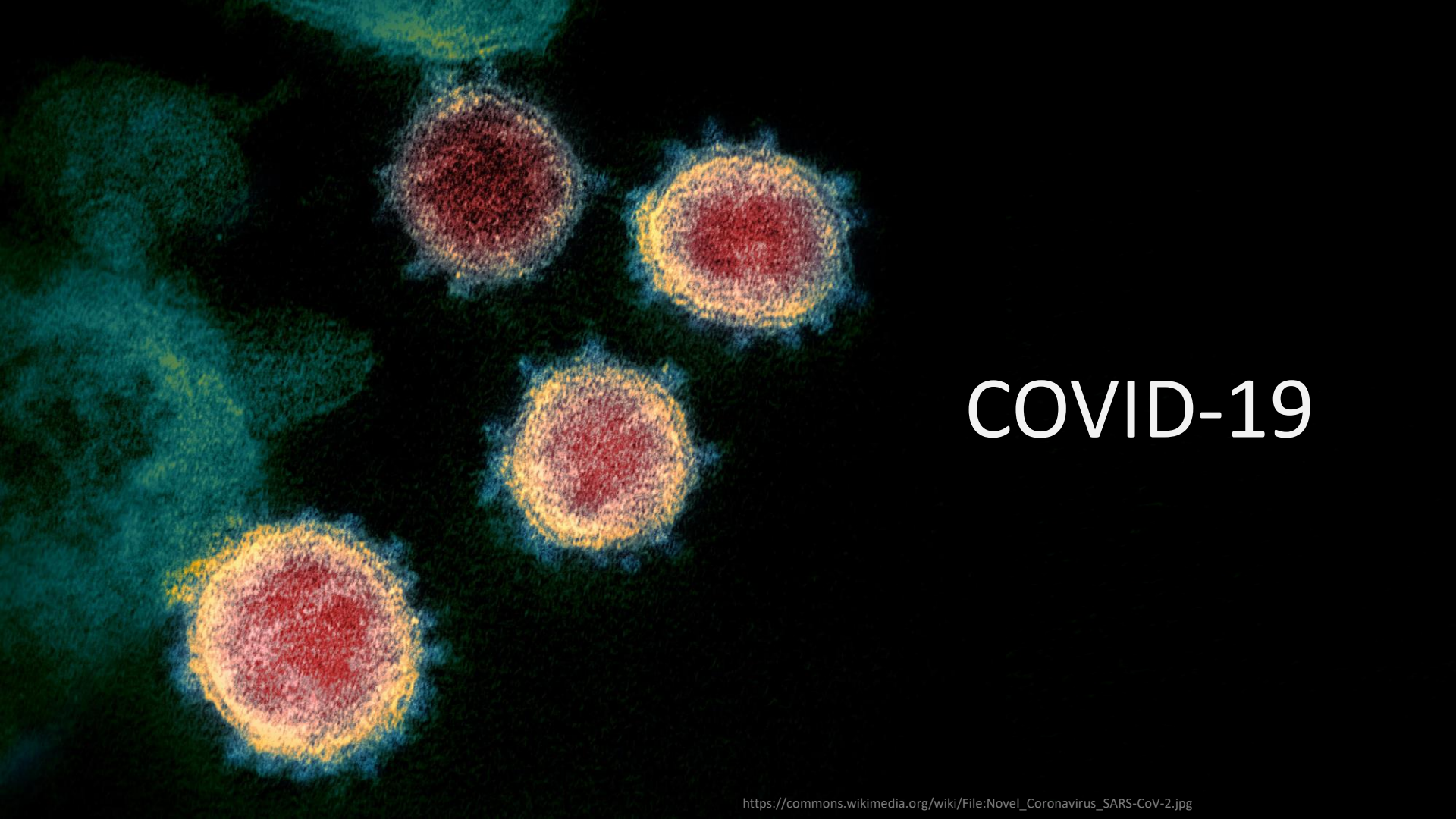
Qu'a-t-on appris depuis le début de la pandémie?

Yves Longtin, MD
Jewish General Hospital, Montreal
Professeur associé de médecine, Université McGill

Déclarations

- Subventions de recherche
  - Merck Canada, BD Diagnostics
- Support salarial du *Fonds de Recherche en Santé du Québec*

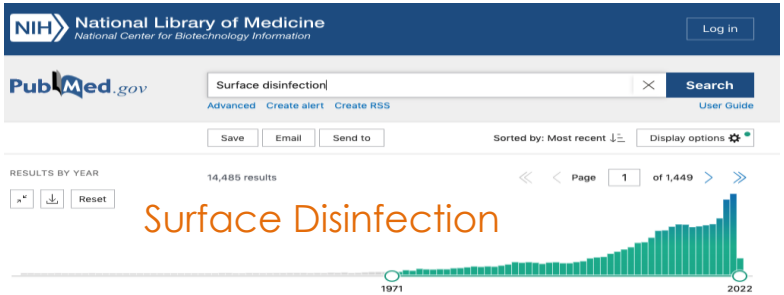
On ne peut pas tout couvrir



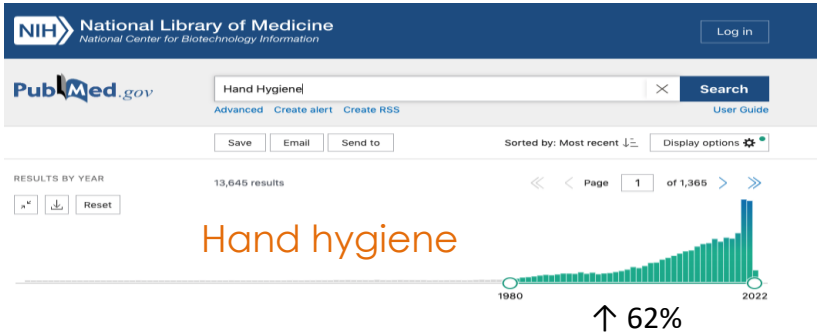
COVID-19

https://commons.wikimedia.org/wiki/File:Novel_Coronavirus_SARS-CoV-2.jpg

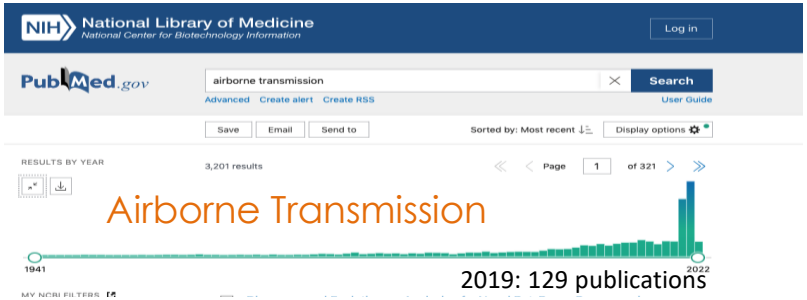
Impact de la COVID sur les publications scientifiques



↑ 25%



↑ 62%

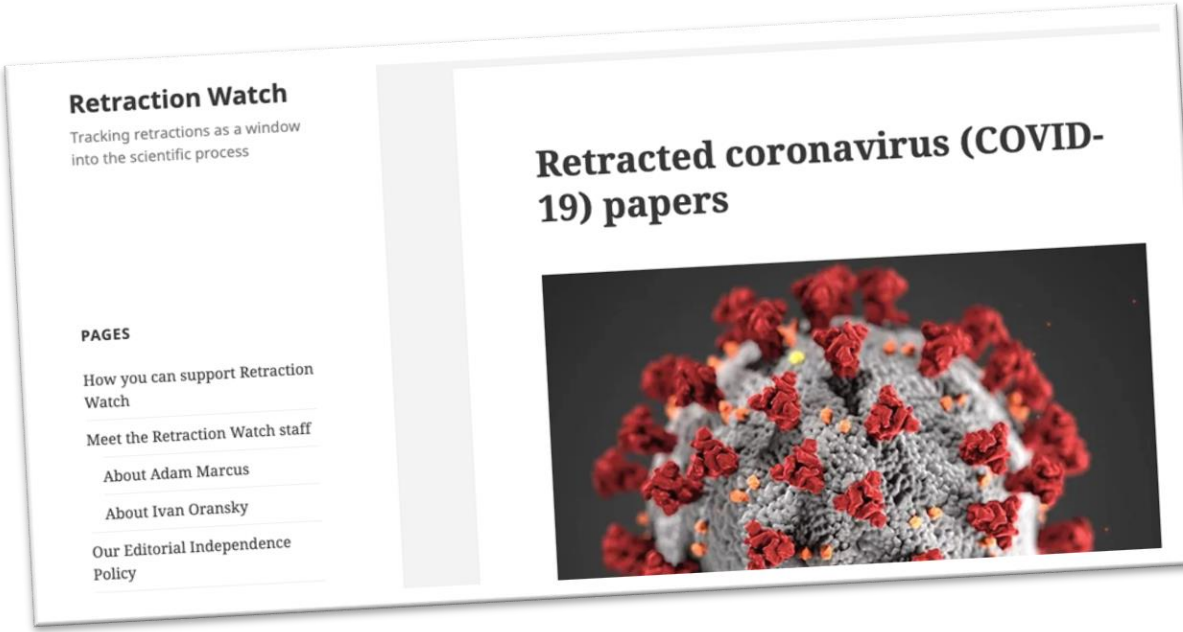


2019: 129 publications
2021: 697 publications
↑ 540%

2019: 62 publications
2021: 592 publications
↑ 950%

Qualité de la recherche

- Rétraction d'articles sur la COVID-19 (sur nombre total)
  - 2020: 36/91,000
  - 2021: 35/136,000
- Toutes publications Pubmed
  - 2020: 735/ 1,626,000 (45 per 100,000)
  - 2021: 281/ 1,768,000 (16 per 100,000)



https://retractionwatch.com/retracted-coronavirus-covid-19-papers/

Source: Pubmed, Feb 26, 2022

The new england journal of medicine

Correspondence

Nursing Home Staff Vaccination and Covid-19 Outcomes

To the Editor: Nursing home staff are considered to be a source of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection (95% confidence interval [CI], 1.05 to 2.07) additional Covid-19 cases per 100 beds among residents, 1.50 (95% CI, 1.06 to 1.94) additional

- Effet de la vaccination du personnel sur les résidents des maisons de retraite
- Immense base de données nationale (Medicare, Medicaid)
  - 12,364 maisons de retraite (81% du total USA)
- Détermination de la couverture vaccinale du personnel (Juin 2021)
- Comparaison des centres avec une couverture vaccinale faible vs élevée (quartile le plus bas vs le quartile le plus élevé) en tenant compte des comtés
  - Modèles de régression multivariés ajustés pour les taux de vaccination des résidents, les antécédents d'infection au COVID parmi le personnel, …

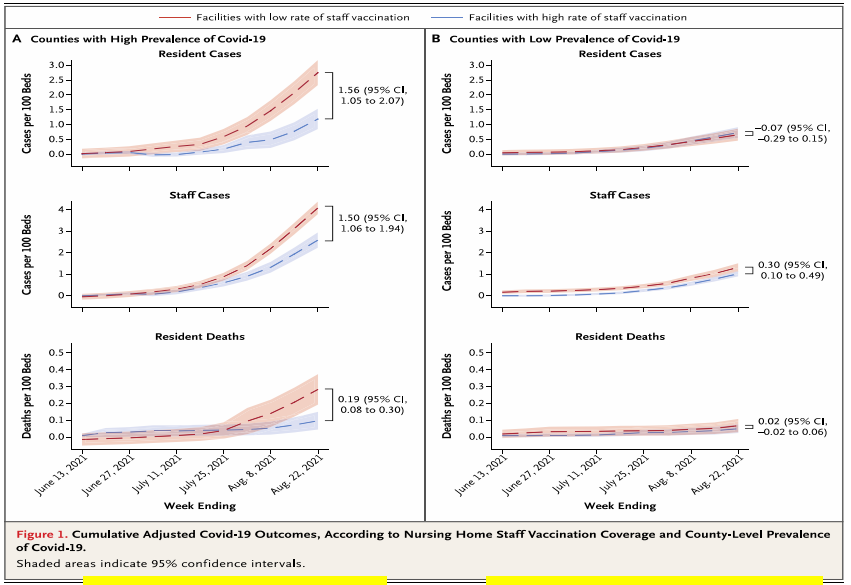


Figure 1. Cumulative Adjusted Covid-19 Outcomes, According to Nursing Home Staff Vaccination Coverage and County-Level Prevalence of Covid-19.
Shaded areas indicate 95% confidence intervals.

Effet plus marqué dans les comtés à forte prévalence de COVID-19

Effet moins marqué dans les comtés à faible prévalence de COVID-19

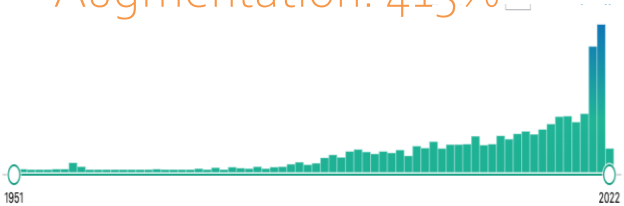
SI TOUS LES ÉTABLISSEMENTS AVAIENT UNE COUVERTURE VACCINALE ÉLEVÉE (83 % EN MOYENNE), cela aurait empêché :

- 4775 infections parmi les résidents (29% du total pendant la période d'étude)
- 7501 infections de TdS
- 703 décès chez les résidents (48% du total)

McGarry BE et al. N Engl J Med. 2022 Jan 27;386(4):397-398.

EPI

Augmentation: 415%



3 fois plus nombreux que HdM

https://www.nelsonstar.com/news/b-c-s-covid-hospitalizations-continue-to-decline-no-new-deaths-reported/

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Availability and crisis standards of care for personal protective equipment during fall 2020 of the COVID-19 pandemic: A national study by the APIC COVID-19 task force

Terri Rebmann PhD, RN, CIC, FAPIC [a,*], Rebecca T. Alvino RN, MS, CNS, CIC [b], Jill E. Holdsworth MS, CIC, FAPIC, NREMT, CRCST [c]

[a] Institute for Biosecurity, Department of Epidemiology & Biostatistics, Saint Louis University, College for Public Health and Social Justice, Saint Louis, MO
[b] UCSF Health, San Francisco, CA
[c] Infection Prevention Department, Emory University Hospital Midtown, Atlanta, GA

- Sondage members APIC, Octobre 2020
  - Lien envoyé à tous les membres
- 1081 répondants
  - “convenience sample”
  - 94.5% femmes
  - Surtout C.s. aigus (59%)
- Pénurie plus aiguë pour le N95, les fournitures de désinfection, les blouses réutilisables

Healthcare facility type[†]	
Hospital	59.0 (638)
Ambulatory care	27.0 (292)
Long-term care facility	18.4 (199)
Critical access hospital	15.2 (164)
Inpatient rehabilitation center or behavioral health	12.6 (136)
Urgent care	6.3 (68)
Home health or hospice	6.1 (66)
Dialysis	4.1 (44)

Table 2
Access to personal protective equipment and infection prevention supplies

	N = 1,081						
		Current amount available*					
	Current amount available $\bar{x}$ (*sd*)	Have none % (n)	Almost out % (n)	Running A bit Low % (n)	Have sufficient amount % (n)	Have plenty % (n)	Has sufficient amount (yes/no) % (n)
Personal Protectiveequipment							
Masks	3.1 (.65)	0	2.0 (22)	10.3 (111)	62.2 (672)	25.5 (276)	87.7 (948)
Face Shields	3.1 (.68)	0.6 (6)	1.5 (16)	10.5 (113)	61.3 (663)	6.2 (283)	87.5 (946)
Goggles	3.0 (.87)	3.5 (38)	2.5 (27)	11.7 (127)	59.3 (641)	22.9 (248)	82.2 (889)
Gloves	3.1 (.85)	0	3.6 (39)	20.2 (218)	37.5 (405)	38.8 (419)	76.2 (824)
Isolation Gowns	2.9 (.88)	1.9 (20)	3.2 (35)	21.3 (230)	46.3 (500)	27.4 (296)	73.6 (796)
N95 Respirators	2.7 (.92)	5.2 (56)	3.7 (40)	18.2 (197)	60.3 (652)	12.6 (136)	72.9 (788)
Cloth gowns	2.2 (1.6)	29.5 (319)	1.9 (20)	7.7 (83)	36.9 (399)	24.1 (260)	61.0 (659)
Other Infection prevention Supplies							
Hand Soap	3.4 (.70)	0.2 (2)	1.0 (11)	8.9 (96)	43.7 (472)	46.3 (500)	89.9 (972)
Injection Supplies	3.4 (.75)	0.4 (4)	1.5 (16)	9.5 (103)	38.6 (417)	50.0 (541)	88.6 (958)
Hand Sanitizer	3.1 (.78)	0.2 (2)	2.4 (26)	16.5 (178)	45.3 (490)	35.6 (385)	80.9 (875)
Disinfection Supplies	2.9 (.82)	0	4.7 (51)	23.2 (251)	46.6 (504)	25.4 (275)	72.1 (779)

*0 = have none; 1 = almost out (unsure if current supplies will last until replacements arrive); 2 = running a bit low (more has been ordered but we should have enough until it arrives); 3 = have sufficient amount (crisis standards of care are in place, but we have enough); 4 = have plenty (no crisis standards of care in place; PPE are single use items).

Grande disparité entre les répondants

Rebmann T et al. Am J Infect Control. 2021 Jun;49(6):657-662.

Contents lists available at ScienceDirect
American Journal of Infection Control
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[b] UCSF Health, San Francisco, CA
[c] Infection Prevention Department, Emory University Hospital Midtown, Atlanta, GA

- Type d'établissement et pénuries d'EPI
  - Les établissements de soins de longue durée, les soins ambulatoires et les soins à domicile sont moins susceptibles de déclarer un nombre suffisant de respirateurs
  - Les soins ambulatoires sont moins susceptibles de déclarer suffisamment de gants et de masques
  - Aucune variation entre le type d'installation pour la protection oculaire
- 30 % des installations ont utilisé des N95 non approuvés par le NIOSH

Table 3
Respiratory decontamination methods currently employed or used during the past 3 months

Decontamination method	N = 1081% (n)
Vaporous hydrogen peroxide	24.1 (261)
Ultraviolet germicidal irradiation	19.0 (205)
Batelle®	3.6 (39)
Moist Heat	1.8 (19)
Other	1.9 (20)

- Réutilisation du matériel
  - 65 % réutilisent les respirateurs
    - Jusqu'à 5 fois 61%
    - Autant de fois que possible 39%
  - 45 % des N95 décontaminés à un moment donné
  - 32 % réutilisent les blouses d'isolement (en tissu ou jetables)

Rebmann T et al. Am J Infect Control. 2021 Jun;49(6):657-662.

Infection Control & Hospital Epidemiology (2021), 1–6
doi:10.1017/ice.2021.218

Original Article

A simulation study to evaluate contamination during reuse of N95 respirators and effectiveness of interventions to reduce contamination

Daniel F. Li BS[1], Heba Alhmidi MD[1], Jacob G. Scott MD, DPhil[2,3], Ian C. Charnas BS[4], Basya Pearlmutter BS[1], Sandra Y. Silva MD[5], Brigid M. Wilson PhD[6] and Curtis J. Donskey MD[3,6]

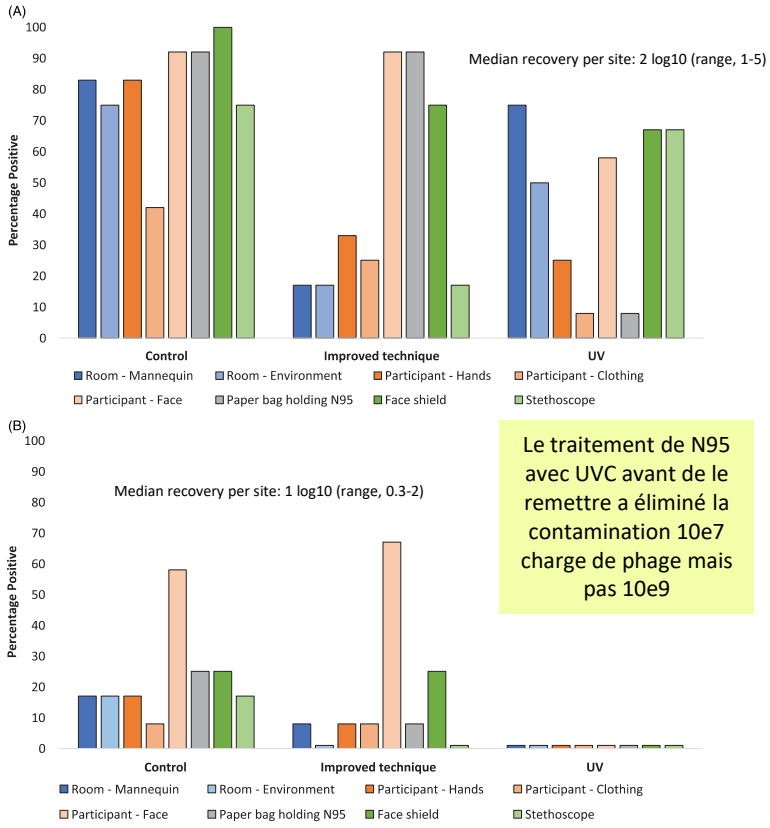
[1]Research Service, Louis Stokes Cleveland Veterans' Affairs (VA) Medical Center, Cleveland, Ohio, [2]Cleveland Clinic Lerner Research Institute, Cleveland, Ohio, [3]Case Western Reserve University School of Medicine, Cleveland, Ohio, [4]Case Western Reserve University School of Engineering and Sears think[box], Cleveland, Ohio, [5]Clinical and Translational Science Program, Case Western Reserve University School of Medicine, Cleveland, Ohio and [6]Geriatric Research, Education, and Clinical Center, Louis Stokes Cleveland VA Medical Center, Cleveland, Ohio

- Contamination du N95 par le bacteriophage MS2 10e7-10e9* PFU, puis mise en place dans 3 conditions différentes
- Soins simulés sur mannequin
  - Examen du patient, objets en mouvement, etc.
- En fin de simulation, prélèvement de différentes zones (respirateur, main, vêtements, écran facial, mannequin, barrières de lit) pour culture bactériophage

* Récupération: 10e4 to 10e6 PFU

Li DF et al. Infect Control Hosp Epidemiol. 2021 May 10;1-6.

Contamination on Donning



Le traitement de N95 avec UVC avant de le remettre a éliminé la contamination 10e7 charge de phage mais pas 10e9

Fig. 1. Percentage of sites positive for contamination with bacteriophage MS2 in 3 groups during simulations with N95 respirators with (A) a higher level and (B) a lower level of contamination.

Infection Control & Hospital Epidemiology (2021), 1–6
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- 1 ml Contamination de l'avant du respirateur avec de la lotion fluorescente (n = 6)

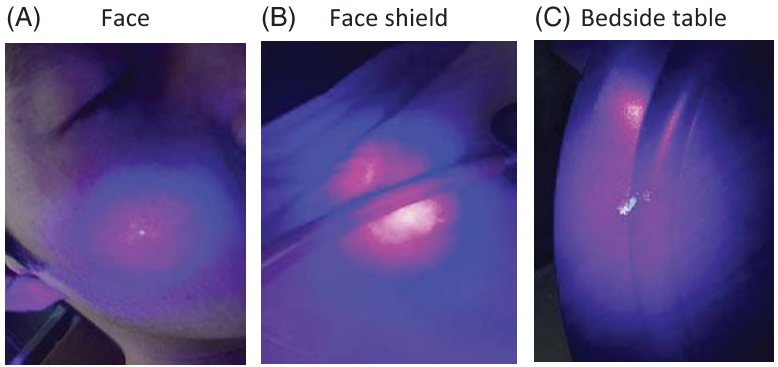


Fig. 2. Pictures showing fluorescent lotion transferred from the external facepiece of an N95 respirator during simulated patient care encounters to (A) a participant's face, (B) face shield, and (C) bedside table.

Li DF et al. Infect Control Hosp Epidemiol. 2021 May 10;1-6.

AMÉLIORER l'ÉPI

JAMA Internal Medicine | Original Investigation

Evaluation of Cloth Masks and Modified Procedure Masks as Personal Protective Equipment for the Public During the COVID-19 Pandemic

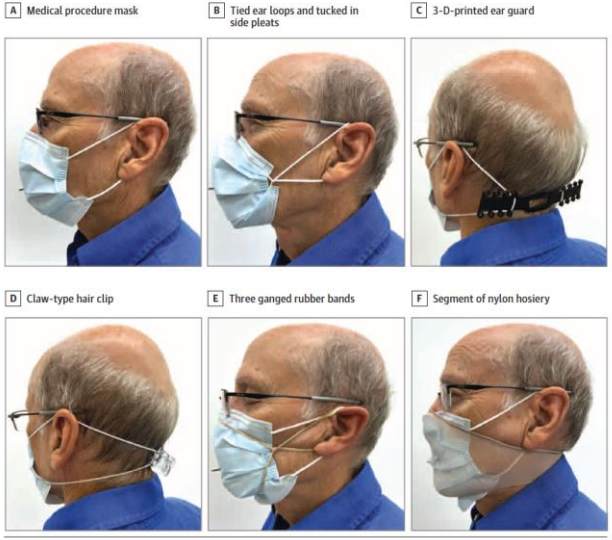
Phillip W. Clapp, PhD; Emily E. Sickbert-Bennett, PhD, MS; James M. Samet, PhD, MPH; Jon Berntsen, PhD; Kirby L. Zeman, PhD; Deverick J. Anderson, MD, MPH; David J. Weber, MD, MPH; William D. Bennett, PhD; for the US Centers for Disease Control and Prevention Epicenters Program

Améliorer l'ajustement du masque de procédure

Protection du TdS

- Évaluer l'efficacité de filtration ajustée (EFF) de diverses modifications de masques de procédure médicale pour améliorer l'ajustement
- EFF évaluée en chambre d'exposition
  - Particules de NaCl avec un diamètre médian de 0,05 um (plage, 0,02 – 0,60 um)*
  - Ambiance représentative des conditions intérieures typiques
  - Orifice d'échantillonnage dans chaque masque pour échantillonner derrière le masque avec échantillonnage simultané de l'air atmosphérique
  - Un seul participant (homme de 163lbs, 5'10'' imberbe).

Figure 2. Medical Procedure Mask and Modifications Designed to Enhance Mask Fit or Comfort for the Wearer



A medical procedure mask with ear loops (A) was modified by tying the ear loops and tucking in the side pleats (B), attaching ear loops to a 3-dimensional–printed "ear guard" (C), fastening ear loops with a 23-mm claw-type hair clip placed behind the wearer's head (D), placing a ring of 3 ganged rubber bands over the mask and around the wearer's ears (E), and sliding a 10-inch segment of nylon hosiery over the fitted procedure mask (F).

Clapp PW et al. JAMA Intern Med. 2021;181(4):463-469.

*SARS-CoV-2: 0.06-0.14um in diameter

JAMA Internal Medicine | Original Investigation

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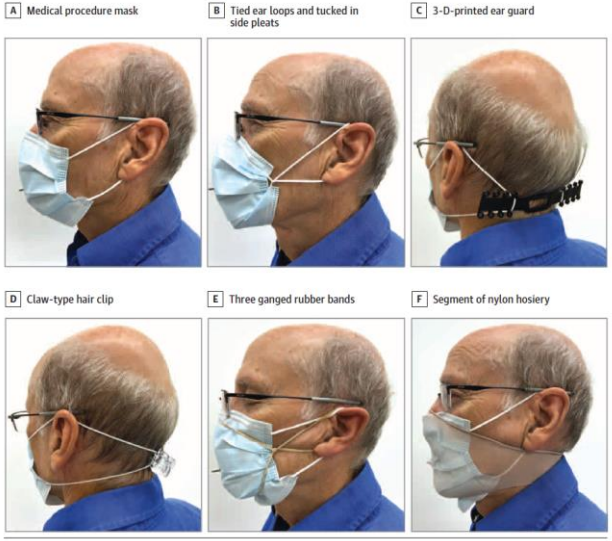

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Medical face masks and modifications		
3M 9210 NIOSH-approved N95 respirator	New	98.4 (0.5)
Surgical mask with ties	New	71.5 (5.5)
Procedure mask with ear loops	New	38.5 (11.2)
Procedure mask with ear loops		
Loops tied and corners tucked in	New	60.3 (11.1)
Ear guard	New	61.7 (6.5)
23-mm Claw hair clip	New	64.8 (5.1)
Fix-the-mask (3 rubber bands)	New	78.2 (3.3)
Nylon hosiery sleeve	New	80.2 (3.1)

Abbreviations: FFE, fitted filtration efficiency; NIOSH, National Institute for Occupational Safety and Health.

[a] The percentage of FFE corresponds to 100 × (1 − behind the mask particle concentration / ambient particle concentration). Overall FFE percentage and SD were calculated across the length of the test.

Clapp PW et al. JAMA Intern Med. 2021;181(4):463-469.

American Journal of Infection Control 50 (2022) 133–140

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Améliorer l'ajustement du masque de procédure

Major Article

Face mask fit modifications that improve source control performance

Francoise M. Blachere MSc [a,*], Angela R. Lemons MSc [a], Jayme P. Coyle PhD [a], Raymond C. Derk MSc [a], William G. Lindsley PhD [a], Donald H. Beezhold PhD [a], Karen Woodfork PhD [b,d], Matthew G. Duling MSc [c], Brenda Boutin BS [c], Theresa Boots MSc [a], James R. Harris PhD [c], Tim Nurkiewicz PhD [b,d], John D. Noti PhD [a]

[a] Health Effects Laboratory Division, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Morgantown, WV
[b] Department of Physiology and Pharmacology, West Virginia University School of Medicine, Morgantown, WV
[c] National Personal Protective Technology Laboratory, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Morgantown, WV
[d] Center for Inhalation Toxicology, West Virginia University School of Medicine, Morgantown, WV

- Étudier les modifications qui améliorent l'ajustement du masque en tant que dispositif de contrôle de la source (pour réduire la quantité de gouttelettes de toux et d'aérosols expulsés)
- 2 masques médicaux et 3 masques en tissu
- Tests d'ajustement sur mannequin propulsant des particules contenant de la fluorescéine (gamme de taille, 0-20um diam) lors de simulations de toux et de respiration.
- Particules émises mesurées avec Anderson Impactor

Contrôle de la source

National Institute for Occupational Safety and Health NIOSH

Blanchere FM et al. Am J Infect Control. 2022 Feb;50(2):133-140.

edure

Contrôle de la source

ELSEVIER

Major Article

Face mask fit modification

Francoise M. Blachere MSc [a,*], An
William G. Lindsley PhD [a], Donald
Brenda Boutin BS [c], Theresa Boots

[a] Health Effects Laboratory Division, National Institute for
[b] Department of Physiology and Pharmacology, West Virg
[c] National Personal Protective Technology Laboratory, Na
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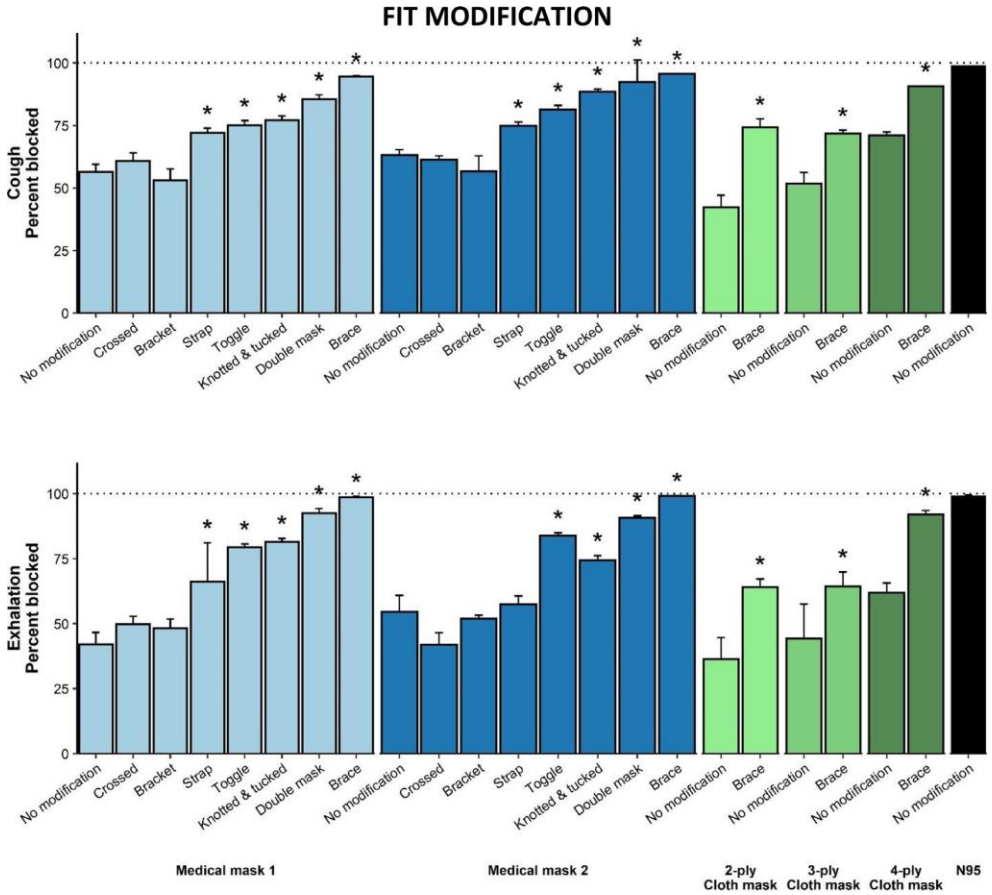

Fig 1. Source control performance of face masks (denoted by colors) with and without fit modifications. For comparison, source control data for an N95 respirator was included. Total particles blocked (%) by medical and cloth face masks with and without fit modifications following cough (top) and exhalation (bottom) simulations. Percentage blocked is based on mass of particles collected following unmasked source coughing and exhalation experiments. Asterisks (*) indicate the modification was determined to be statistically significant ($p < .05$) compared to the corresponding no modification control.

Blanchere FM et al. Am J Infect Control. 2022 Feb;50(2):133-140.

American Journal of Infection Control 50 (2022) 133–140

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Improving procedure mask fit

Contrôle de la source

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[d] Center for Inhalation Toxicology, West Virginia University School of Medicine, Morgantown, WV

Performances réduites du masque non modifié en raison d'une efficacité de collecte inférieure des particules <3,3 um de diamètre

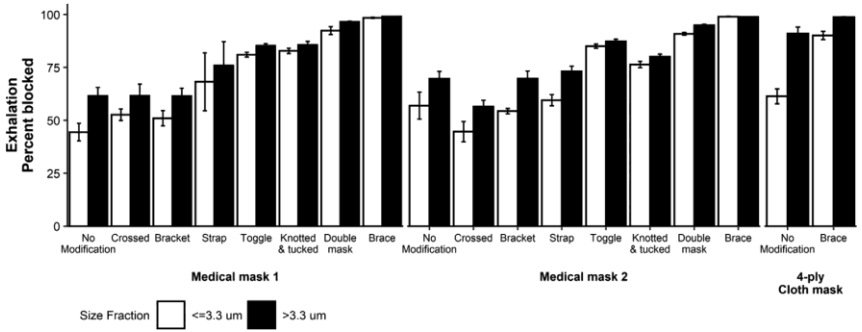


Fig 2. Percentage of particles in size fractions less and greater than 3.3 μm blocked by face masks with and without fit modifications. Particles blocked (%) in the size fraction ≤3.3 μm (white bars) and the size fraction >3.3 μm (black bars) following cough (top) and exhalation (bottom) simulations.

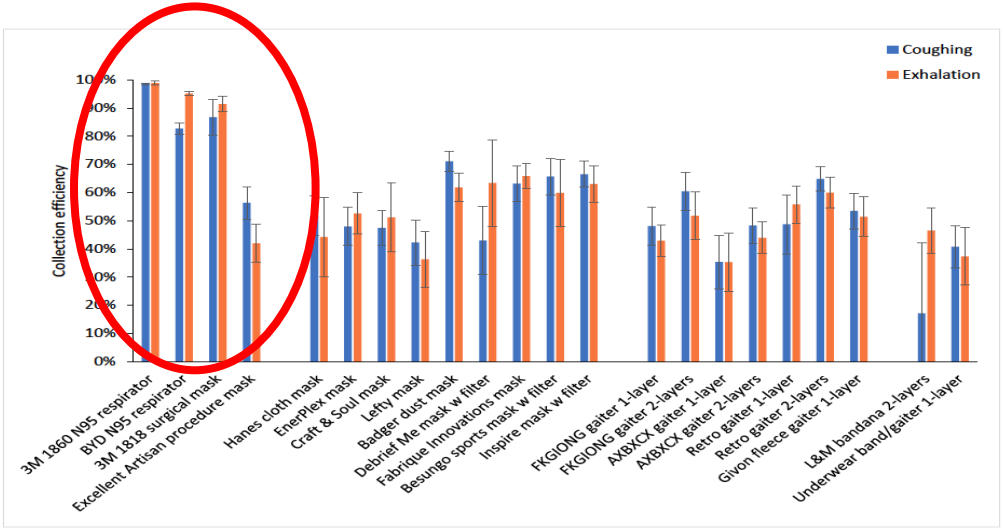
Blanchere FM et al. Am J Infect Control. 2022 Feb;50(2):133-140.

A comparison of performance metrics for cloth face masks as source control devices for simulated cough and exhalation aerosols

William G. Lindsley [a], Francoise M. Blachere [a], Donald H. Beezhold [a], Brandon F. Law [a], Raymond C. Derk [a], Justin M. Hettick [a], Karen Woodfork [b, d], William T. Goldsmith [b, d], James R. Harris [c], Matthew G. Duling [c], Brenda Boutin [c], Timothy Nurkiewicz [a, b, d], and John D. Noti [a]

PrePrint

Quelques nuances re. efficacité de collecte des masques N95. Tous les respirateurs ne sont pas égaux



Manikin in cough chamber

Figure 3: Collection efficiencies of N95 respirators, medical masks, cloth face masks, neck gaiters and bandanas during coughing and exhalation aerosol tests with the respiratory aerosol source control measurement system. Each bar is the mean of 4 or 6 experiments. Error bars show the standard deviation.

Lindsley WG et al. medRxiv. 2021 Feb 19;2021.02.16.21251850.

Masques chirurgicaux

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevier.com/locate/jhin

The defects of lace-up surgical masks and related solutions in operating rooms

X. Wang [a,†], F. Lin [b,†], Z. Wang [c,†], J. Hu [d], X. Li [d], B. Zhu [d], J. Zhang [d,*]

[a] Department of Clinical Medicine, Medical College of Qinghai University, Xining, China
[b] Department of Anesthesiology, Beijing Shijitan Hospital, Capital Medical University/Peking University Ninth School of Clinical Medicine, Beijing, China
[c] National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China
[d] Department of General Surgery, Beijing Shijitan Hospital, Capital Medical University/Peking University Ninth School of Clinical Medicine, Beijing, China

- Difficile de faire en sorte que les masques chirurgicaux à lacets soient bien ajustés autour du visage (mauvaise tension des cordes non extensibles)
- Développement de nouvelles méthodes de port
- Amélioration des taux d'ajustement
  - Conventionnel : 47%
  - Trois nœuds : 92 %
  - Bande élastique : 100%
- Note de satisfaction
  - 5 contre 6,9 contre 7,1

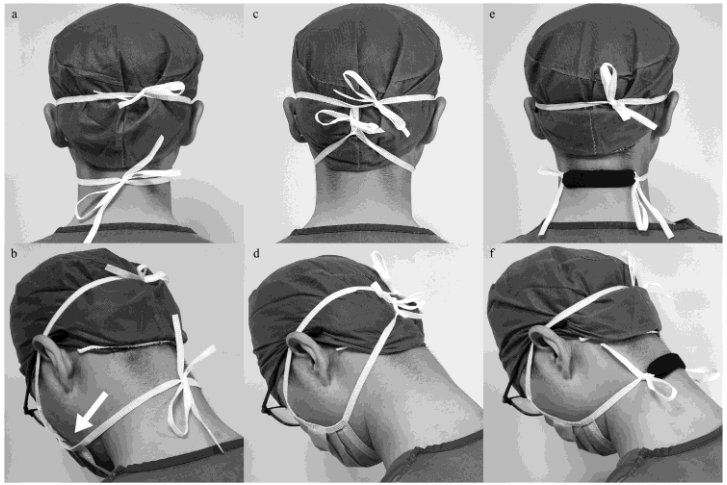


Figure 1. (a, b) The loose fit between the face and the mask (conventional method), (c, d) the method of tying together the upper and lower strings (Three Knots method), and (e, f) the method of making the lower strings elastic (Elastic Band method). Consent has been obtained from Dr. X. Li.

Wang X et al. J Hosp Infect. 2021 Sep;115:64-70.doi: 10.1016/j.jhin.2021.06.005.

Available online at www.sciencedirect.com

Journal of Hospital Infection

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- Diminution de la contamination de la zone sterile en salle d'operation simulée

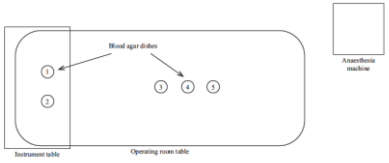
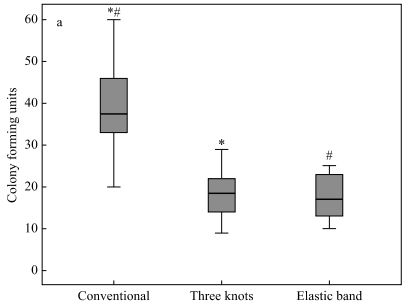


Figure 3. The layout of blood agar dishes on the sterile area.



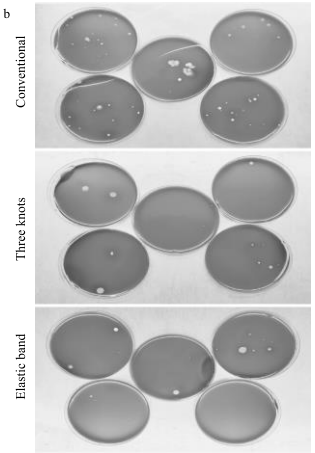


Figure 4. Microbial assessment by blood agar dishes. (a) Higher numbers of colony-forming units were observed in the Conventional group compared with the Three Knots group and Elastic Band group: *37.5 (13) vs 18(8) cfu, $P<0.001$; #37.5 (13) vs 17(10) cfu, $P<0.001$. (b) Representative microbiological results.

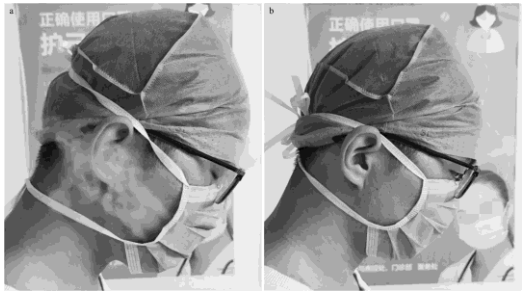


Figure 2. In the smoke experiment, more smoke leaked through the gap between mask and face, when the mask did not fit tightly (a); close fit (b).

Wang X et al. J Hosp Infect. 2021 Sep;115:64-70.doi: 10.1016/j.jhin.2021.06.005.

DISPARITÉ ENTRE LES SEXES

115 groupes de travail nationaux COVID de 87 pays :

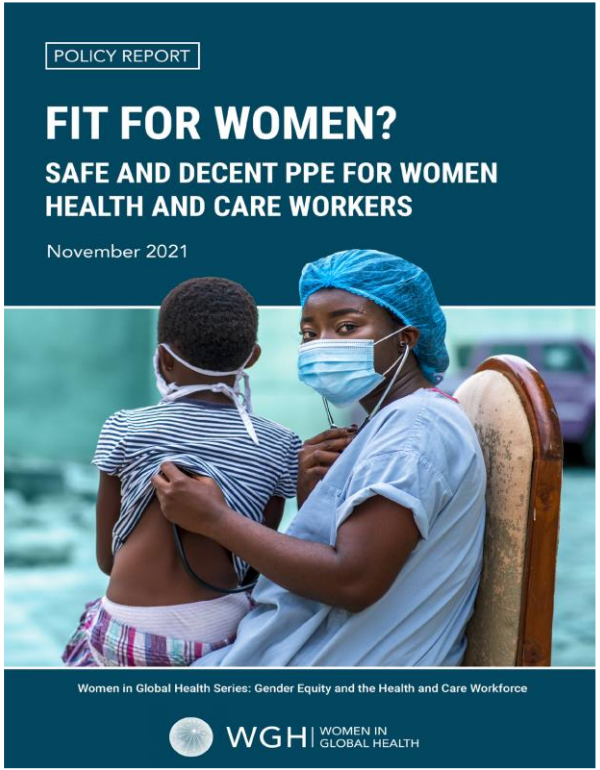
- 81% dirigé par un homme
- 85% de majorité d'hommes (seulement 3,5% de parité et 11% majoritairement de femmes)

Comités d'urgence COVID de l'OMS :
24 % à 37 % de femmes uniquement

LES FEMMES REPRÉSENTENT 70 % DE TOUS LES TdS DANS LE MONDE

van Daalen KR et al. BMJ Global Health 2020;5:e003549.

DISPARITÉ ENTRE LES SEXES



https://www.womeningh.org/fitforwomen

La plupart des EPI ont été conçus pour convenir aux hommes européens ou américains moyens

Par conséquent, les blouses peuvent ne pas être coupées pour s'adapter à la taille, aux seins, aux hanches ou aux grossesses des femmes.

Les femmes ont signalé que les masques, les lunettes et les blouses étaient souvent trop grands, ce qui entraînait des lacunes dans la protection, des risques de trébuchement, des mouvements entravés et des décolletés béants

	♀	♂
Blouse trop grande	55%	13%
Masque de protection trop grand	54%	27%

Janson LD et al. Appl Ergon. 2022 Feb;99:103610. doi: 10.1016/j.apergo.2021.103610.

Clinical Infectious Diseases

BRIEF REPORT

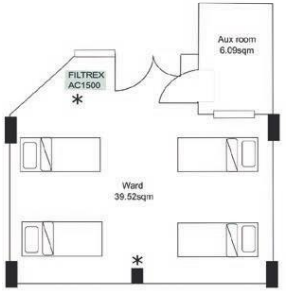
Appareils de filtration d'air portables

The Removal of Airborne Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Other Microbial Bioaerosols by Air Filtration on Coronavirus Disease 2019 (COVID-19) Surge Units

Andrew Conway Morris,[1,2,a] Katherine Sharrocks,[3,a] Rachel Bousfield,[3,4,a] Leanne Kermack,[5,a] Mailis Maes,[5] Ellen Higginson,[5] Sally Forrest,[5] Joana Pereira-Dias,[5] Claire Cormie,[5] Tim Old,[2] Sophie Brooks,[2] Islam Hamed,[1] Alicia Koenig,[1] Andrew Turner,[6] Paul White,[6,7] R. Andres Floto,[6,8] Gordon Dougan,[5] Effrossyni Gkrania-Klotsas,[3,b] Theodore Gouliouris,[3,4,b] Stephen Baker,[5] and Vilas Navapurkar[1,©]

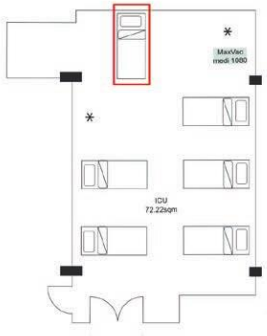
- Les données concernant les systèmes de filtration d'air portables manquent
- 2 « unités » COVID (2 chambres à plusieurs lits en fait) (Cambridge UK) – Crossover off/on/off (3 semaines)
- 2 systèmes de filtration d'air portables différents (combinant HEPA + lumière UV)
- Prélèvement d'air avec NIOSH Cyclone (6 heures/jour)

A



Unité COVID "RÉGULIÈRE"
4 lits
Aucun support resp autre que le simple O_2
Passivement ventilée, 2-4 CHA

B



SERVICE COVID "USI"
5-6 lits
Ventilation invasive et non invasive
Passivement ventilée, 2-4 ACH

Morris AC et al. Clin Infect Dis. 2021 Oct 30;ciab933.

Clinical Infectious Diseases

BRIEF REPORT

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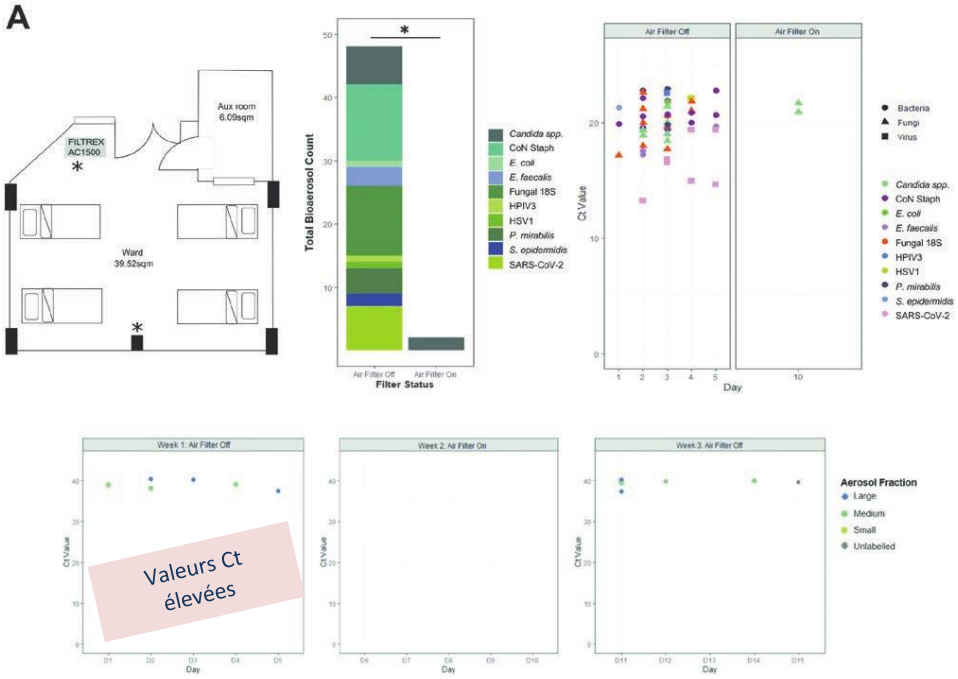

SARS-CoV-2 détecté dans l'air 9/10 jours avec filtre désactivé contre 0/5 avec filtre activé.
Taille des particules avec SARS-CoV-2 : 1-4 um et > 4 um

High throughput Assay

Semaine 1 : Acide nucléique détecté pour une gamme d'agents pathogènes bactériens, viraux et fongiques tous les jours d'échantillonnage

Semaine 2 : 1/5 jours détectés uniquement des levures

Morris AC et al. Clin Infect Dis. 2021 Oct 30;ciab933.

Clinical Infectious Diseases

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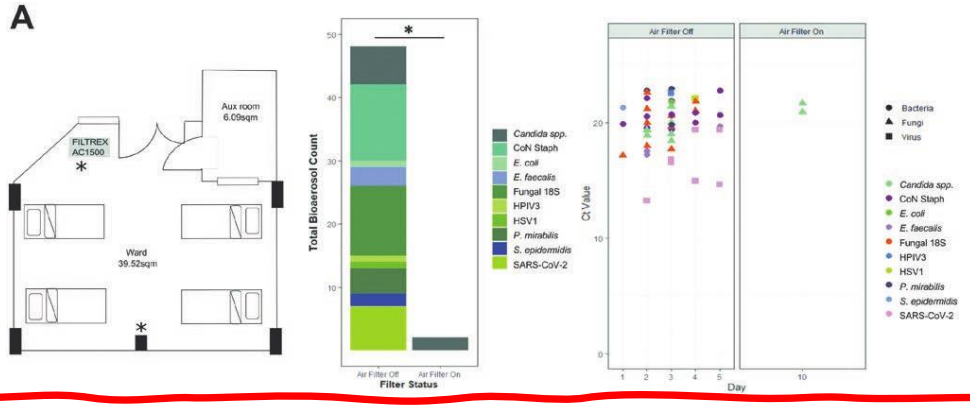

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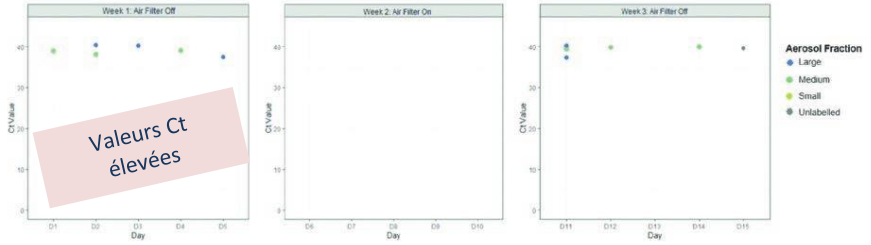

Valeurs Ct élevées

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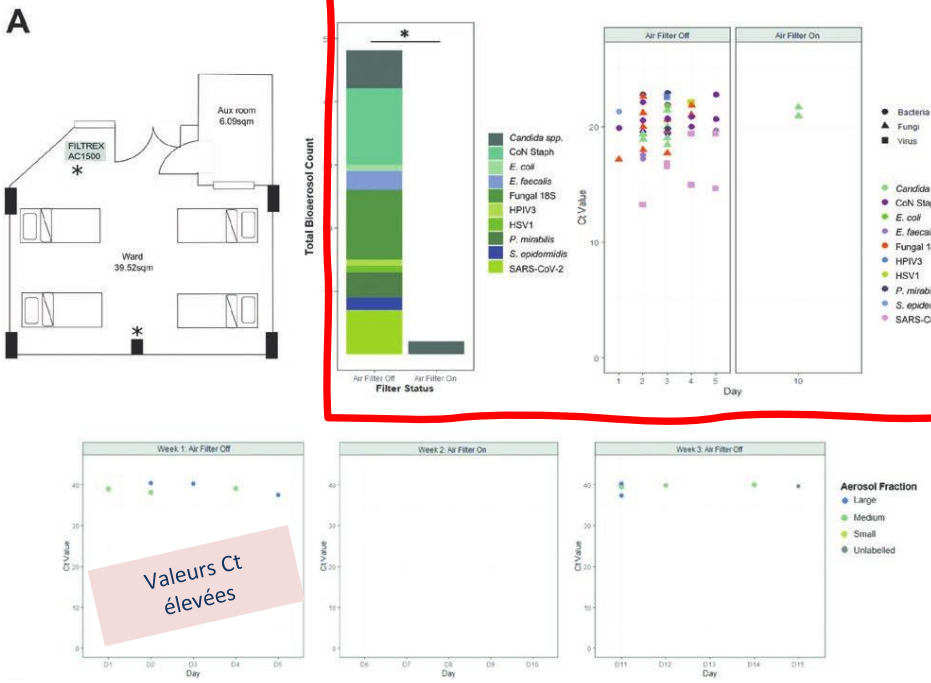

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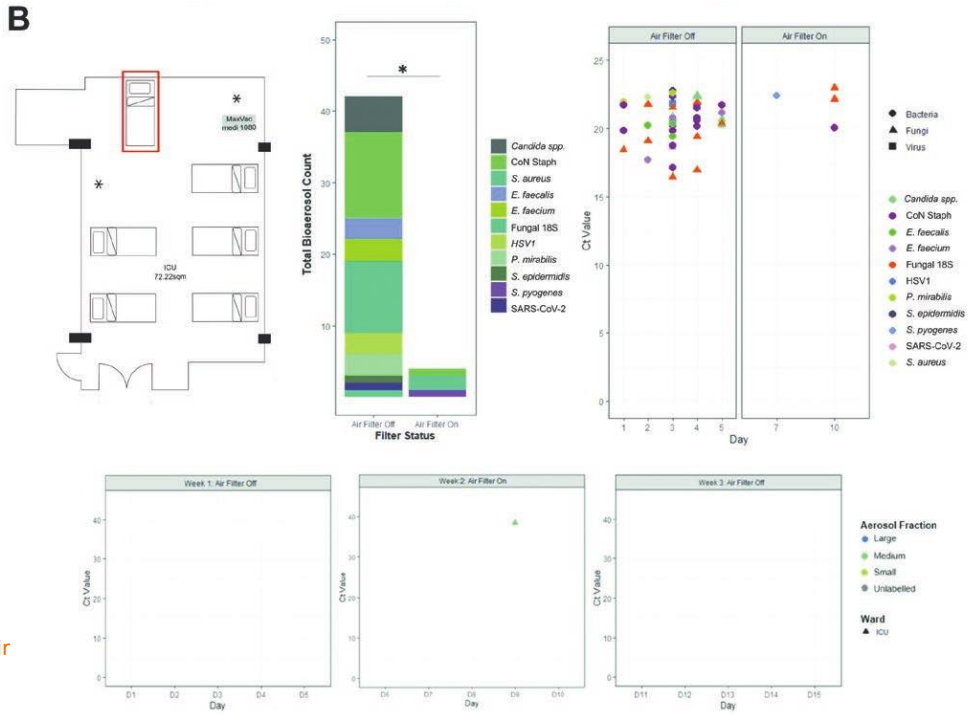


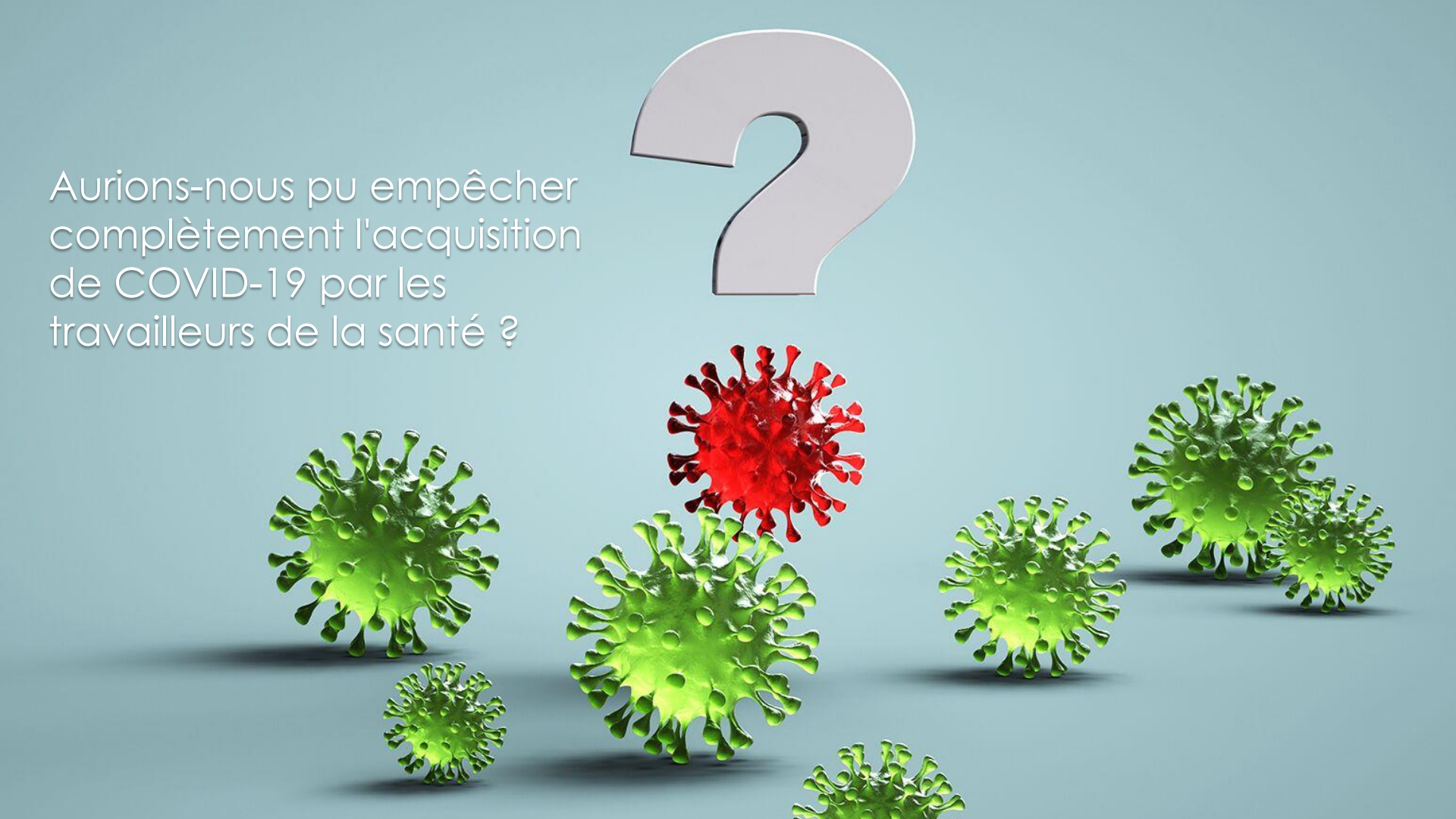
ICU ward: SARS-CoV-2 never detected in the air when filter off, but once when filter "On"

Filtration des aérosols : plus importante dans les services conventionnels qu'aux USI ?

Figure 1. Bioaerosol detection in specific air sampler fractions over the 3-week testing period on a "surge" ward and "surge" ICU. *A*, Data from "surge" ward. Top left: Layout of the room on the "surge" ward with 4 beds. Air filter was installed in the marked location and set to operate at 1000 m^3/hour with a room volume of approximately 107 m^3. Top middle: Stacked bar chart showing collated total number of bioaerosol detections during weeks 1 (filter off) and 2 (filter on). $*P = .05$ by Mann-Whitney *U* test. Top right: CT values of detected pathogens by high-throughput qPCR when filter switch on and off. Bottom: CT values for the single qPCR SARS-CoV-2 detection when filter switch on and off. *B*, Data from "surge" ICU. Top left: Layout on the "surge" ICU with 6 beds including the addition of a further supra-capacity bed to increase occupancy (labeled with red box). Air filter was installed in the marked location and set to operate at 1000 m^3/hour with a room volume of approximately 195 m^3. Top middle: Stacked

Morris AC et al. Clin Infect Dis. 2021

Aurions-nous pu empêcher complètement l'acquisition de COVID-19 par les travailleurs de la santé ?



Infection Control & Hospital Epidemiology (2021), 1–10
doi:10.1017/ice.2021.119

Original Article

Multipronged infection control strategy to achieve zero nosocomial coronavirus disease 2019 (COVID-19) cases among Hong Kong healthcare workers in the first 300 days of the pandemic

Vincent Chi-Chung Cheng MD[1-2-a], Shuk-Ching Wong MNurs[1-a], Danny Wah-Kun Tong PhD[3], Vivien Wai-Man Chuang FRCPath[4], Jonathan Hon-Kwan Chen PhD[2], Larry Lap-Yip Lee MBBS[5], Kelvin Kai-Wang To MD[6], Ivan Fan-Ngai Hung MD[7], Pak-Leung Ho MD[6], Deacons Tai-Kong Yeung MBBS[8], Kin-Lai Chung MBBS[4] and Kwok-Yung Yuen MD[6]

[1]Infection Control Team, Queen Mary Hospital, Hong Kong West Cluster, Hong Kong Special Administrative Region, China, [2]Department of Microbiology, Queen Mary Hospital, Hong Kong Special Administrative Region, China, [3]Nursing Services Department, Cluster Services, Hospital Authority, Hong Kong Special Administrative Region, China, [4]Quality & Safety Division, Hospital Authority, Hong Kong Special Administrative Region, China, [5]Department of Accident and Emergency, Tin Shui Wai Hospital, New Territories West Cluster, Hong Kong Special Administrative Region, China, [6]Department of Microbiology, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong Special Administrative Region, China, [7]Department of Medicine, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong Special Administrative Region, China and [8]Cluster Services, Hospital Authority, Hong Kong Special Administrative Region, China

- 5269 cas de COVID admis dans des hôpitaux de soins aigus (78 834 jours-patients COVD-19) au cours des 300 premiers jours de la pandémie (décembre 2019-octobre 2020)
- Seulement 38 acquisitions de HCW sur 81 955 HCW (0,05 %)
  - 11 infirmiers, 25 personnels non professionnels et 2 médecins)
  - 5 étaient une transmission de HCW à HCW dans un cadre non clinique
  - Aucun n'était nosocomial

- Incidence du COVID, HK :
  - TdS: 0,46 pour 1 000 agents de santé sur 10 mois (0,046 %)
  - HK Population générale : 0,71 pour 1 000 habitants (p=0,008)
  - Aucune acquisition documentée des soins du patient COVID19
- Québec, Mars-Sept 2020:
  - 241/2056 (11.7%) TdS seropositifs premiers 7 mois
  - Écart entre les hôpitaux : 2.4% to 32%

Cheng VCC et al. Infect Control Hosp Epidemiol. 2021 Mar 19;1-10.

Stratégie PCI à plusieurs volets

- Tous les patients pris en charge au sein de l'AIIR
- Tous les patients pris en charge en tant que gouttelettes/contact/transport aérien
  - Respirateur, casquette, écrans faciaux, blouse isol, gants
  - Utilisation prolongée du N95 en raison de pénuries
- Prévention de la surpopulation dans les hôpitaux avec l'utilisation de Centres Secondaires d'isolement et de traitement communautaire
- Masquage universel pour les travailleurs de la santé et les patients
- Mise en place et retrait sous observation directe des travailleurs de la santé
- Arrangements spéciaux pour les repas des travailleurs de la santé à l'hôpital
- Restreindre les visiteurs
- Formation par simulation pour IPAC
- Chaque cas de COVID dx en dehors de l'AII a fait l'objet d'une enquête en tant qu'éclosion

On ne sait pas "quels" composants ont fonctionné, mais cela semble avoir fonctionné !

Cheng VCC et al. Infect Control Hosp Epidemiol. 2021 Mar 19;1-10.

DÉCHETS BIOMÉDICAUX COVID

https://www.who.int/publications/i/item/9789240039612

Plastic waste release caused by COVID-19 and its fate in the global ocean

Yiming Peng[a,1], Peipei Wu[a,1], Amina T. Schartup[b], and Yanxu Zhang[a,2]

[a]School of Atmospheric Sciences, Nanjing University, Nanjing 210023, China; and [b]Scripps Institution of Oceanography, University of California San Jolla, CA 92037

- La pandémie a entraîné une augmentation de la consommation de plastique à usage unique
- Au total, 8 millions de tonnes de déchets associés à la pandémie (en août 2021)
- Déchets produits pour soigner un patient COVID: env. le double d'un patient "régulier"
- Devenir des déchets plastiques mal gérés :
  - 25 000 tonnes entrant dans l'océan

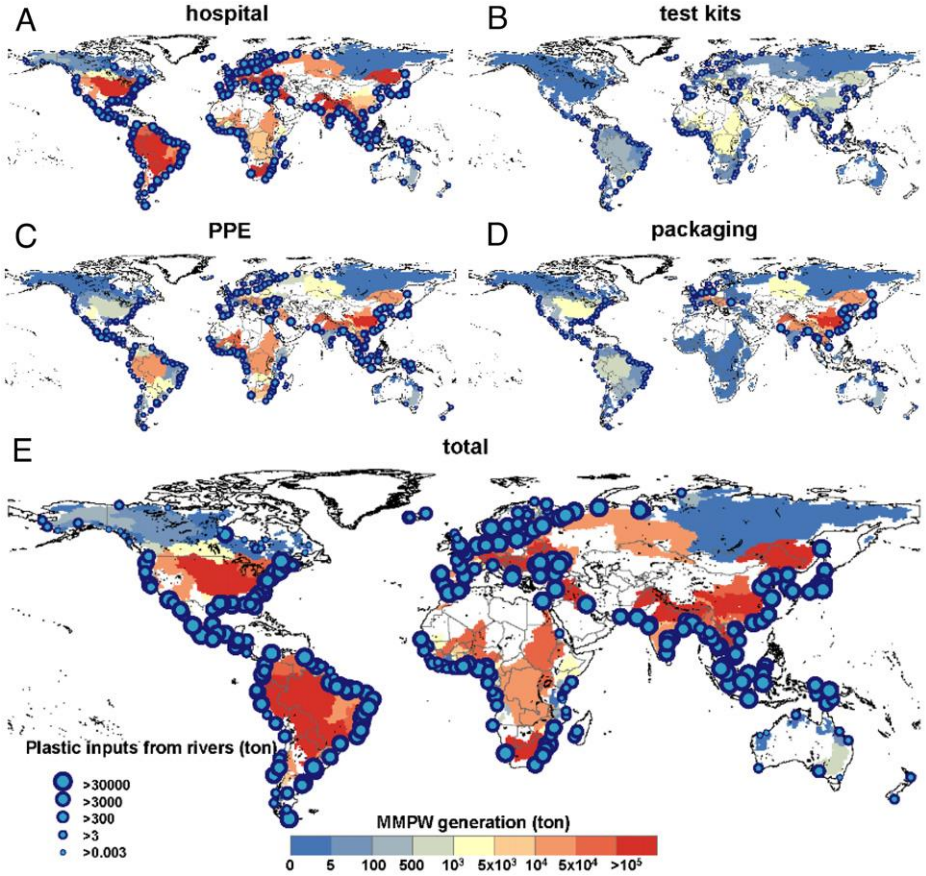


Fig. 2. Accumulated riverine discharge of pandemic-associated mismanaged plastics to the global ocean. Panels are for the discharges caused by (*A*) hospital medical waste, (*B*) COVID-19 virus test kits, (*C*) PPE, (*D*) online-shopping packaging material, and (*E*) the total of them. The background color represents the generated MMPW in each watershed, while the sizes of the blue circles are for the discharges at river mouths.

Peng Y et al. PNAS November 23, 2021 118 (47) e2111530118; https://doi.org/10.1073/pnas.2111530118

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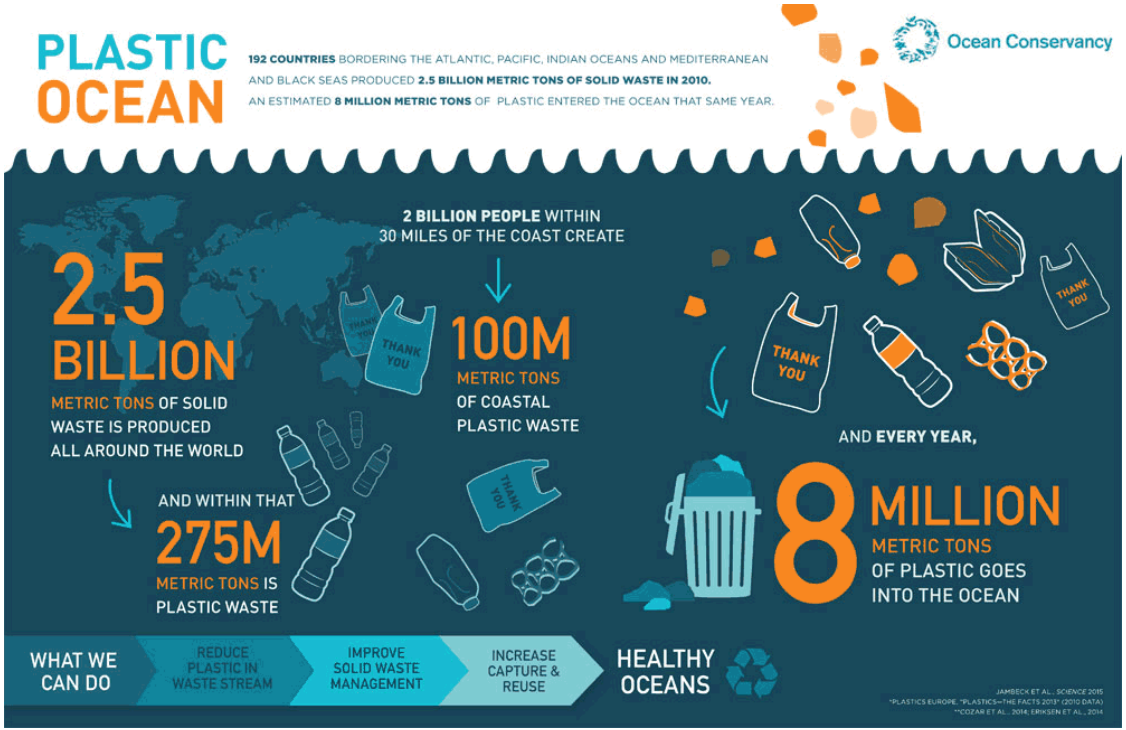
0.3% total annuel

0.3% du total annuel



Peng Y et al. PNAS November 23, 2021 118 (47) e2111530118; https://doi.org/10.1073/pnas.2111530118

Illustration by Carole Hénaff for TIME

En dehors de la COVID-19

Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis

*Antimicrobial Resistance Collaborators**

Summary

Background Antimicrobial resistance (AMR) poses a major threat to human health around the world. Previous publications have estimated the effect of AMR on incidence, deaths, hospital length of stay, and health-care costs for specific pathogen–drug combinations in select locations. To our knowledge, this study presents the most comprehensive estimates of AMR burden to date.

Lancet 2022; 399: 629–55

Published Online January 20, 2022 https://doi.org/10.1016/S0140-6736(21)02724-0

AMR

- Objectif : Quantifier le fardeau des BMR dans 204 pays en 2019
  - 12 syndromes infectieux et 23 agents pathogènes
  - Plusieurs sources de données:
    - Revues systématiques, bases de données de surveillance, bases de données hospitalières
    - Total : 471 millions de dossiers individuels ou isolats
- 2 comparaisons
  - Comparaison d'une infection due à la RAM et de la même infection mais pas de BMR
  - Comparer l'infection due à la BMR à l'absence d'infection
  - Cela permet de comparer le fardeau de l'infection et le fardeau de la résistance

Lancet. 2022 Feb 12;399(10325):629-655.

Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis

*Antimicrobial Resistance Collaborators**

Summary

Background Antimicrobial resistance (AMR) poses a major threat to human health around the world. Previous publications have estimated the effect of AMR on incidence, deaths, hospital length of stay, and health-care costs for specific pathogen–drug combinations in select locations. To our knowledge, this study presents the most comprehensive estimates of AMR burden to date.

Lancet 2022; 399: 629–55

Published Online January 20, 2022 https://doi.org/10.1016/S0140-6736(21)02724-0

- conclusion
  - Décès dus aux BMR : 4,95 millions (IC à 95 %, 3,62-6,57)
- Décès attribuables à la résistance: 1,27 million en 2019 (IC à 95 %, 0,91-1,71)*
- Avantages additif de la prévention des infections et de la prévention de la propagation de la RAM
- Une seule BMR majeure est évitable par la vaccination (pneumocoque)

*Comparateurs: VIH: 680K décès; Malaria: 627k décès

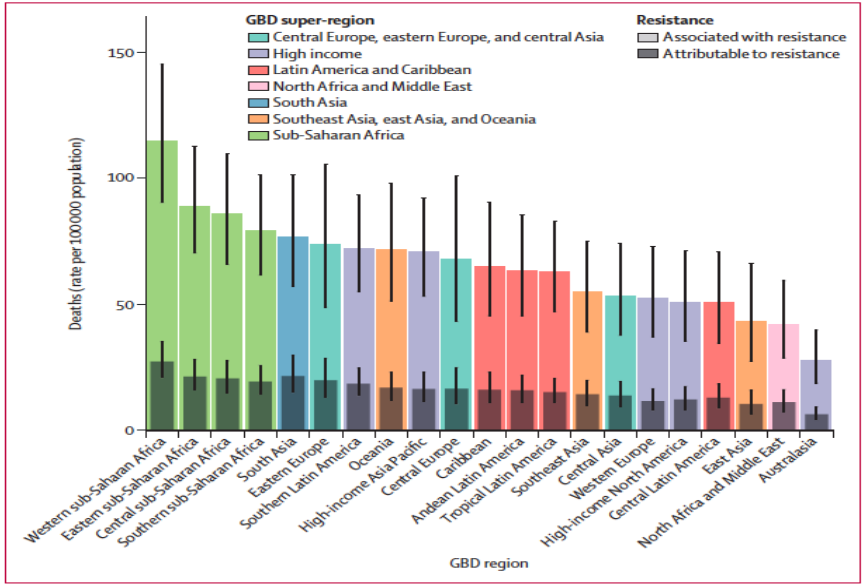


Figure 2: **All-age rate of deaths attributable to and associated with bacterial antimicrobial resistance by GBD region, 2019**

Estimates were aggregated across drugs, accounting for the co-occurrence of resistance to multiple drugs. Error bars show 95% uncertainty intervals. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study.

Lancet. 2022 Feb 12;399(10325):629-655.

Neoplasmes: 250

Cardiovasculaire: 176

Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis

*Antimicrobial Resistance Collaborators**

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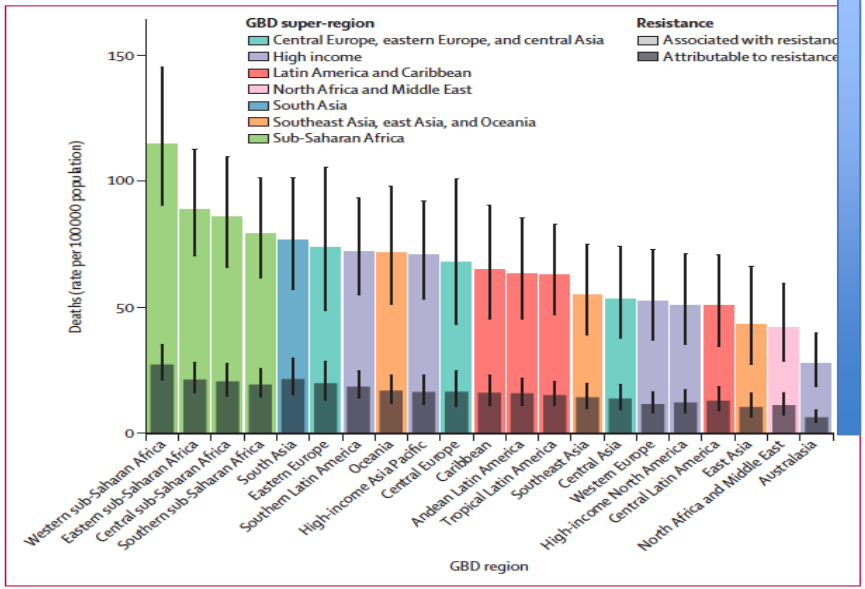

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Chlorhexidine plus alcohol versus povidone iodine plus alcohol, combined or not with innovative devices, for prevention of short-term peripheral venous catheter infection and failure (CLEAN 3 study): an investigator-initiated, open-label, single centre, randomised-controlled, two-by-two factorial trial

*Jérémy Guenezan, Nicolas Marjanovic, Bertrand Drugeon, Rodérick O Neill, Evelyne Liuu, France Roblot, Paola Palazzo, Vanessa Bironneau, Frederique Prevost, Julie Paul, Maxime Pichon, Matthieu Boisson, Denis Frasca, Olivier Mimoz, on behalf of the CLEAN-3 trial investigators**

- Étude monocentrique
- Open label, Plan factoriel 2x2
  - Préparation de la peau : 2 % de chlorhexidine plus 70 % d'alcool isopropylique ou avec 5 % de povidone iodée plus 69 % d'éthanol pendant 30 s.
  - Type de dispositif : Système innovant vs système standard (cathéter ouvert + robinets 3 voies)
- Système innovant :
  1. Système intégré fermé
  2. Connecteurs sans aiguille à déplacement positif
  3. Bouchons désinfectants
  4. Seringues de rinçage à usage unique préremplies (NS)

KT périphérique : le dispositif invasif le plus fréquent

4 cathéters périphériques pour chaque voie centrale

Guenezan J et al. Lancet Infect Dis. 2021 Jul;21(7):1038-1048.

Chlorhexidine plus alcohol versus povidone iodine plus alcohol, combined or not with innovative devices, for prevention of short-term peripheral venous catheter infection and failure (CLEAN 3 study): an investigator-initiated, open-label, single centre, randomised-controlled, two-by-two factorial trial

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Outcome principaux:

- Complications infectieuses liées au cathéter :
  - Infection locale
  - Colonisation du cathéter (dilution quantitative du bouillon >1000 UFC/ml)
  - CR-BSI
- Délai de défaillance du cathéter
  - Retrait prématuré avant la fin du traitement
  - Raisons diverses : Phlébite, infiltration, occlusion, délogement, infection locale, CR-BSI

Outcome composite parce que les BACP sont rares - aurait nécessité plus de 10 000 patients

Guenezan J et al. Lancet Infect Dis. 2021 Jul;21(7):1038-1048.

Chlorhexidine plus alcohol versus povidone iodine plus alcohol, combined or not with innovative devices, for prevention of short-term peripheral venous catheter infection and failure (CLEAN 3 study): an investigator-initiated, open-label, single centre, randomised-controlled, two-by-two factorial trial

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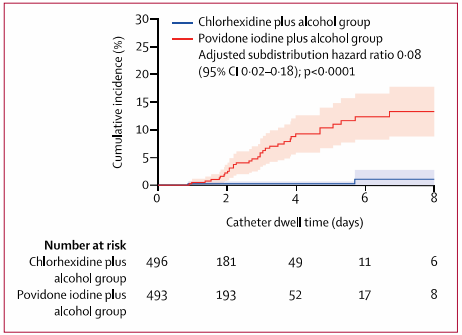

Figure 2: Cumulative incidence and adjusted subdistribution hazard ratio for catheter-related infectious complications by antiseptic group allocation

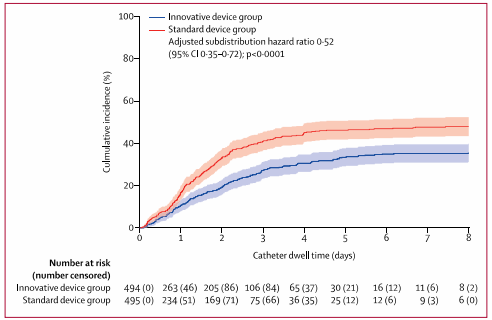

Figure 3: Cumulative incidence and adjusted subdistribution hazard ratio for catheter removal due to catheter failure by device group allocation

Complications infectieuses moins fréquentes dans groupe CHG
aHR 0.08 (0.02-0.18, p<0.001)
* Aucune BACP détectée

Moins de défaillances de cathéter dans groupe “innovateur”
aHR 0.52 (0.35-0.72), p<0.001

Guenezan J et al. Lancet Infect Dis. 2021 Jul;21(7):1038-1048.

Chlorhexidine plus a
alcohol, combined c
prevention of short
and failure (CLEAN
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Jérémy Guenezan, Nicolas Marjanovic, Bertra
Frederique Prevost, Julie Paul, Maxime Pichon,

	Entire population (n=989)	Antiseptic groups		Adjusted relative risk	Device groups		Adjusted relative risk
		CHG group (n=496)	PVI group (n=493)		Innovation group (n=494)	Standard group (n=495)	
Infectious complications							
Catheter colonisation*	74/846 (9%)	4/431 (1%)	70/415 (17%)	0·06 (0·05 to 0·06)	42/431 (10%)	32/415 (8%)	1·11 (0·77 to1·67)
Local infection	6 (1%)	0	6 (1%)	0·45 (0·26 to 0·99)	2 (<1%)	4 (1%)	0·48 (0·34 to 1·43)
Catheter-related bloodstream infections	0	0	0	..	0	0	..
All-causes bloodstream infections	21 (2%)	8 (2%)	13 (3%)	0·59 (0·40 to 1·07)	9 (2%)	12 (2%)	0·71 (0·48 to 1·43)
Non-infectious complications							
Infiltration	153 (16%)	79 (16%)	74 (15%)	1·07 (0·83 to 1·43)	71 (14%)	82 (17%)	0·71 (0·50 to 1·43)
Occlusion	64 (7%)	36 (7%)	28 (6%)	1·11 (0·48 to1·91)	20 (4%)	44 (9%)	0·48 (0·32 to 0·98)
Dislodgment	161 (16%)	73 (15%)	88 (18%)	0·83 (0·67 to 1·67)	67 (14%)	94 (19%)	0·63 (0·53 to 0·91)
Phlebitis	23 (2%)	8 (2%)	15 (3%)	0·48 (0·34 to 1·03)	12 (2%)	11 (2%)	1·01 (0·45 to 2·33)
Patient-related outcomes							
Pain at catheter insertion	0 (0 to 2)	0 (0 to 2)	0 (0 to 2)	..	0 (0 to 2)	0 (0 to 2)	..
Effect of venous line on mobility	0 (0 to 2)	0 (0 to 2)	0 (0 to 2)	..	0 (0 to 2)	0 (0 to 2)	..
Satisfaction at catheter removal	9 (8 to 10)	9 (8 to 10)	10 (8 to 10)	−1 (−2 to 0)†	10 (8 to 10)	9 (8 to 10)	1 (0 to 1)†
Skin adverse events							
Minor	16 (2%)	9 (2%)	7 (1%)	1·06 (0·77 to 1·35)	8 (2%)	8 (2%)	0·91 (0·83 to 1·11)
Severe	0	0	0	..	0	0	..
Hospital stay length, days	6 (3 to 11)	6 (3 to 11)	6 (3 to 10)	0 (−1 to 0)†	6 (3 to 11)	6 (3 to 11)	0 (−1 to 0)†

Data are median (IQR), n (%), n/N (%), or [95% CI]. CHG=2% alcoholic chlorhexidine. PVI=5% alcoholic povidone iodine. Complications are described twice, once in the antiseptic groups columns and once in the device groups columns. *Only 846 catheter tips were cultured. †These are adjusted mean difference.

***Table 3*: Secondary outcomes**

Temps pour défaillance: 30h vs 50h

Mais groupe innovant = pas de diminution de la colonisation ou de l'infection, pas de diminution de la phlébite ou de l'infiltration.

Amélioration des résultats en raison de la diminution de l'occlusion ou du délogement

No cost assessment

Guenezan J et al. Lancet Infect Dis. 2021 Jul;21(7):1038-1048.

Candida auris

ORIGINAL RESEARCH

Annals of Internal Medicine

Rapid Assessment and Containment of *Candida auris* Transmission in Postacute Care Settings–Orange County, California, 2019

Ellora N. Karmarkar, MD, MSc; Kathleen O'Donnell, MPH; Christopher Prestel, MD; Kaitlin Forsberg, MPH; Lalitha Gade, MPharm; Seema Jain, MD; Douglas Schan, MPH; Nancy Chow, PhD; Darby McDermott, DVM; John Rossow, DVM; Mitsuru Toda, MS, PhD; Ryan Ruiz, MS; Sopheay Hun, MBA, MLS(ASCP)cm; Jennifer L. Dale, PhD; Annastasia Gross, MPH, MT(ASCP); Tyler Maruca, MS; Janet Glowicz, MPH, PhD, RN, CIC; Richard Brooks, MD, MPH; Hosniyeh Bagheri, RN, BSN; Teresa Nelson, RN, BS, CIC; Nicole Gualandi, MSN, MPH; Zenith Khwaja, MSN; Sam Horwich-Scholefield, MPH; Josh Jacobs, MA; Michele Cheung, MD, MPH; Maroya Walters, PhD; Kara Jacobs-Slifka, MD; Nimalie D. Stone, MD; Lydia Mikhail, MBA, MEL, TS(ABB); Sudha Chaturvedi, PhD; Liore Klein, MSPH; Paula Snippes Vagnone, BS, MT (ASCP); Emily Schneider, MPH; Elizabeth L. Berkow, PhD; Brendan R. Jackson, MD; Snigdha Vallabhaneni, MD, MPH; Matthew Zahn, MD; and Erin Epson, MD

Candida auris

- Demande du ministère de la Santé d'accroître la surveillance de C auris
- Septembre 2018 : Etablissement d'un programme de Détection passive de C auris dans des échantillons d'urine de "SNF" et de "LTACH"
- Février 2019 : Détection du 1er C. auris dans un échantillon d'urine
- Confinement rapide des éclosions

L'identification de C. auris dans les échantillons d'urine a permis la détection des épidémies avant l'apparition de toute infection et un confinement rapide

Karmarkar EN et al. Ann Intern Med. 2021 Nov;174(11):1554-1562.

nature medicine

ARTICLES

https://doi.org/10.1038/s41591-021-01383-w

Check for updates

Integrated genomic, epidemiologic investigation of *Candida auris* skin colonization in a skilled nursing facility

Diana M. Proctor[1], Thelma Dangana[2], D. Joseph Sexton[3], Christine Fukuda[2], Rachel D. Yelin[2], Mary Stanley[2], Pamela B. Bell[2], Sangeetha Baskaran[2], Clay Deming[1], Qiong Chen[1], Sean Conlan[1], Morgan Park[4], NISC Comparative Sequencing Program*, Rory M. Welsh[3], Snigdha Vallabhaneni[3,5], Tom Chiller[3], Kaitlin Forsberg[3], Stephanie R. Black[6], Massimo Pacilli[6], Heidi H. Kong[7], Michael Y. Lin[2], Michael E. Schoeny[8], Anastasia P. Litvintseva[3], Julia A. Segre[1,9] ✉ and Mary K. Hayden[2,9] ✉

- Enquêtes sur la prévalence en 3 points de janvier à avril 2019 auprès de 57 patients dans un établissement de soins infirmiers qualifié (service de ventilation) à Chicago, IL, endémique pour C auris

- 10 sites échantillonnés par participant
  - Culture (quantitatif)
  - microbiote
  - quantification de la concentration de CHG

- Bain à la CHG 2% quotidiennement

Proctor DM et al. Nat Med . 2021 Aug;27(8):1401-1409. doi: 10.1038/s41591-021-01383-w. Epub 2021 Jun 21.

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Results

- 49/57 (86%) colonisés >= 1 site!
- Éclosion clonale du Clade IV (South America)
  - SNV: 1-20
- Toutes les souches S fluco et amphoB
- Pas d'infections

Table 1 | Bivariate associations of clinical characteristics with *C. auris*–colonization status at the time of the first survey

	Colonized ($n=46$)	Not colonized ($n=11$)	OR (95% CI)	*P* value	
Length of stay (d) between admission and first swab (M ± IQR)	361 ± 801	571 ± 1,372	1.00 (0.99, 1.00)	0.26	
Age in years (mean ± s.d.)	59 ± 14	59 ± 14	1.00 (0.95, 1.05)	0.89	
Female (*n* (%))	18 (39)	5 (45)	0.77 (0.20, 2.91)	0.74	
African American (*n* (%))	31 (74)	9 (90)	0.31 (0.066, 2.76)	0.42	
Mechanical ventilation (*n* (%))	23 (50)	0 (0)	23.00 (1.28, 413.3)	0.002	Invasive devices
Gastrostomy tube (*n* (%))	35 (78)	3 (27)	9.33 (2.08, 41.89)	0.003	Invasive devices
Tracheostomy (*n* (%))	34 (74)	6 (55)	2.36 (0.61, 9.17)	0.27	
Urinary catheter (*n* (%))	33 (72)	3 (27)	6.77 (1.55, 29.56)	0.012	
Hospital stay within past 90 d (*n* (%))	20 (44)	3 (27)	2.13 (0.50, 9.11)	0.5	
Charlson comorbidity index (M ± IQR)	3 ± 2	3 ± 2	0.91 (0.65, 1.28)	0.59	
Congestive heart failure (*n* (%))	10 (22)	5 (45)	0.33 (0.084, 1.32)	0.11	
Chronic lung disease (*n* (%))	36 (78)	6 (55)	3.00 (0.76, 11.90)	0.11	
Braden scale score[a] (mean ± s.d.)	13 ± 2	16 ± 5	0.74 (0.59, 0.94)	0.013	
History of carbapenemase- producing bacterial colonization or infection[b]	31 (67)	6 (55)	1.72 (0.45, 6.56)	0.49	CPE colonization
Antibacterial receipt in prior 90 d (*n* (%))	34 (74)	5 (45)	3.4 (0.88, 13.21)	0.030	Antibiotics
Antifungal receipt in prior 90 d (*n* (%))	5 (11)	0 (0)	3.05 (0.16, 59.29)	0.57	

[a]The Braden Scale for Predicting Pressure Sore Risk assesses a person's risk of developing a pressure ulcer by examining six criteria: moisture, activity, mobility, nutrition and friction and shear. [b]Screening of facility residents for carbapenemase-producing bacterial colonization was performed routinely. Screening for colonization by other multidrug-resistant organisms was not performed. CI, confidence interval; IQR, interquartile range; M, median; OR, odds ratio.

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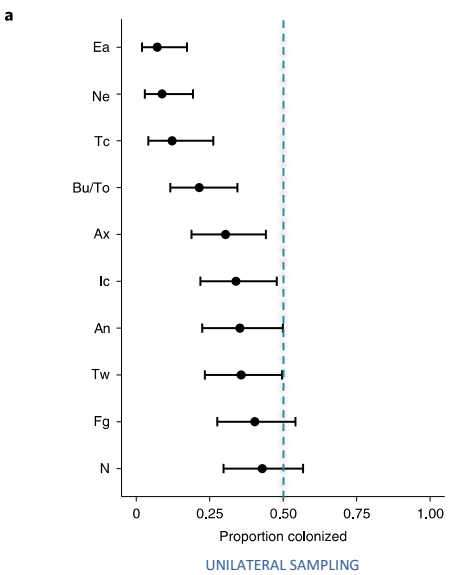
- Patterns de colonisation des sites corporels fortement individualisés
- Aucun site n'était très sensible
  - Site de colonisation le plus fréquent : narines (48 % seulement)
- La détection de tous les résidents colonisés nécessitait au moins 6 sites corporels



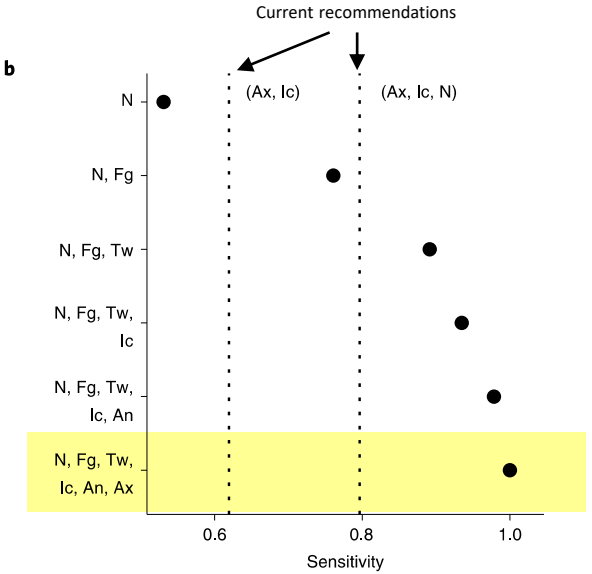


Fig. 1 | Screening of multiple skin, nares, perianal and oral body sites for prevalence and individual-level bioburden of *C. auris* colonization. a, The proportion of residents colonized at each body site. $n = 542$ independent samples of each of ten body sites of each of 57 residents at the time of the first screening. Data are presented as a point estimate ±95% confidence intervals. An, perianal skin; Ax, axilla; Bu, buccal mucosa; Ea, external auditory canal; Fg, palm and/or fingertips; Ic, inguinal crease; N, anterior nares; Ne, neck; Tc, tracheostomy; To, tongue; Tw, toe web. **b**, Sensitivity analysis to calculate the proportion of colonized residents captured by screening different groupings of sites. Sensitivity is defined as the proportion colonized at each site grouping divided by the total number of residents identified as colonized at any body site. Dashed vertical lines correspond to the sensitivity of two routine screening strategies targeting the body sites axilla and inguinal crease (left dashed line) and axilla, inguinal crease and nares (right dashed line). A minimum of six sites was required to achieve 100% sensitivity, capturing all colonized individuals. **c**, Number of viable *C. auris*, determined by the MPN, plotted for the inguinal crease ($n = 16$), nares ($n = 19$) and axilla ($n = 16$). Groupwise medians are demarcated with black lines. Statistical significance of differences between sites was assessed with the Kruskal–Wallis test ($P < 0.05$).

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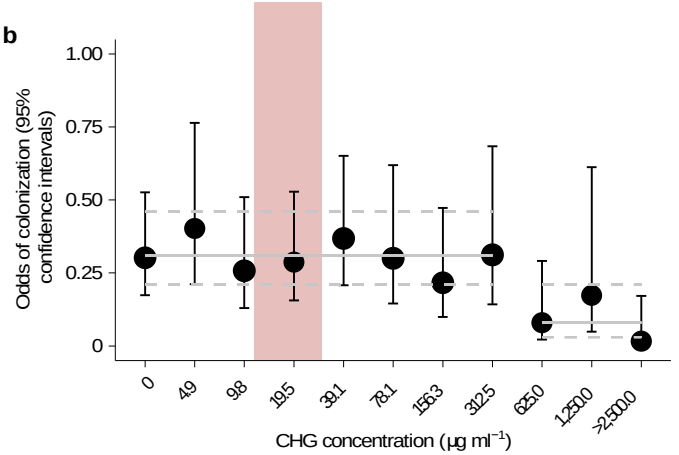
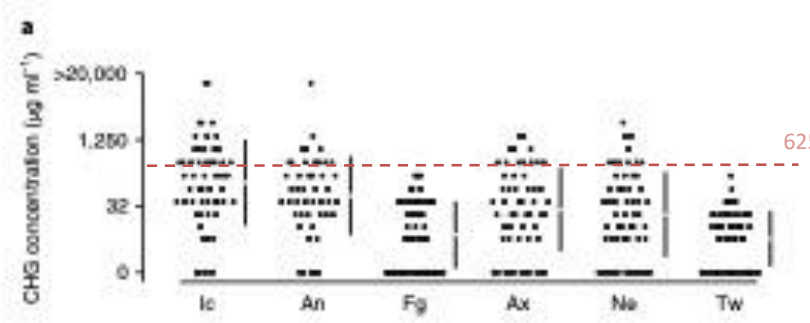
- La concentration de CHG pour inhiber C. auris pourrait être plus élevée in vivo

CHG concentration needed to decrease body site colonization

In vitro: MIC = 16-32 ug/ml





Theatre

More than truth or lies: staging *Dr Semmelweis*

Adapting the life of one of medicine's most radical pioneers would be a challenge for any theatre company, but director Tom Morris, writers Stephen Brown with Mark Rylance, and the cast of *Dr Semmelweis* balance historicity and creative interpretation. [illegible] takes a biographical

work was unpublished. Semmelweis's ideas also undermined the identity of the physician as a gentleman and upstanding citizen whose bloodstained apron was a sign of experience. He eventually returned to Budapest in 1850, where he launched a renewed campaign to reform obstetric practice. Despite presenting papers and working towards the publi[illegible] of *The Aetiology, the Concept a[illegible] Prophylaxis of Childbed Fever* ([illegible] his marginalisation and d[illegible]

> "Rylance delivers a strong memorable performance portrayal of Semmelweis tortured journey."

for sceptics limited the [illegible] of his work. He died in an a[illegible]

in response to their pleadings. Within professional circles, his fury drives away potential allies and in one scene set at a medical gathering he labels attending delegates a "conference of killers". His growing disillusionment is shown to take a toll on his wife, Mária (Thalissa Teixeira) and friends, as he dulls his pain through alcohol and [illegible]

Geraint Lewis

Dr Semmelweis
A play by Stephen Brown with Mark Rylance.
A Bristol Old Vic production in association with Sonia Friedman Productions, the National Theatre, and Shakespeare Road Theatre. Bristol Old Vic, Bristol, UK, until Feb 19, 2022
https://bristololdvic.org.uk/whats-on/dr-semmelweis

Mawdsley S Lancet February 12, 2022 DOI:https://doi.org/10.1016/S0140-6736(22)00238-0

Clinical Infectious Diseases

MAJOR ARTICLE

Association Between Hospital Outbreaks and Hand Hygiene: Insights from Electronic Monitoring

Adam Kovacs-Litman,[1] Matthew P. Muller,[1,2] Jeff E. Powis,[1,3] Dan Ricciuto,[4] Allison McGeer,[1,5] Victoria Williams,[6] and Alex Kiss,[7] and Jerome A. Leis[1,6,7,8]

[1]Department of Medicine, University of Toronto, Toronto, Ontario, Canada, [2]Division of Infectious Diseases, St. Michael's Hospital, Toronto, Ontario, Canada, [3]Division of Infectious Diseases, Michael Garron Hospital, Toronto, Ontario, Canada, [4]Division of Infectious Diseases, Lakeridge Health, Toronto, Ontario, Canada, [5]Sinai Health System, Toronto, Ontario, Canada, [6]Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada, [7]Sunnybrook Research Institute, Toronto, Ontario, Canada, and [8]Centre for Quality Improvement and Patient Safety, University of Toronto, Toronto, Ontario, Canada

- La norme standard pour auditer la conformité de l'HdM a de nombreuses limites
- AEMS détectant l'utilisation de produit à HdM (savon ou SHA)
  - Dénominateur estimé en HHO par lit (précédemment validé)
- Évaluer l'association entre les éclosions et les changements dans l'adhésion HdM
  - L'éclosion entraîne-t-elle des changements dans les performances du ménage ?
- ITS controllée

Kovacs-Litman A et al. Clin Infect Dis. 2021 Dec 6;73(11):e3656-e3660.

Clinical Infectious Diseases

MAJOR ARTICLE

Association Between Hospital Outbreaks and Hand Hygiene: Insights from Electronic Monitoring

Adam Kovacs-Litman,[1] Matthew P. Muller,[1,2] Jeff E. Powis,[1,3] Dan Ricciuto,[4] Allison McGeer,[1,5] Victoria Williams,[6] and Alex Kiss,[7] and Jerome A. Leis[1,6,7,8]

[1]Department of Medicine, University of Toronto, Toronto, Ontario, Canada, [2]Division of Infectious Diseases, St. Michael's Hospital, Toronto, Ontario, Canada, [3]Division of Infectious Diseases, Michael Garron Hospital, Toronto, Ontario, Canada, [4]Division of Infectious Diseases, Lakeridge Health, Toronto, Ontario, Canada, [5]Sinai Health System, Toronto, Ontario, Canada, [6]Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada, [7]Sunnybrook Research Institute, Toronto, Ontario, Canada, and [8]Centre for Quality Improvement and Patient Safety, University of Toronto, Toronto, Ontario, Canada

- 26 unités réparties dans 5 établissements (746 lits) avril 2017-décembre 2018
- 1,5 million de HHO par mois
- Éclosions : BMR, viraux, pathogènes entériques (définitions locales) (n=20)
- Adhésion HdM comparée (%) du jour -60 au jour +90 de chaque éclosion dans les unités en éclosion vs unités contrôle

Table 1. Baseline Characteristics of 20 Outbreaks Across 5 Acute Care Hospitals With Group Electronic Hand Hygiene Monitoring

	Out-breaks	Patient cases	Staff cases	Median outbreak length, IQR	Serious adverse events[b]
AROs[a]	7	39	0	42, 21–50	0
Respiratory	7	19	19	8, 7–8.5	3
Influenza A	5	14	15	8, 7–9	3
Influenza B	1	2	4	7, 7–7	0
Unknown respiratory	1	3	0	8, 8–8	0
Enteric	6	59	36	11.5, 7.5–20	0
Norovirus	4	33	6	8, 6.5–12.25	0
C. difficile	1	7	0	64, 64–64	0
Unknown enteric[c]	1	19	30	14, 14–14	0
Total	20	117	55	14, 7.25–21.75	3

Abbreviations: ARO, antibiotic-resistant organism; *C. difficile, Clostridium difficile*; CPE, carbapenemase-producing Enterobacteriaceae; ICU, intensive care unit; IQR, interquartile range; MRSA, methicillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant Enterococcus.

[a]AROs included VRE, CPE, and MRSA. All ARO outbreaks were caused by VRE during the study period.

[b]Serious adverse events included patient deaths or ICU transfers directly related to the outbreak agent.

[c]Presumed norovirus outbreak.

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- Tendance séculaire à l'amélioration dans tous les groupes, mais plus grande amélioration dans les unités en éclosion

PRE-OUTBREAK PERIOD

Case units: 35.8% (35.3-36.4%)

Control units: 39.3% (38.9-39.7%)

IRR: 0.91 (0.88-0.93) p<0.001

OUTBREAK PERIOD

Greater improvement on the outbreak wards

IRR: 1.04 (1.02-1.06) p=0.003

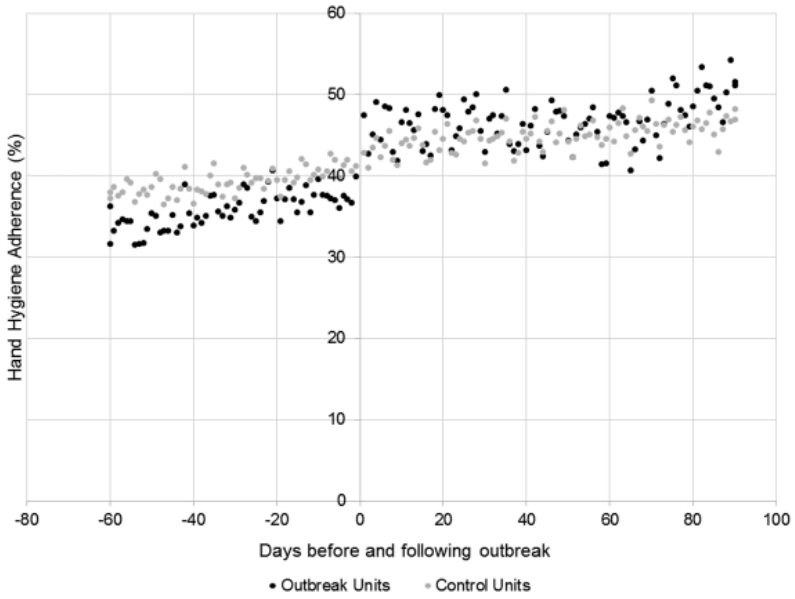

Figure 1. Hand hygiene adherence among units on outbreaks as compared to controls during the same time period, 60 days prior to 90 days following outbreak.

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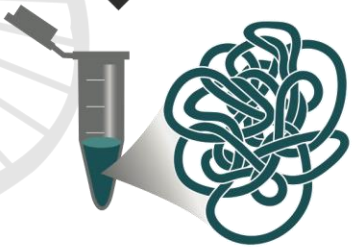
The Whole Genome Sequencing (WGS) Process

WGS is a laboratory procedure that determines the order of bases in the genome of an organism in one process. WGS provides a very precise DNA fingerprint that can help link cases to one another allowing an outbreak to be detected and solved sooner.

Bacterial Culture

1. DNA Extraction

1 Scientists take bacterial cells from an agar plate and treat them with chemicals that break them open, releasing the DNA. The DNA is then purified.



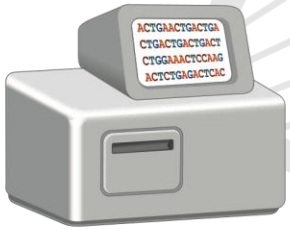
2. DNA Shearing

2 DNA is cut into short fragments of known length, either by using enzymes "molecular scissors" or mechanical disruption.

3. DNA Library Preparation

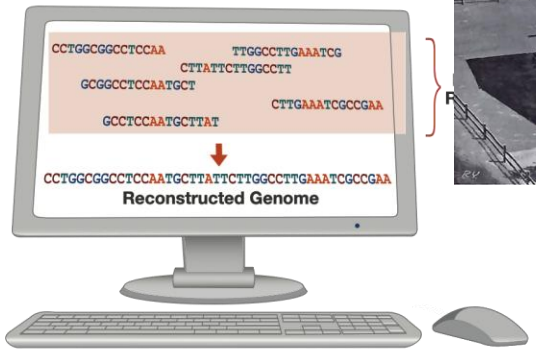
3 Scientists make many copies of each DNA fragment using a process called polymerase chain reaction (PCR). The pool of fragments generated in a PCR machine is called a "DNA library."

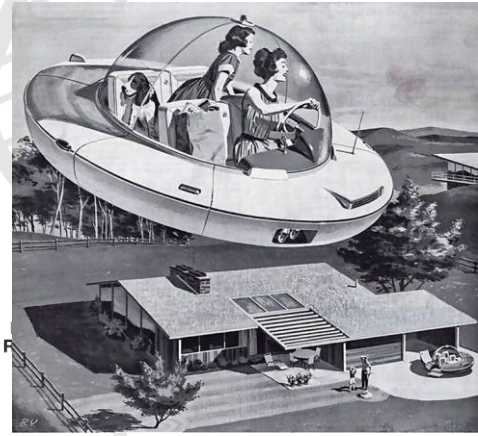
4. DNA Library Sequencing



4 The DNA library is loaded onto a sequencer. The combination of nucleotides (A, T, C, and G) making up each individual fragment of DNA is determined, and each result is called a "DNA read."

5. DNA Sequence Analysis





5 The sequencer produces millions of DNA reads and specialized computer programs are used to put them together in the correct order like pieces of a jigsaw puzzle. When completed, the genome sequence containing millions of nucleotides (in one or a few large pieces) is ready for further analysis.

CS264789-A

https://www.cdc.gov/pulsenet/pathogens/wgs.html

Clinical Infectious Diseases
MAJOR ARTICLE

Whole-Genome Sequencing Surveillance and Machine Learning of the Electronic Health Record for Enhanced Healthcare Outbreak Detection

Alexander J. Sundermann,[1,2,3] Jieshi Chen,[4] Praveen Kumar,[5] Ashley M. Ayres,[6] Shu-Ting Cho,[2] Chinelo Ezeonwuka,[1,2] Marissa P. Griffith,[1,2] James K. Miller,[4] Mustapha M. Mustapha,[1,2] A. William Pasculle,[7] Melissa I. Saul,[3] Kathleen A. Shutt,[1,2] Vatsala Srinivasa,[1,2] Kady Waggle,[1,2] Daniel J. Snyder,[3] Vaughn S. Cooper,[8] Daria Van Tyne,[2] Graham M. Snyder,[2,8] Jane W. Marsh,[1,2] Artur Dubrawski,[4] Mark S. Roberts,[5,9] and Lee H. Harrison,[1,2,3]

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Détection d'éclosion

- La détection traditionnelle des éclosions repose sur la détection par les humains de grappes de cas (associations spatio-temporelles)
  - WGS suit une fois que l'épidémie est détectée/suspectée
  - Enquête limitée aux cas qui sont inclus dans la "liste de cas"
  - Peut manquer des voies de transmission s'il manque des cas
- Développement d'un système de détection amélioré pour la transmission associée aux soins de santé (EDS-HAT)
  - Combinaison du WGS et de l'apprentissage automatique des dossiers de santé électroniques pour identifier les voies de transmission

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- Étude monocentrique (centre universitaire de 758 lits) sur 2 ans
- Surveillance WGS des pathogènes bactériens nosocomiaux Nov 2016-Nov 2018
- Apprentissage automatique
  - Les paramètres correspondent à l'aide de 9 épidémies historiques
  - Routes de transmission statistiquement significatives (appareil, emplacement ou fournisseur)
- Comparateur
  - Éclosions détectées par l'IPAC
  - WGS demandé par l'IPAC au cas par cas

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Résultats

- 3165 isolats
  - 2752 isolats de patients uniques
  - 99 clusters impliquants 297 (10.8%) patients detectés par WGS
  - Taille des clusters: 2-14 patients
  - >=1 route de transmission détectées dans 66% des clusters
- PCI traditionnelle
  - 15 éclosions suspectées involvant 133 patients
  - >= 1 route de transmission détectées dans 5/133 patients (3.8%)
- Bénéfices potentiels:
  - WGS pourrait avoir détecté entre 25-63 transmissions additionnelles
  - EDS-HAT pourrait être “cost-effective? (économies globales USD 192,000 to USD 692,000)

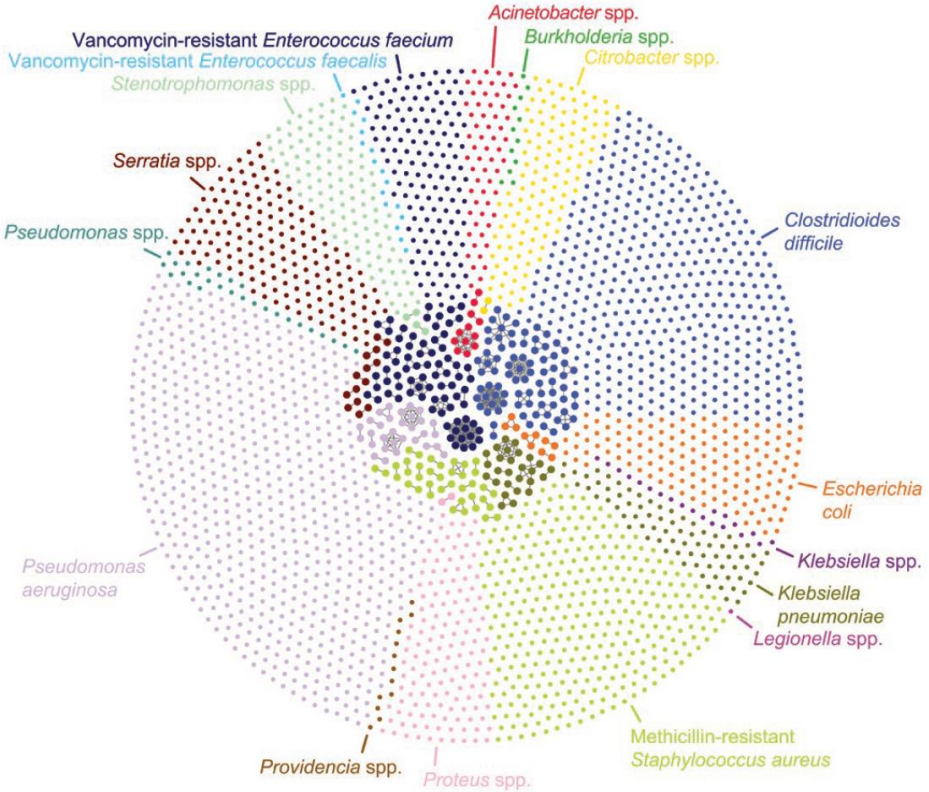

Figure 2. Cluster network of EDS-HAT isolates sequenced, grouped by bacterial species. The outer circle shows patient isolates that are not genetically related. The inr circle shows outbreaks of genetically related isolates as defined by cgSNP cutoffs described in Methods. The network plot was visualized with Gephi. Abbreviations: cgSN core genome single nucleotide polymorphism; EDS-HAT, Enhanced Detection System for Healthcare-Associated Transmission.

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and Medicine, University of Pittsburgh School of Medicine, Pittsburgh, Pe

Table 1. EDS-HAT Isolates Sequenced and Attributable Readmissions

	Sequenced				Attributable Readmissions	
Species	Collected	Unique Patient Isolates	No. Related[a] (%)	Clusters	7-Day	30-Day
Acinetobacter species	83	72	12 (16.7)	3	1	1
Burkholderia species	12	12	0 (0)	0	0	0
Citrobacter species	126	118	2 (1.7)	1	0	0
Clostridioides difficile	558	524	80 (15.3)	21	2	10
Escherichia coli (ESBL)	170	149	10 (6.7)	4	0	1
Klebsiella species (ESBL, not *pneumoniae*)	25	20	0 (0)	0	0	0
Klebsiella pneumoniae (ESBL)	111	102	27 (26.5)	8	0	1
Legionella species	1	1	0 (0)	0	0	0
Methicillin-resistant *Staphylococcus aureus*	425	365	39 (10.7)	18	1	5
Proteus species	151	140	2 (1.4)	1	0	0
Providencia species	14	13	0 (0)	0	0	0
Pseudomonas aeruginosa	881	693	31 (4.5)	10	2	3
Pseudomonas species (not *aeruginosa*)	28	27	0 (0)	0	0	0
Serratia species	181	173	14 (8.1)	7	1	3
Stenotrophomonas species	127	114	4 (3.5)	2	0	0
Vancomycin-resistant *Enterococcus faecalis*	17	17	0 (0)	0	0	0
Vancomycin-resistant *Enterococcus faecium*	247	212	76 (35.8)	24	5	16
Total	3165	2752	297 (10.8)	99	12	40

Abbreviations: EDS-HAT, Enhanced Detection System for Healthcare-Associated Transmission; ESBL, extended-spectrum β-lactamase; SNP, single nucleotide polymorphism.
[a]Fifteen or fewer pairwise SNPs for all organisms except for *C. difficile* (≤2 SNPs) (see Methods).

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Whole-Genom
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Mellon University, Pittsburgh, Pennsylvania, USA;
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[5]Department of Medicine, University of Pittsburgh
and Medicine, University of Pittsburgh School of M

Table 2. High-Impact or Notable Outbreaks Detected by EDS-HAT

Outbreak	Details
Vancomycin-resistant *Enterococcus faecium* outbreak associated with IR and injection of sterile contrast [6]	This outbreak involved 10 initial patients and was ongoing when it was discovered. The EDS-HAT ML algorithm identified IR as a significant transmission route (OR: 43.8; $P < .01$; 95% CI: 5.6 to 346). Nine patients, including 3 with bacteremia, were identified as having IR procedures involving unsterile practices in the preparation of contrast. Safe practices and enhanced environmental cleaning were implemented and no additional IR-associated infections occurred. Subsequently, transmission of the outbreak strain occurred among 4 patients on shared hospital units.
Pseudomonas aeruginosa outbreak associated with gastroscopy [5]	This outbreak comprised 6 patients housed on different units over 7 months. Two patients had bacteremia, 3 had pneumonia, and 1 had a urinary tract infection. The EDS-HAT ML algorithm detected gastroscopy as a significant route for 4 patients (OR: 300.6; $P < .01$; 95% CI: 15.8 to 5690.5) with a fifth patient who did not have a charge code that reflected the gastroscopy procedure but who had a clinical note reflecting the procedure that was identified on manual EHR review. A post-disinfection gastroscope culture performed as part of routine IP practice was positive for *P. aeruginosa*; the isolate was sequenced and belonged to the outbreak, confirming gastroscopy as the responsible transmission route.
Outbreaks of multiple pathogens at the embedded chronic care facility	EDS-HAT ML identified 11 clusters involving 38 patients over 22 months, with a range of 2–9 total patients per cluster; 25 (65.8%) patients had this facility as a plausible transmission route. Pathogens included *C. difficile* (6 clusters), *Klebsiella pneumoniae* (1 cluster), MRSA (1 cluster), *P. aeruginosa* (2 clusters), and VRE (1 cluster). Three patients with *C. difficile* in 3 clusters were subsequently transferred to our institution and had unit-based commonalities with 3 additional patients who later developed *C. difficile* infection suggesting continuing transmission.
Outbreaks of multiple pathogens on an ICU	There were 12 clusters with 57 patients (range: 2–14), of whom 28 (49.1%) had a single ICU stay identified by EDS-HAT ML as the potential transmission route. Organisms included *C. difficile* (3 clusters involving 10 patients), *K. pneumoniae* (3 clusters involving 16 patients), *P. aeruginosa* (1 cluster involving 3 patients), *Serratia marcescens* (1 cluster involving 2 patients), and VRE (4 clusters involving 26 patients).
C. difficile outbreaks associated with wound care	There were 9 *C. difficile* clusters, ranging in size from 2 to 12 patients. Of 52 patients, 29 (55.8%) had wound care service identified as a potential transmission route, with exposures occurring 1–92 days (mean: 16 days; median: 9 days) before the positive test for *C. difficile*. This consult service involved nurses providing management of sacral pressure ulcer wounds.
MRSA infections associated with EEG	This cluster consisted of 2 patients with culture dates separated by 8 days. The EDS-HAT ML algorithm identified EEG as a transmission route. Manual EHR review determined that both patients had a bedside EEG performed on the same day on separate units by the same physician and technician, 2 and 10 days before positive culture dates.

Abbreviations: CI, confidence interval; EDS-HAT, Enhanced Detection System for Healthcare-Associated Transmission; EEG, electroencephalography; EHR, electronic health record; ICU, intensive care unit; IP, infection prevention; IR, interventional radiology; ML, machine learning; MRSA, methicillin-resistant *Staphylococcus aureus*; OR, odds ratio; VRE, vancomycin-resistant *Enterococcus faecium*.

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Original article

A prospective multicentre surveillance study to investigate the risk associated with contaminated sinks in the intensive care unit

Anne-Sophie Valentin [1], Sandra Dos Santos [1], Florent Goube [1], Rémi Gimenes [1], Marie Decalonne [1], Laurent Mereghetti [2], Côme Daniau [3], Nathalie van der Mee-Marquet [1, *] on behalf of the SPIADI ICU group[†]

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[2] Service de Bactériologie, Virologie et Hygiène, Centre Hospitalier Universitaire, Tours, France
[3] Unité Infections Associées aux Soins et Résistance aux Antibiotiques, Agence Santé Publique France, Saint Maurice, France

- Etude prospective multicentrique janvier-mai 2020 (73 USI en France, 16% de tous les lits en USI française)
- Lavabos à proximité des patients testés pour P. aeruginosa et Enterobacteriaceae
  - Coton-tige inséré à 5-7 cm dans le drain, Amies TM
  - MDR : EB R 3GCC ou CPE, et Pseudo R Imi
- Questionnaire sur les facteurs de risque de colonisation des éviers

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RESULTATS

- 39 % des éviers présentaient des éclaboussures visibles lors de l'utilisation de l'évier
- 30,5% des lavabos étaient proches du lit (<2m) sans barrière
- 50,9% des éviers contaminés par des bactéries MDR
  - 3GCR 43,9 % ; EPC 2,5 % ; IRPA 7,6 %
- Risque de colonisation plus élevé lorsque l'évier est utilisé pour l'élimination des déchets que uniquement pour HdM
  - 41% (DD) vs 55% (Élimination des déchets) p<0,001

Table 1
Distribution of the MDR Enterobacteriaceae and imipenem-resistant *P. aeruginosa* recovered from the 1191 sink samples

Distribution of the MDR enterobacteriaceae and PA isolated from sink samples	Ceftazidime and/or cefotaxime R	Carbapenemase producers				
		N	bla_{OXA48}	bla_{NDM-1}	bla_{VIM}	Bla_{IMP}
Enterobacteriaceae	833	37	16	17	4	
Klebsiella	254	17	6	9	2	
K. pneumoniae	161	13	5	8		
K. oxytoca	82	4	1	1	2	
other	11					
Enterobacter	315	6	2	4		
E. cloacae	197	3	1	2		
E. asburiae	101	3	1	2		
other	17					
Citrobacter	213	11	6	3	2	
C. freundii	183	10	6	2	2	
Other	30	1		1		
Serratia marcescens	26	2	2			
Escherichia coli	17	1		1		
other Enterobacteriaceae	8					
Imipenem resistant Pseudomonas aeruginosa (n=91)	37	13			9	4

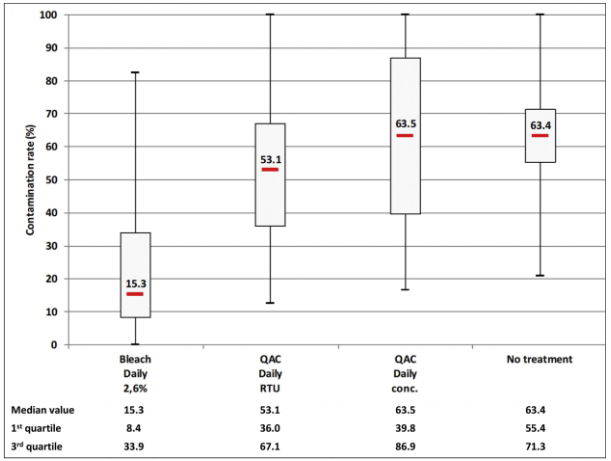

Fig. 1. Box plots representative of the sink contamination rates observed in the 73 ICUs, according to the daily sink treatment (2.6% bleach solution, ready-to-use (RTU) or (concentrated quaternary ammonium compound) QAC solution) and for sinks with no routine disinfection.

Le risque de colonisation diminue avec l'eau de Javel quotidienne mais pas avec l'ammonium quaternaire quotidien

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A prospective multicentre surveillance study to investigate the risk associated with contaminated sinks in the intensive care unit

Anne-Sophie Valentin [1], Sandra Dos Santos [1], Florent Goube [1], Rémi Gimenes [1], Marie Decalonne [1], Laurent Mereghetti [2], Côme Daniau [1], Nathalie van der Mee-Marquet [1, *] on behalf of the SPIADI ICU group[†]

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- Risque d'augmentation de l'incidence des BSI associées aux MDR

Facteurs de risque pour le taux de BSI > 0,7/1000 pd (valeur moyenne pour tous les hôpitaux)

1. >51 % Contamination des éviers
2. >= 14% Éviers avec éclaboussures visibles
3. >=21% de lavabos à proximité du lit des patients sans barrière
4. Pas de traitement quotidien à l'eau de javel

- Aucune association entre la contamination de l'évier et le PAV-BMR

✓ 0-1 ou 2 facteurs de risque : 6/30 (20 %) avec MDR BSI supérieur à la moyenne

✓ 3 ou 4 facteurs de risque : 14/28 (50%) avec MDR BSI supérieur à la moyenne p=0,016

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Original Article

Healthcare microenvironments define multidrug-resistant organism persistence

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- Le microbiome hospitalier est influencé par :
  - Dépôt par des particuliers
  - Caractéristiques environnementales qui soutiennent la croissance
  - Pratiques de nettoyage

- Le microbiome environnemental pourrait ne pas être uniforme dans une pièce

Méthode:

- Étude de cohorte prospective des chambres occupées par 51 patients colonisés par le BMR (single Academic Center in Philadelphia)

- Détection de la contamination bactérienne dans la chambre du patient et sa relation avec la position des patients et les sites de drain

- 3 zones : près du patient, près des drains et distance intermédiaire

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Détection de la contamination bactérienne dans la chambre du patient et sa relation avec la position des patients et des sites de drain

CULTURE-BASED

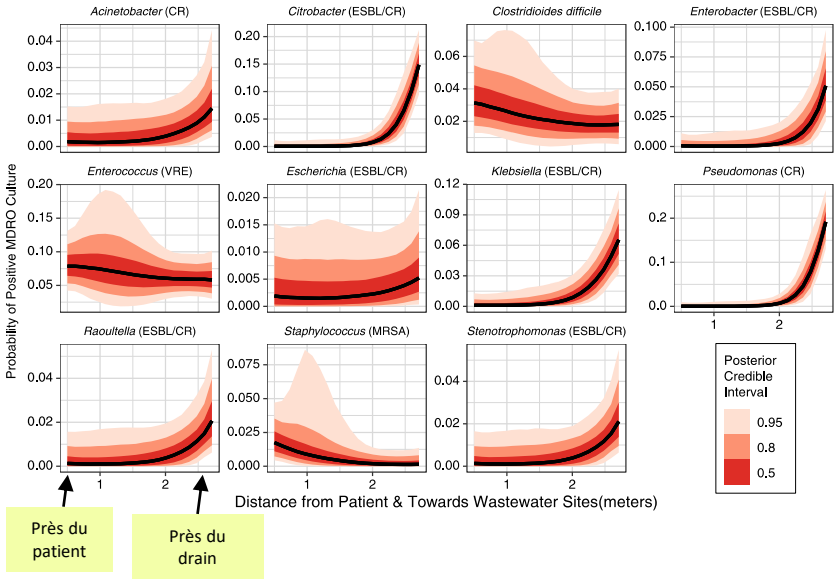

Fig. 1. Impact of distance from the patient on detection of multidrug-resistant organisms (MDROs) in the healthcare environment. Distance from the head of the patient's bed and towards the wastewater sites is shown on the horizontal axis. The vertical axis depicts the probability of MDRO detection by selective culture for each of 11 detected MDROs according to a logistic regression model incorporating a Gaussian process prior for distance. The black line shows the best estimate, and shades of red indicate 50%, 80%, and 95% posterior credible intervals. Note. ESBL, extended-spectrum beta-lactamase; CR, carbapenem-resistant; VRE, vancomycin-resistant *Enterococcus*; MRSA, methicillin-resistant *Staphylococcus aureus*.

16S rRNA GENE SEQ-BASED

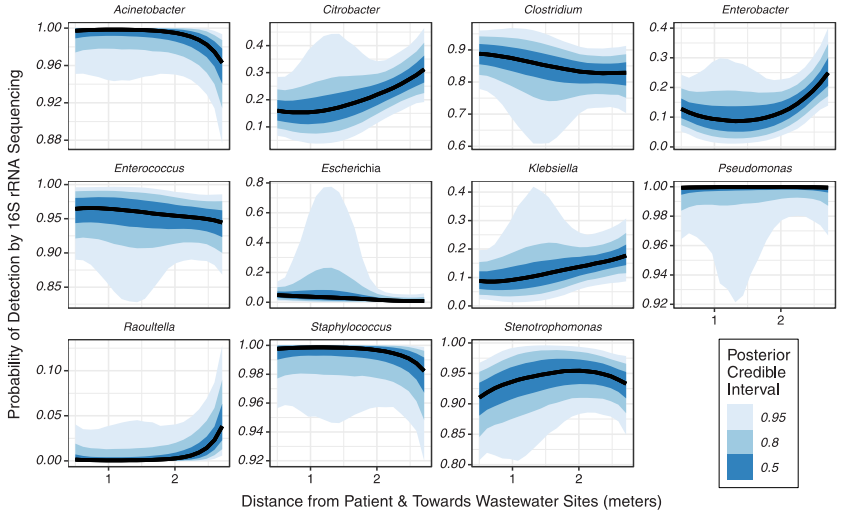

Fig. 2. Impact of distance from the patient on bacterial DNA deposition in the healthcare environment. Distance from the head of the patient's bed and toward the wastewater sites is shown on the horizontal axis. The vertical axis depicts the probability of bacterial genus detection by 16S rRNA gene sequencing for genera corresponding to each of 11 detected multidrug-resistant organisms (MDROs) according to a logistic regression model that incorporates a Gaussian process prior for distance. The black line shows the best estimate, and shades of blue indicate 50%, 80%, and 95% posterior credible intervals.

Les "Hot Spots" sont spécifiques aux agents pathogènes!

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THANK YOU!