Exposition des professionnels de santé à la Covid-19

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INSERM U 1142 - LIMICS

COMMENT SONT ILS EXPOSÉS ?

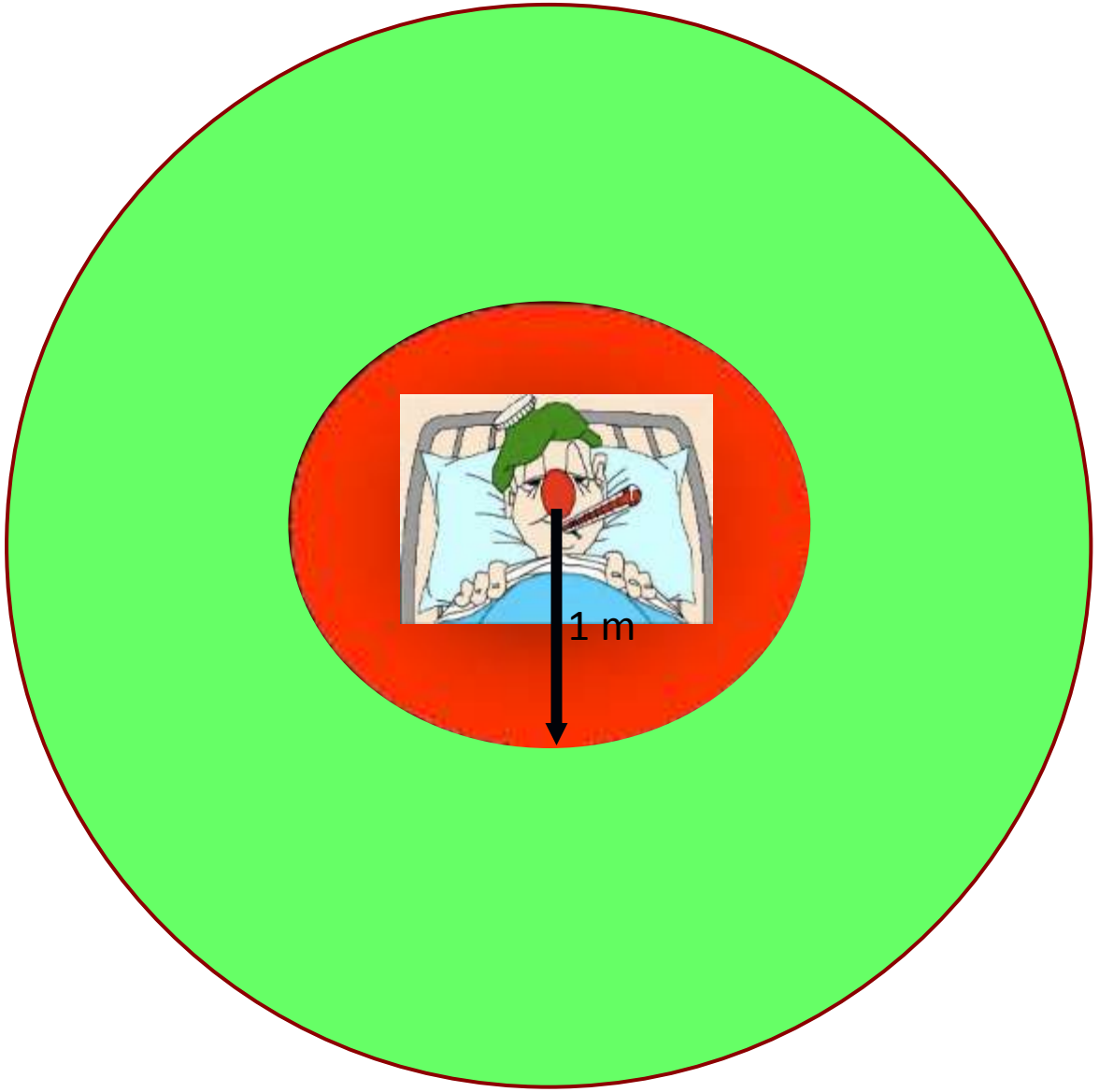
Travaux de Wells, 1934

- Calcul du taux d'évaporation d'une gouttelette en fonction de
  - la taille
  - la distance

- Gouttelette > 100 µm sédimente
  - Droplet

- Gouttelette < 100 µm s'évapore complètement avant 1 m
  - reste en suspension
  - « Droplet nuclei »

Transmission gouttelettes ?



Travaux de Xie

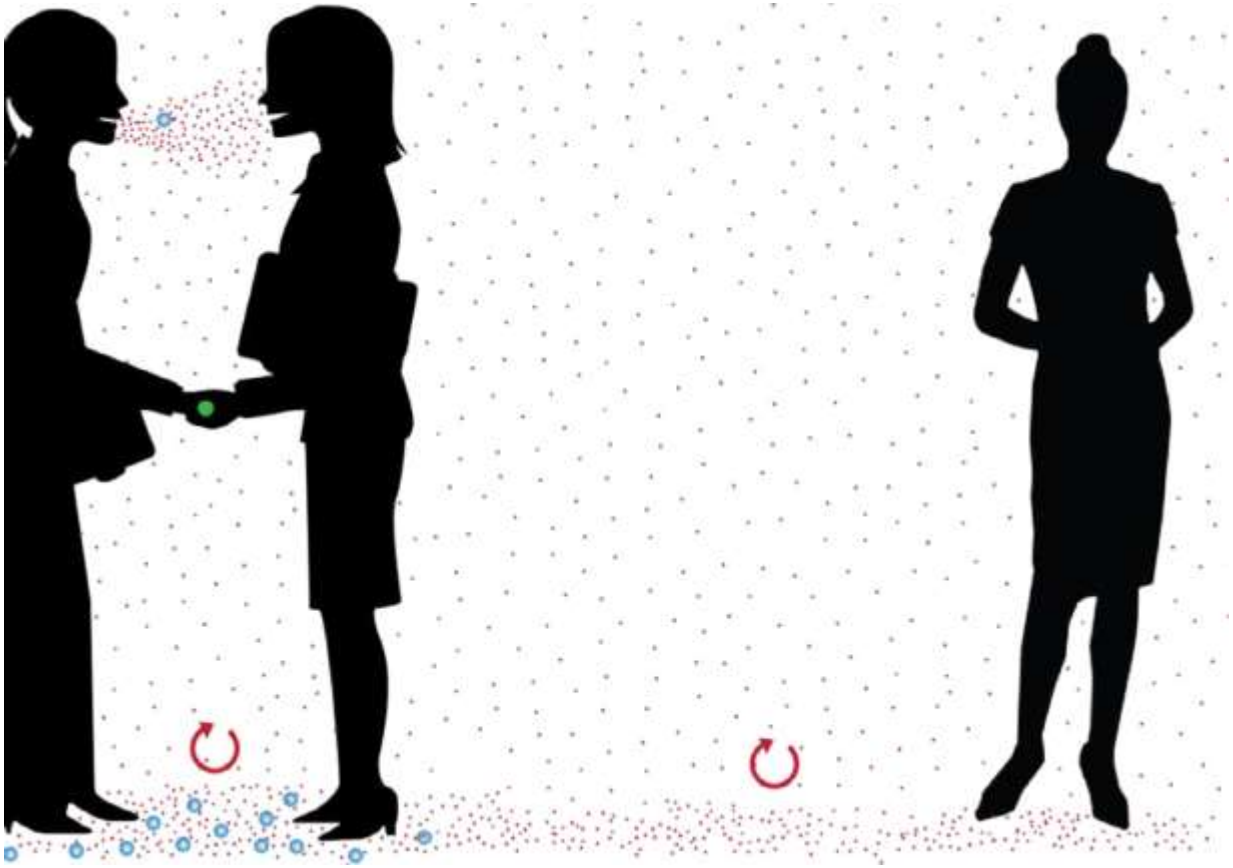
- Définition d'une « grosse » gouttelette selon l'hygrométrie
  - 0% : 125 µm
  - 50% : 100 µm
  - 70% : 85 µm
  - 90% : 60 µm
- Distance parcourue par une « droplet »
  - Eternuement (vélocité 50 m/s) : 6 m
  - Toux (vélocité 10 m/s) : 2 m
  - Parole (vélocité 1 m/s) : 1 m
- Plus de notion de 1 ou 2 m.
  - Entrée dans la chambre en milieu hospitalier

Xie, Indoor Air 2007

Comportement des particules liquidiennes

Caractérisation des émissions

- Mesures expérimentales peu nombreuses & anciennes
  - Duguid, 1946; Loudon & Roberts, 1967
- Génération possible d'aérosols viraux par des personnes infectées
  - Eternuement : 10^6 particules de 0,5 à 16 µm (Gerone, 1966 ; Tang, 2006)
  - Toux : 10^3 à 10^4 particules (0,5 ->30 µm)
  - Parler pendant 5 mn : 3000 particules
  - Respiration simple 10 à 10^4 particules /l d'air expiré (Fabian et al., 2008)
    - forte disparité selon les individus (Edwards et al., 2004)
    - diamètre < 1 µm (Fabian et al., 2008 ; Morawska et al., 2008)



Range of respiratory particles and potential spread over distance. Blue particles represent droplets, typically >100-mm diameter, that fall to the floor under gravity within 2 m of the source. Red particles represent aerosols, typically <100 mm, that stay suspended for longer, but eventually fall to the ground if the air is motionless for long enough (at least 30 min). (Tang, JHI, 2021)

Visualisation des particules

- Visualizing Speech-Generated Oral Fluid Droplets with Laser Light Scattering (NEJM, 41s))
  - https://www.nejm.org/doi/full/10.1056/nejmc2007800

- Eternuement (NHK, 47s)
  - https://www.youtube.com/watch?v=9Mkb4TMT_Cc

- https://www.tu.berlin/en/research/themenportal-forschen/2020/mai/the-risk-of-infection-is-in-the-air/

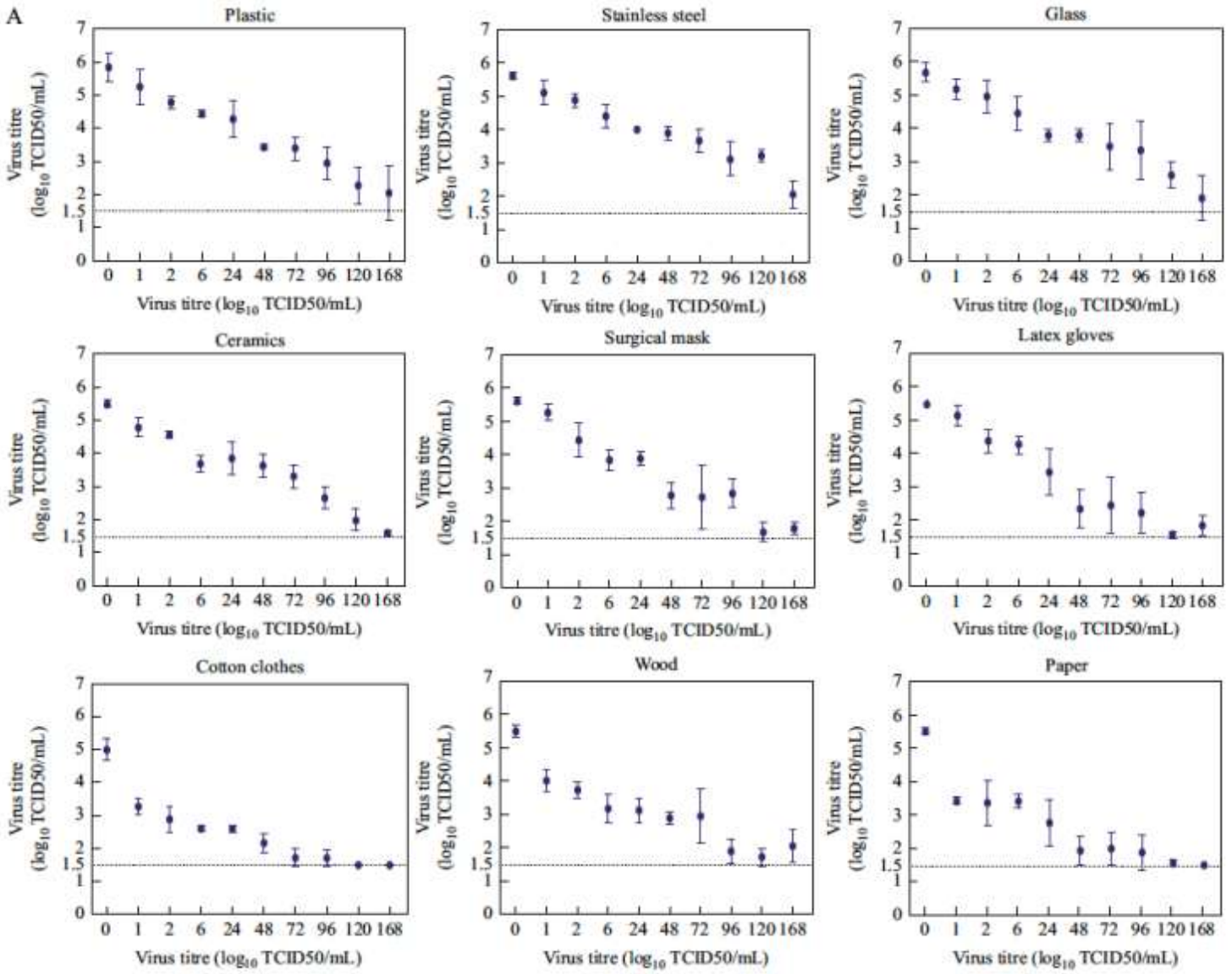
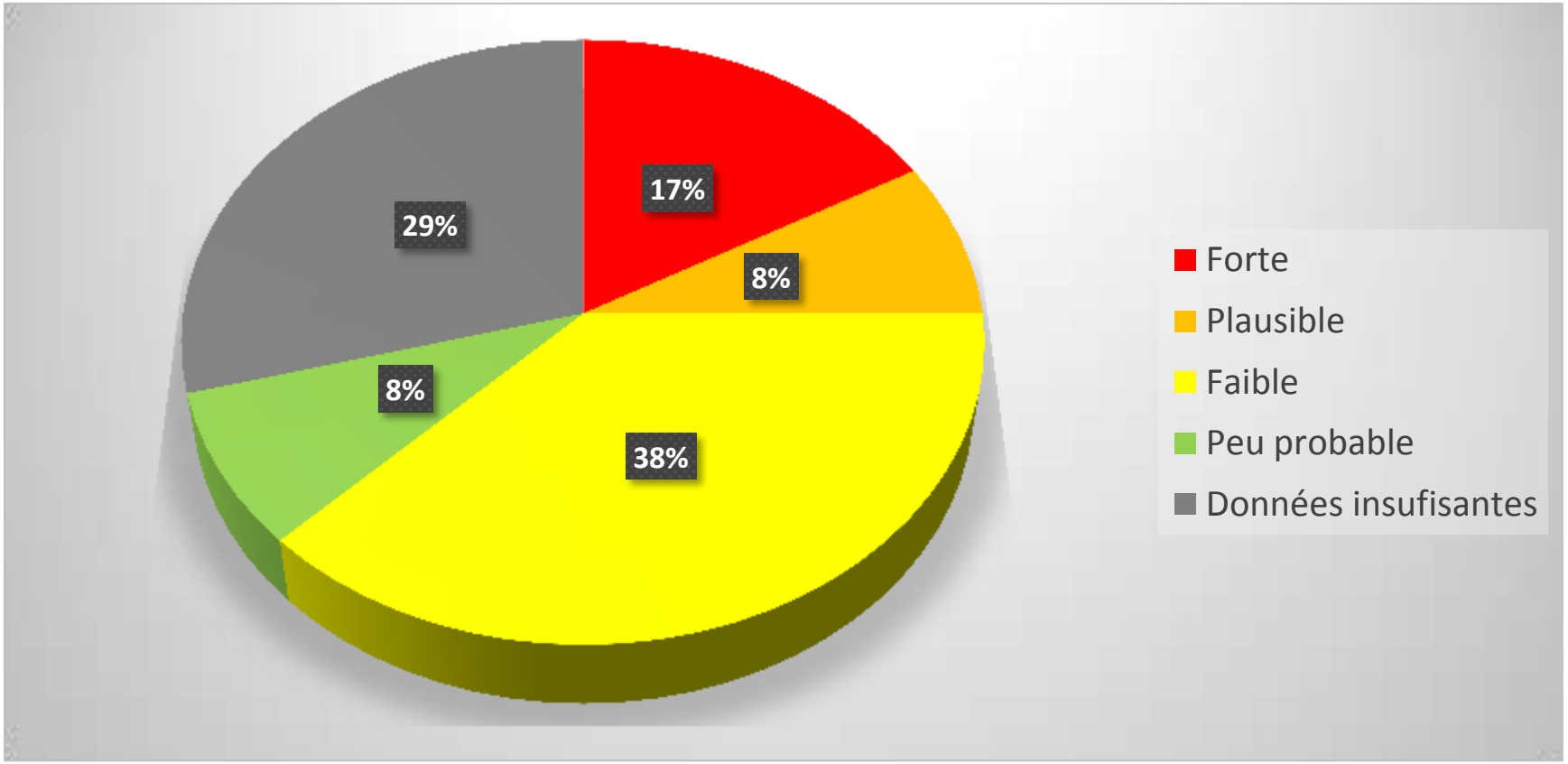


Figure 1. Stability of SARS-CoV-2 on environmental surfaces and in human excreta. (A) Survival time of SARS-CoV-2 on nine surfaces. The limit of detection (LOD) for the assays was $10^{1.5}$ tissue culture infectious dose ($TCID_{50}$)/mL. (B) Survival time of SARS-CoV-2 in three faecal and urine specimens. The LOD for the assays was $10^{2.5}$ $TCID_{50}$/mL due to cytotoxicity caused by faecal and urine specimens.

Liu Y et al., Stability of SARS-CoV-2 on environmental surfaces and in human excreta, Journal of Hospital Infection, https://doi.org/10.1016/j.jhin.2020.10.021

Rôle des fomites dans la transmission ?

Revue de littérature : 25 études inclues (Flahaut, 2021)



Diamond Princess

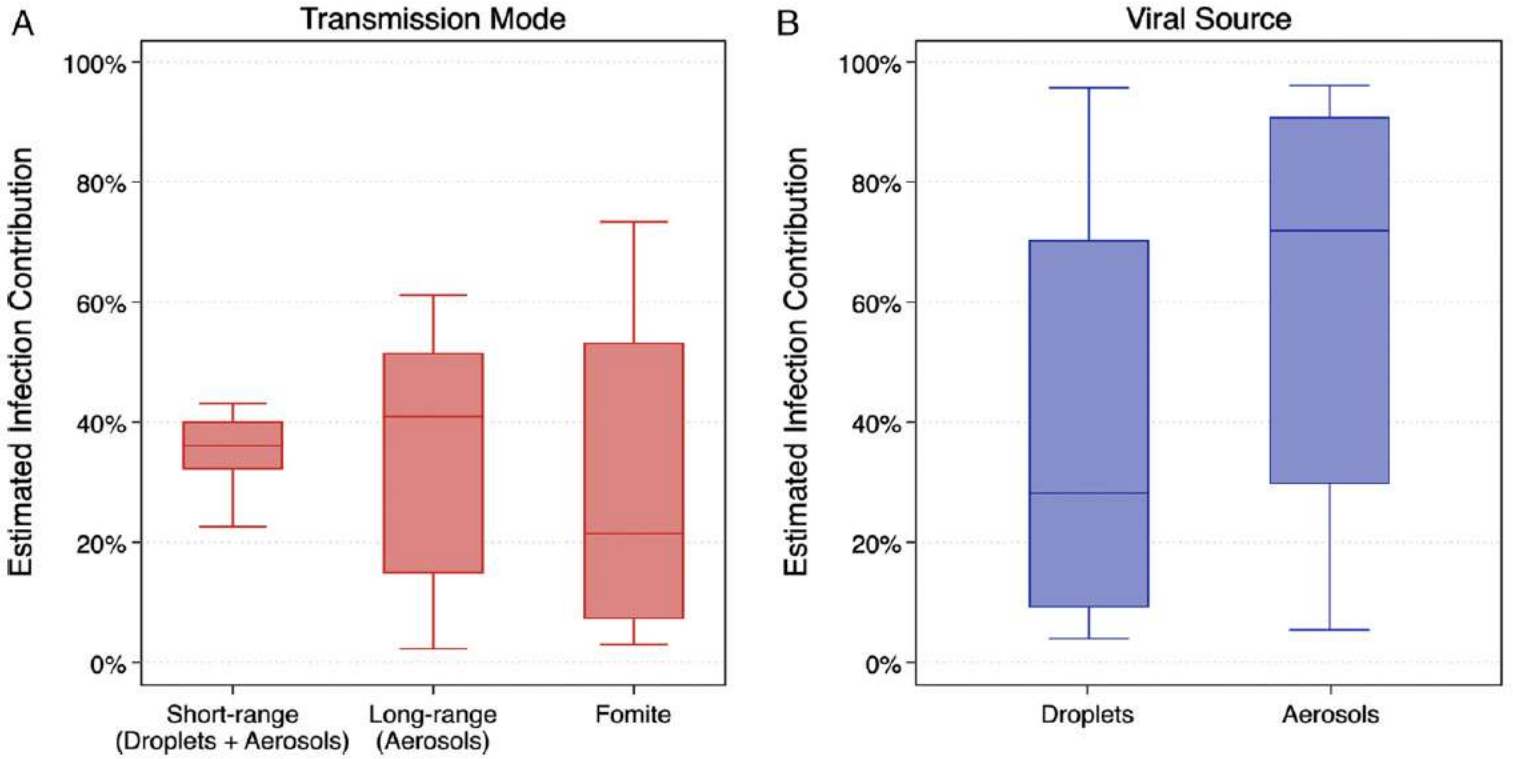


Fig. 2. Estimates of the contributions of transmission modes (*A*) and viral sources (*B*) to infected cases aboard the *Diamond Princess* cruise ship over the entirety of the simulation period.

Mean estimates of the contributions of short-range, long-range, and fomite transmission modes to infected cases across the entire simulation period were 35%, 35%, and 30%, respectively. Mean estimates of the contributions of larger respiratory droplets and smaller respiratory aerosols were 41% and 59%, respectively.

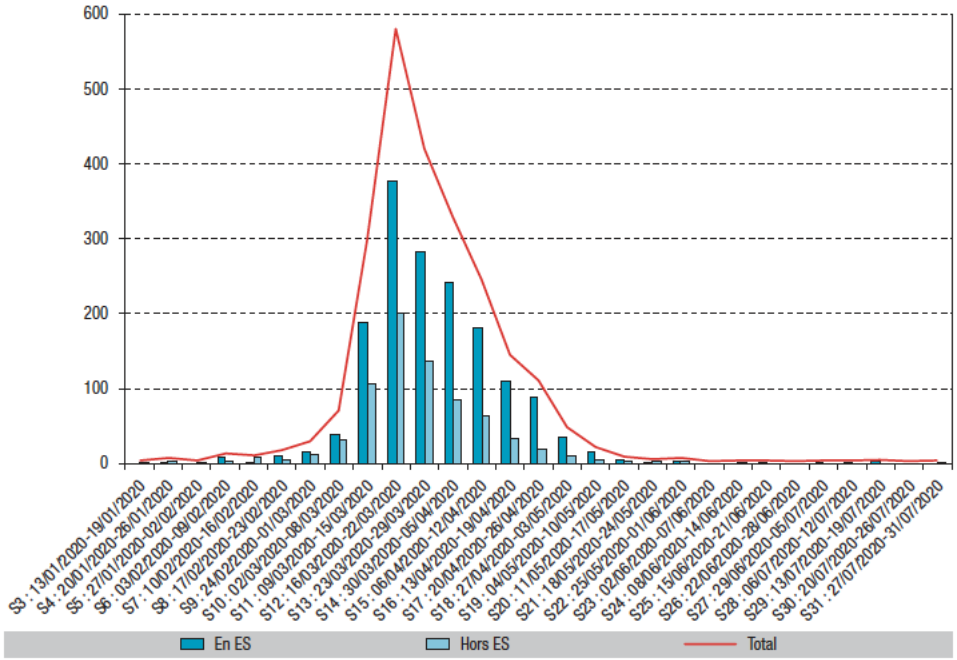
Azimi, PNAS February 23, 2021 118 (8) e2015482118; https://doi.org/10.1073/pnas.2015482118

SONT-ILS DES PROFESSIONNELS À RISQUE ?

Cas rapportés chez les soignants

- ECDC, 31 janvier 2020 – 13 janvier 2021 (9 pays)
  - 261 080 cas soignants / 2 918 100 cas (8,9%)
  - 10,1% des soignants / 4,1% de la population
- En France : étude Geres 17 avril – 15 aout 2020 (BEH 8/12/20)

Distribution hebdomadaire des dates de début des symptômes chez les participants à l'enquête (données au 15 août 2020), France



ES : établissement de santé.

Seroprévalence chez les soignants

> Population générale

Revue de littérature -> juillet 2020 (Gomez-Ochoa, Am J Epidemiol 2021)
28 études : prévalence 7% (4-11%)

	Belgique	Espagne	Suède	Danemark
IDE	10%	32,2%	35%	4,03%
Médecins	6,4%	39,6%	21%	4,07%
Administratifs	2,9%	27,6%	7%	2,70%
Période	Mars – mai 2020	Avril 2020	Avril 2020	Avril 2020

Rudberg, Nat Commun 2020 DOI: 10.1038/s41467-020-18848-0
Naesens, Epidemiol Infect 2021 DOI: 10.1017/S0950268821001497
Galan, Inferm Infecc Microbiol Clin 2021 doi: 10.1016/j.eimc.2020.11.015
Iversen, Lancet Infect Dis 2020 https://doi.org/10.1016/S1473-3099(20)30589-2

Facteurs de risque soignants

- Danemark, avril 2020
- 28 792 sérologies chez des soignants
  - Soignants vs donneurs de sang : OR 1,33 (1,12-1,58)
  - 1ere ligne vs autre secteur : OR 1,38 (1,22-1,56)
  - Secteur COVID vs autre secteur : OR 1,65 (1,34-2,03)

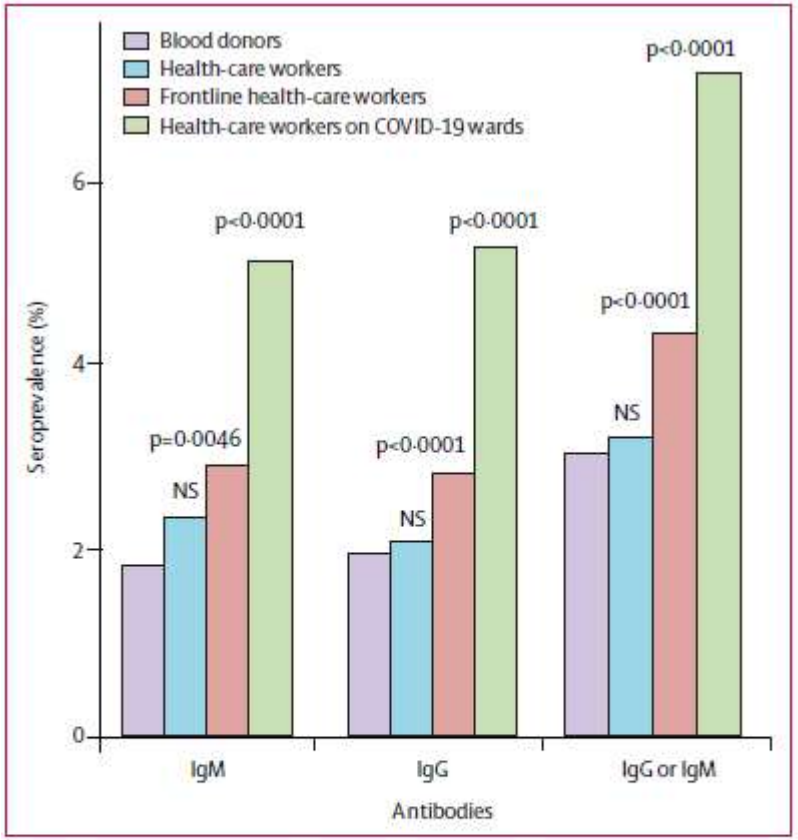


Figure 1: **Seroprevalence according to job assignment compared with blood donors**
Purple indicates blood donors serving as a proxy for the general population (n=4672). Blue indicates health-care workers not working on dedicated COVID-19 wards or frontline (n=11 488). Red indicates frontline health-care workers not working on dedicated COVID-19 wards (n=15 983). Green indicates health-care workers working on dedicated COVID-19 wards (n=1321). NS=not significant.

Iversen, Lancet Infect Dis 2020

Facteurs de risques HCWs

- Etude soignants Wuhan (Zhang, Clin Microbiol Infect 2020)
- 424 soignants positifs
  - Intubation ou extubation : OR 4,1 (1,2-13,9)
  - Port régulier d'un N95 : OR 0,4 (0,2-0,7)
  - Port de lunettes de protection : OR 0,2 (0,1-0,4)

Clinical Infectious Diseases
MAJOR ARTICLE

Viral Sequencing to Investigate Sources of SARS-CoV-2 Infection in US Healthcare Personnel

Katarina M. Braun,[1,a] Gage K. Moreno,[2,a] Ashley Buys,[3] Elizabeth D. Somsen,[2] Max Bobholz,[2] Molly A. Accola,[3,4] Laura Anderson,[3,4] William M. Rehrauer,[3,4] David A. Baker,[2] Nasia Safdar,[5] Alexander J. Lepak,[5] David H. O'Connor,[2,6,b] and Thomas C. Friedrich[1,6,b]

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- 95 soignants et 137 contacts, Wisconsin, mars-dec 2020
- Mesures barrières appliquées
- Séquençage des virus

Table 1. Likely Sources of Severe Acute Respiratory Syndrome Coronavirus Disease 2 Infection in the Healthcare Personnel Evaluated

Likely Source of Infection in HCP[a]	SARS-CoV-2 Cases, No. (%)
No evidence of healthcare-associated transmission	55 (57.9)
Combined patient and employee cluster	12 (12.6)
Inconclusive	11 (11.6)
Employee source (via employee-employee interactions)	10 (10.5)
Patient source (via employee-patient interactions)	4 (4.2)
Outside community	3 (3.2)
Total	95 (100)

Abbreviations: HCP, healthcare personnel; SARS-CoV-2, severe acute respiratory syndrome coronavirus. 2.

[a]Full definitions for each transmission bin can be found in Supplementary File 1. Briefly, "no evidence of healthcare-associated transmission" includes cases in which available sequences do not support transmission in the healthcare setting, and "outside community" includes cases in which transmission outside the healthcare setting could be reasonably established. "Inconclusive" includes cases in which no consensus sequence was available for the HCP and/or there were no appropriate comparator sequences.

CID. 2021;73

Available online at www.sciencedirect.com
Journal of Hospital Infection
journal homepage: www.elsevier.com/locate/jhin
Healthcare Infection Society
ELSEVIER

Short Report

SARS-CoV-2 infection: advocacy for training and social distancing in healthcare settings

A. Gagneux-Brunon [a,b,c], C. Pelissier [d], J. Gagnaire [a], S. Pillet [b,e], B. Pozzetto [b,e], E. Botelho-Nevers [a,b,c], P. Berthelot [a,b,c,e,*]

- Etude St Etienne, 25 mars – 28 avril 2020

Table I
Odds ratio for severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection in 1000 healthcare workers (HCWs) in the different types of wards between 25th March and 28th April 2020 at the University Hospital of Saint-Etienne, France

	Infected no./total no. of HCWs (%)	95% CI	Odds ratio for SARS-CoV-2 infection (95% CI)	*P*-value
COVID-19 wards (type 1)	11/315 (3.5)	1.4–5.4	1	0.005
Mixed COVID-19 wards (type 2)	7/209 (3.3)	0.9–5.7	1 (0.4–2.5)	
Non-COVID-19 wards (type 3)	37/476 (7.8)	5.4–10.2	2.3 (1.2–4.6)	

COVID-19, coronavirus disease 2019; CI, confidence interval.

SARS-CoV-2 seroprevalence and transmission risk factors among high-risk close contacts: a retrospective cohort study

- Suivi de 7770 contacts de 1114 cas à Hong Kong (Ng, Lancet Infect Dis March 2021)
- Taux d'attaque
  - Domicile : 5·9% (95% CI 4·9-7·1)
  - Travail : 1·3% (0·9-1·9)
  - Contacts sociaux : 1·3% (1·0-1·7)
- Facteurs de risques
  - A domicile
    - Partage de chambre : OR 5·38 [95% CI 1·82-15·84]; p=0·0023
    - Parler > 30 mn : OR 7·86 [3·86-16·02]; p<0·0001
  - Hors domicile
    - Contact avec plusieurs cas : OR 3·92 [95% CI 2·07-7·40], p<0·0001
    - Parler > 30 mn : OR 2·67 [1·21-5·88]; p=0·015
    - Partage d'un véhicule : OR 3·07 [1·55-6·08]; p=0·0013
- Sans impact
  - Repas commun
  - Co-usage toilettes

Ng, Lancet Infect Dis March 2021

Exposures associated with SARS-CoV-2 infection in France: A nationwide online case-control study

- SARS-CoV-2 infected adults recruited between 27 October and 30 November 2020
- 3426 cases and 1713 controls, multivariable analysis
- Increased risk of infection associated with
  - any additional person living in the household (adjusted-OR : 1,16; 95%CI: 1,11-1,21);
  - having children attending :
    - day-care (aOR : 1,31; 95%CI: 1,02-1,62),
    - kindergarten (aOR : 1,27; 95%CI: 1,09-1,45),
    - middle school (aOR : 1,30; 95%CI: 1,15-1,47),
    - high school (aOR : 1,18; 95%CI: 1,05-1,34);
  - attending professional (aOR : 1,15; 95%CI: 1,04-1,26)
  - Attending private gatherings (aOR : 1,57; 95%CI: 1,45-1,71);
  - having frequented bars and restaurants (aOR : 1,95; 95%CI: 1,76-2,15),
  - having practiced indoor sports activities (aOR : 1,36; 95%CI: 1,15-1,62).
- No increase in risk associated with frequenting shops, cultural or religious gatherings, or with transportation, except for carpooling (aOR : 1,47; 95%CI: 1,28-1,69).
- Teleworking was associated with decreased risk of infection (aOR : 0,65; 95%CI: 0,56-0,75).

Galmiche, Lancet Regional Health Europe 2021

Risques chez les soignants

- Contact
  - Familial (extérieure)
  - Collègues
- Prise en charge de patients
  - Secteurs non-Covid (diagnostic)
- Facteurs de risque
  - Gestes à risque d'aérosolisation
  - Masques inappropriés ou mal-portés
  - Temps de contact / soins rapprochés ?
- Facteurs protecteurs
  - Mesures barrières
  - Formation /information et suivi

Facteurs de risque chez les soignants

- Etude cas témoins 1130 soignants (244+, 886 -)
- Prise en charge de patients sans AGP : OR 1,4 (1,04-1,9)

Variable	All Cases, Unadjusted	*P* Value	All Cases, Adjusted	*P* Value
Exposures outside work				
Person with known COVID-19	1.5 (0.95–2.5)	.08	1.5 (0.9–2.5)	.10
Person with COVID symptoms	1.2 (0.8–1.8)	.42	1.1 (0.7–1.7)	.75
Household member, known COVID-19	4.4 (1.9–10.3)	<.001	3.8 (1.5–9.3)	.004
Household member, COVID symptoms	3.0 (1.6–5.8)	<.001	3.1 (1.5–6.3)	.002
Gathering of ≥10 people	4.6 (3.1–7.0)	<.001	4.6 (3.0–7.1)	<.001
Patronized restaurant or bar[a]	15.8 (8.6–29.3)	<.001	16.2 (8.6–30.5)	<.001
In-person retail shopping	0.9 (0.6–1.2)	.35	0.9 (0.6–1.2)	.36
Used public transportation	5.4 (3.5–8.2)	<.001	4.4 (2.8–6.9)	<.001

Lentz, ICHE 2020

Facteurs de risque chez les soignants

- Comparaison prévalence soignants / population générale (Jacob, JAMA Netx Open 2021)
  - Sérologie
  - 24 749 personnels, 19 avril → 30 aout 2020
  - Vs prévalence lieu d'habitation
  - Aucun facteur professionnel → augmentation du risque
    - Infirmière
    - Travail au contact de patients COVID
    - Travail en service d'urgences

Revue de littérature risques soignants

- Chou et al. Ann Int Med 30 mars 2021
- Travail dans une unité COVID vs unité non COVID :
  - OR : 1,50-2,39
- Soignant de 1ere ligne vs non première ligne :
  - 0R 1,73 (1,16-2,54)
- Contact direct avec les patients vs pas de contact ou contact minimal
  - OR 2,06 (1,63-2,62)

Professions à risque

- Abattoirs (Allemagne, Portugal, US, France)
  - USA Mai 2020, COVID-19 chez 9.1% des 112 616 travailleurs de l'industrie de la viande/volaille (Waltenburg, MMWR 2020)
    - 0,4 – 3% dans la population
  - Température, humidité, hébergement

TABLE 1 Count and prevalence of COVID-19 cases by major occupational group

Major occupational group	Case count	Number employed in Washington	Estimated cases/employed × 100,000
Architecture and engineering	97	77,020	125.9
Arts, design, entertainment, sports, and media	93	49,860	186.5
Building and grounds cleaning and maintenance	579	90,590	639.1
Business and financial operations	203	225,940	89.8
Community and social service	178	52,280	340.5
Computer and mathematical	111	173,940	63.8
Construction and extraction	606	169,600	357.3
Education, training, and library	241	189,670	127.1
Farming, fishing, and forestry	741	22,250	3330.3
Food preparation and serving related	517	299,950	172.4
Healthcare practitioners and technical	1208	171,440	704.6
Healthcare support	989	144,170	686
Installation, maintenance, and repair	240	133,320	180
Legal	49	22,500	217.8
Life, physical, and social science	54	39,850	135.5
Management	667	162,850	409.6
Office and administrative support	695	392,860	176.9
Personal care and service	579	74,900	773
Production	964	178,980	538.6
Protective service	231	66,690	346.4
Sales and related	712	316,510	225
Transportation and material moving	1096	263,330	416.2

Zhang, AJIM 2020

Table 1 Number of employed, active workers in the lockdown phase, risk class of SARS-CoV-2 infection and compensation claims applications by economic sector in Italy

Code	Economic sector (first digit ATECO classification)	Employed (thousands)	Active workers during the lockdown (thousands)	Average risk class	Compensation claims applications for COVID-19 (%)
A	Agriculture, forestry and fishing	908.8	854.1	L	2.1
B	Mining and quarrying	24.7	9.7	L	0.0
C	Manufacturing	4321.4	1444.1	L	2.6
D	Electricity, gas, steam and air conditioning supply	114.1	114.1	L	0.1
E	Water supply; sewerage, waste management and remediation activities	242.8	242.8	L	0.1
F	Construction	1339.4	523.7	L	0.2
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	3286.5	1804.1	L	1.1
H	Transportation and storage	1142.7	1142.7	L	1.1
I	Accommodation and food service activities	1480.2	317.6	L	2.4
J	Information and communication	618.1	618.1	L	0.2
K	Financial and insurance activities	635.6	635.6	L	0.2
L	Real estate activities	164.0	0.0 *	L	0.4
M	Professional, scientific and technical activities	1516.4	1438.4	L	1.1
N	Administrative and support service activities	1027.9	662.9	L	4.1
O	Public administration and defence; compulsory social security	1242.6	1242.6	MH	10.4
P	Education	1589.5	1589.5	ML	0.6
Q	Human health and social work activities	1922.3	1922.3	H	71.6
R	Arts, entertainment and recreation	318.2	0.0*	ML	0.3
S	Other service activities	711.6	280.8	ML	1.4
T	Activities of households as employers; undifferentiated goods and services-producing activities of households for own use	738.9	733.3	MH	0.0
U	Activities of extraterritorial organisations and bodies	14.1	0.0*	L	0.0
	Total	23 359.9	15 576.3		29 320 (100%)

Sources: Employed and active workers during the lockdown period data have been retrieved by Istat (Italian Institute of Statistics); average risk class by economic sectors (Italian Scientific Committee) as stated in Methods section; compensation claims by Inail (Italian Workers Compensation Authority).
*Economic activity in this sector was completely suspended during the pandemic lockdown.
H, high; L, low; MH, medium-high; ML, medium-low.

Asymptomatic COVID-19 Adult Outpatients

- Etude française : sur 17911 patients, 496 (2.8%) PCR COVID positifs dont 180 (36.3%) asymptomatiques
- Sur les 180 patients asymptomatiques :
  - We found that the proportion of asymptomatic patients with low viral loads was significantly higher than that observed in symptomatic patients (Ct values ≥ 30: 25% versus 11.7%, *P* = 0.003, Fig. 1B
  - Mais 75% avaient une charge virale élevée (significativement plus élevée que la moyenne des sujets symptomatiques),
    - mean Ct value (± SD) 20.08 ± 2.97
  - 50.6% ont présenté une culture cellulaire positive (virus viable).

Glenet, Nature Scientific Reports 2021

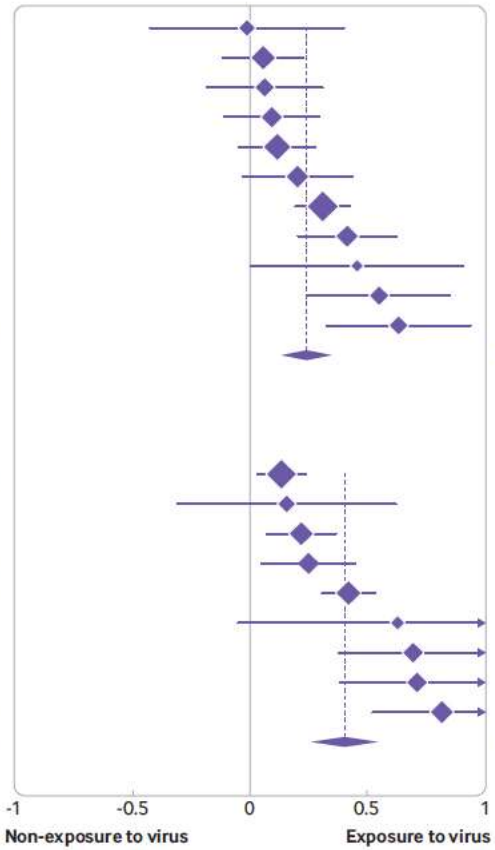
CHU ROUEN NORMANDIE

Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis

Steve Kisely,[1,2,3,4] Nicola Warren,[1,3] Laura McMahon,[3] Christine Dalais,[3] Irene Henry,[1] Dan Siskind[1,2,5]

- 25 études inclues (5 COVID, 3 MERS, 1 EBOLA, 16 SARS-CoV)

Study or group	Virus contact Mean	SD	Total	Control Mean	SD	Total	SMD IV random (95% CI)	Weight (%)	SMD IV random (95% CI)
Acute/post-traumatic stress									
Chan 2004 (doctors)	15.1	15.8	32	15.4	15.4	81		5.0	-0.02 (-0.43 to 0.39)
Chua 2004	18.6	4.9	271	18.3	5.6	342		11.7	0.06 (-0.10 to 0.22)
Chan 2004 (nurses)	16.8	12.9	74	16.0	12.9	474		8.8	0.06 (-0.18 to 0.31)
Bukhari 2016	2.92	1.1	228	2.81	1.0	159		10.2	0.10 (-0.10 to 0.31)
Chong 2004	39.1	19.3	248	36.6	21.6	527		12.0	0.12 (-0.03 to 0.27)
Oh 2017	33.72	5.72	141	32.25	8.34	172		9.5	0.20 (-0.02 to 0.42)
Lai 2020	22.6	19.3	522	17.0	17.03	735		13.4	0.31 (0.20 to 0.42)
Lee 2018	30.02	19.55	185	22.33	17.7	173		10.0	0.41 (0.20 to 0.62)
Lin 2007	26.03	25.1	66	16.04	8.3	26		4.3	0.45 (-0.00 to 0.91)
Styra 2008	22.07	16.1	120	13.77	13.2	88		7.8	0.55 (0.27 to 0.83)
McAlonan 2007	17.2	14.2	71	9.3	11.2	113		7.2	0.63 (0.33 to 0.94)
Total (95 CI)			1958			2890		100.0	0.25 (0.13 to 0.36)
Test for heterogeneity: τ^2=0.02; χ^2=29.00, df=10, P=0.001; I^2=66%									
Test for overall effect: Z=4.33, P<0.001									
Psychological distress									
Xing pre-print	1.51	0.73	548	1.44	0.43	1388		15.9	0.13 (0.03 to 0.23)
Lin 2007	2.84	2.92	66	2.4	2.7	26		6.9	0.15 (-0.30 to 0.61)
Huang pre-print	3.0	0.94	374	2.77	1.14	430		14.9	0.22 (0.08 to 0.36)
Liu pre-print	41.11	9.79	164	38.83	8.38	348		13.6	0.26 (0.07 to 0.44)
Lai 2020	6.0	5.18	522	4.0	4.44	735		15.5	0.42 (0.31 to 0.53)
Lehmann 2016	3.57	3.26	32	1.75	1.06	12		4.0	0.63 (-0.05 to 1.30)
Yu 2003	28.57	28.23	148	10.92	14.65	52		9.8	0.69 (0.37 to 1.01)
Xuehua 2003	30.22	31.43	101	10.92	14.65	52		9.2	0.71 (0.37 to 1.06)
McAlonan 2007	16.4	12.7	71	8.3	7.5	113		10.1	0.82 (0.51 to 1.13)
Total (95 CI)			2026			3156		100.0	0.41 (0.25 to 0.56)
Test for heterogeneity: τ^2=0.04; χ^2=40.31, df=8, P<0.001; I^2=80%									
Test for overall effect: Z=5.13, P<0.001									



ig 3 | Comparison of continuous scores between low and high risk exposure groups. SMD=standardised mean difference; IV=inverse variance

BMJ 2020

CHU ROUEN NORMANDIE

Box 1: Factors that increase risk of adverse psychological outcomes

Individual factors

- *Clinical*
  - Increased contact with affected patients[6 14 16-18 23 25 26 31 33 36 38 39 41 44 47-49 53 55 56 58-60 62-64 66 67 70]
  - Precautionary measures creating perceived impediment to doing job[50 64]
  - Forced redeployment to look after affected patients[35 55]
  - Higher risk among nurses*[6 23 30 41 50 55 57 64-66]
- *Training and experience*
  - Inadequate training[6 42]
  - Lower levels of education[46]
  - Part time employee[50]
  - Less clinical experience[6 18 36 42]
- *Personal*
  - Increased time in quarantine[14 33 38 59 63 70]
  - Staff with children at home[41 66]
  - Personal lifestyle impacted by epidemic/pandemic[50]
  - Infected family member[25 29 59]
  - Single or social isolation[34 66 70]
  - Female sex†[6 16 23 26 29 36]
  - Lower household income[59 63]
  - Comorbid physical health conditions[29 40 55 67]
  - Younger age‡[32 50 55 59 69]
- *Psychological*
  - Lower perceived personal self-efficacy[40 42]
  - History of psychological distress, mental health disorders, or substance misuse[29 42 45 46 48 53 54 66 69]

Service factors

- Perceived lack of organisational support[12 38 47 48 55 66]
- Perceived lack of adequacy of training[48]
- Lack of confidence in infection control[37]
- No compensation for staff by organisation[13 43]

Societal factors

- Societal stigma against hospital workers[15 40 41 50 51 66]

All studies cited in box are high quality apart from references 13, 14, 26, 30, 39-41, 54, and 52.
*Two studies reported a higher risk for doctors[34 46] and 10 reported a higher risk for nurses.[6 23 30 41 50 55 57 64 65 66]
†Seven studies reported higher risk for women[6 16 23 26 29 36] and one reported higher risk for men.[14]
‡Five studies reported higher psychological distress among younger people[32 50 55 59 69] and two reported higher psychological distress in older people.[28 59]

Box 2: Factors that decrease risk of adverse psychological outcomes

Individual factors

- Frequent short breaks from clinical duties[40]
- Adequate time off work[32 33 43 60]
- Greater experience through years worked[36 42 66]
- Working in an administrative or managerial role[41 50]
- Self-perception of being adequately trained and supported[37 48]
- Faith in precautionary measures[35 40 50 52]
- Supportive peers[12 17 19 34 39 43 52 67]
- Family support[17 35 52]

Service factors

- Positive feedback to staff[38]
- Staff faith in service's infection control procedures[13 43 47 50]
- Provision of protective gear[13 17 29 41 43 52 55 58 66 67]
- Effective staff training in preparation for outbreaks[43 48]
- Staff support protocols[34 71]
- Clear communication with staff[31 34 52 55]
- No infection among staff after start of strict protective measures[13]
- Infected colleagues getting better[13]
- Access to tailored psychological interventions based on needs of individual staff[35 43 55 60 65]

Societal factors

- A general drop in disease transmission[13]

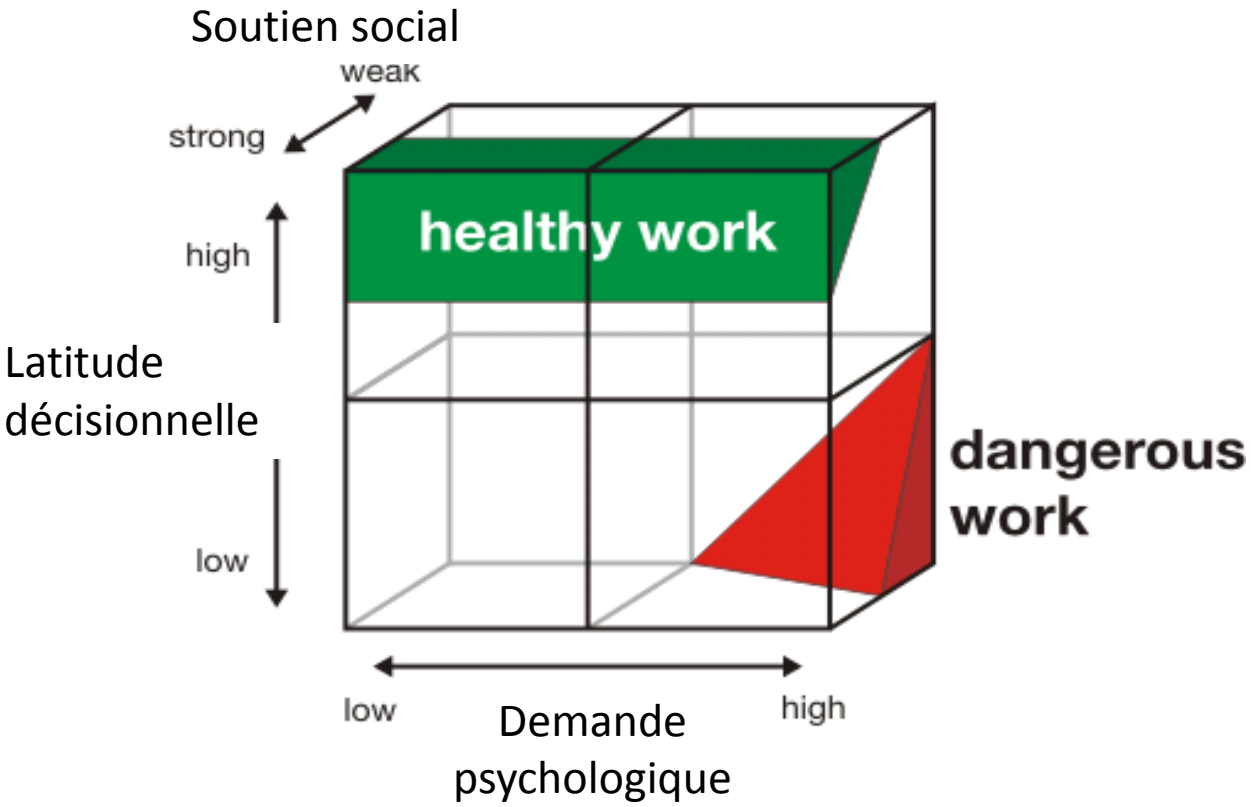
All studies cited in box are high quality apart from references 13, 40, 41, 45, 49, 52, and 54.

Anxiety, depression, trauma-related, and sleep disorders among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis

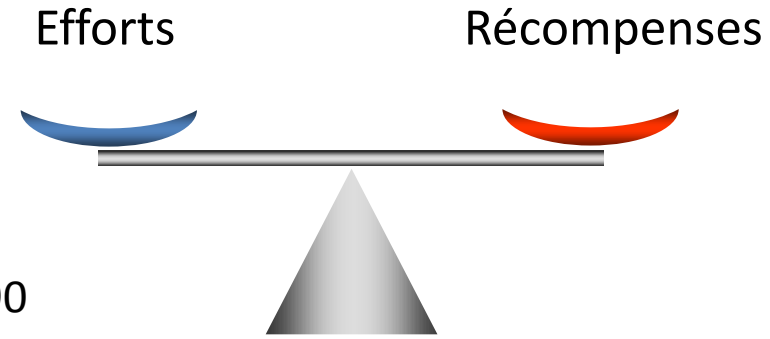
Maxime Marvaldi [a,1], Jasmina Mallet [a,e,f,g,1], Caroline Dubertret [a,e,f,g], Marie Rose Moro [a,b,c,d], Sélim Benjamin Guessoum [a,b,c,d,*]

- 70 études inclues (101 107 participants) dont 31 dans la méta-analyse
- Prévalence :
  - Anxiété : 30 % (24,2-37)
  - Dépression : 31,1% (25,7-36,8)
  - PTSD : 31,4% (17,5-47,3)
  - Troubles du sommeil : 44% (24,6-64,5)
- Proche de la population générale

Neuroscience and Biobehavioral Reviews 126 (2021) 252–264

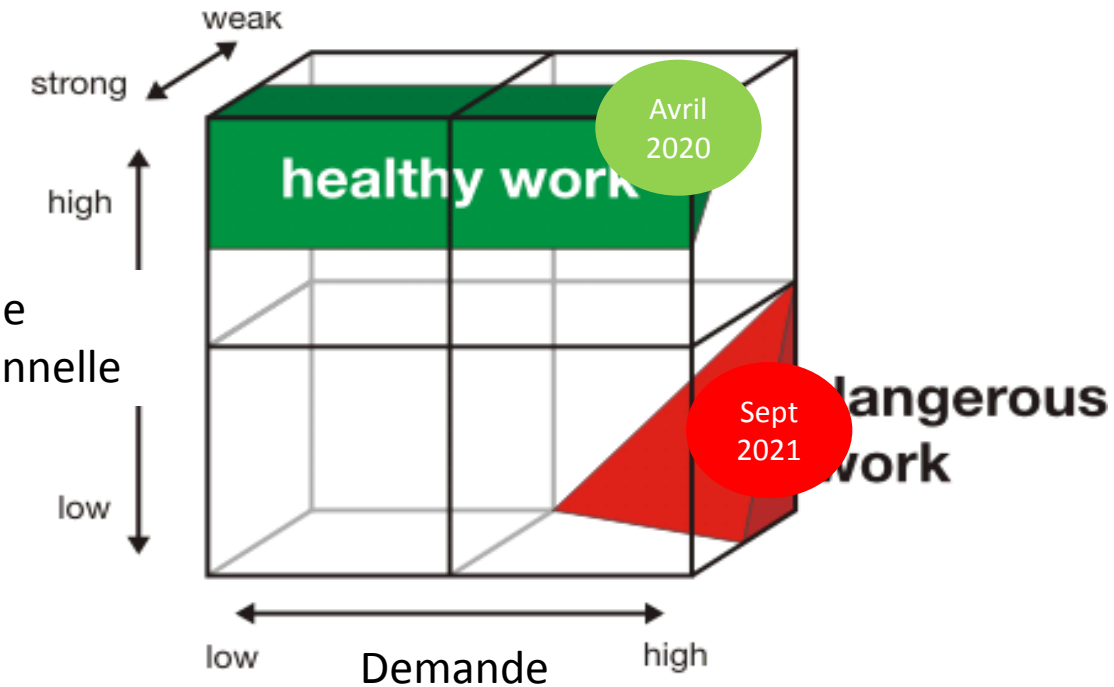


Karasek, 1979
Johnson, 1988



Siegrist, 1990

Soutien social



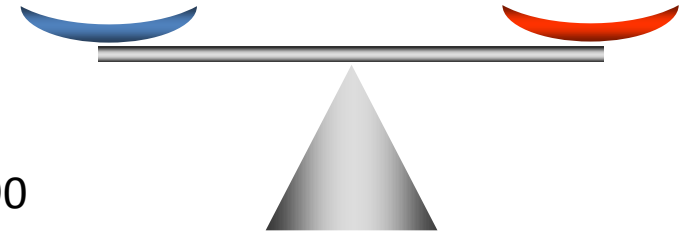
Latitude décisionnelle

Karasek, 1979
Johnson, 1988

Prime COVID

Efforts

Récompenses



Siegrist, 1990

COMMENT PRÉVENIR LA CONTAMINATION

CHU ROUEN NORMANDIE

La question de la transmission

FORMAL SYSTEMATIC REVIEW (COMMISSIONED OR NON-COMMISSIONED) — WILEY

Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: A systematic review and meta-analysis of randomized trials

Jessica J. Bartoszko[1] | Mohammed Abdul Malik Farooqi[2] | Waleed Alhazzani[1,3] | Mark Loeb[1,4]

Journal of Hospital Infection — ELSEVIER

Review

Dismantling myths on the airborne transmission of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2)

J.W. Tang, W.P. Bahnfleth, P.M. Bluyssen, G. Buonanno, J.L. Jimenez, J. Kurnitski, Y. Li, S. Miller, C. Sekhar, L. Morawska, L.C. Marr, A.K. Melikov, W.W. Nazaroff, P.V. Nielsen, R. Tellier, P. Wargocki, S.J. Dancer

JAMA Network Open

Original Investigation | Infectious Diseases

Assessment of Air Contamination by SARS-CoV-2 in Hospital Settings

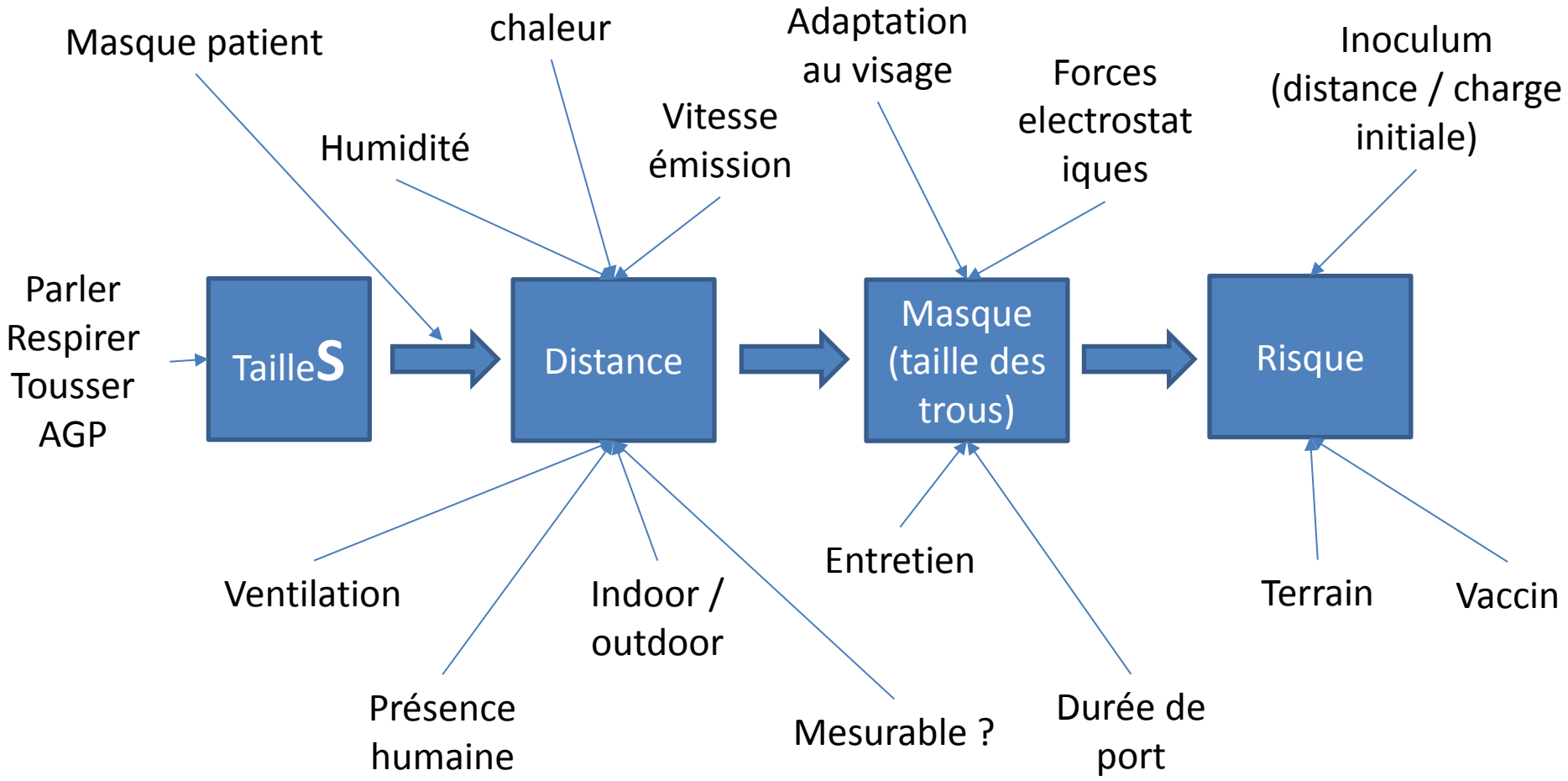
Comment

Ten scientific reasons in support of airborne transmission of SARS-CoV-2

Une sur-simplification

Taille des particules → Masque

Un ensemble complexe



Types masques : grand public

Masque non sanitaire	Définition	Statut	Type	Durée utilisation	Normes étrangères de masques utilisés pour les mêmes usages
	Offrent une protection adaptée pour certaines activités professionnelles, en dehors du domaine médical en complément des gestes barrières	**Masques répondant aux préconisations de l'ANSM et de l'Afnor Spec « masques barrières » S76-001**	**Catégorie 1 (UNS1)** : filtrant au moins 90% des particules de 3 µm **Catégorie 2 (UNS2)** : filtrant au moins 70% des particules de 3 µm https://www.entreprises.gouv.fr/fr/covid-19/covid-19-informations-relatives-aux-masques-grand-public	Doivent répondre aux spécificités techniques décrites dans l'Annexe I de la note d'information interministérielle du 29 mars 2020	**Pas de norme**
La mesure de la respirabilité	Elle doit être complétée par un test de port pendant 4 heures, à réaliser par l'industriel. L'atteinte du niveau d'efficacité de filtration des particules de 3 µm émises et la respirabilité sont à vérifier par la mise en œuvre d'essais de type correspondants : • soit à la méthode de test décrite dans la norme NF EN 149 de septembre 2009 « Appareils de protection respiratoire – Demi masques filtrants contre les particules – Exigences, essais, marquage » ; • soit le protocole d'essais élaboré par les organismes notifiés ; • soit le protocole d'essais décrit dans le document Afnor Spec « masques barrières » ; • soit le protocole d'essais décrit dans le document DGA du 25 mars 2020.				
Cible	**Masques exclusivement réservés à un usage non sanitaire en population générale et uniquement en complément des mesures de distanciation sociales (distance physique, gestes barrières, hygiène des mains) et en milieu professionnel selon l'évaluation du risque**				

Masque à usage non sanitaire	Catégorie 1	Catégorie 2	Fabrication artisanale
Capacité filtrante (du média filtrant)	≥90% des particules de taille moyenne 3 µm	≥70% des particules de taille moyenne 3 µm	Non testée
Spécifications	AFNOR SPEC S76-001	AFNOR SPEC S76-001	AFNOR SPEC S76-001

Avis HCSP 29 oct 2020 : https://www.hcsp.fr/explore.cgi/avisrapportsdomaine?clefr=944

Types masques : masque à usage médical

Masque Chirurgical	Définition	Statut	Type	Durée utilisation	Normes Européennes	Normes étrangères équivalentes
	Protège l'environnement de celui qui le porte en retenant les gouttelettes émises lors de la toux, des éternuements et de la parole. Limite l'exposition de de celui qui le porte aux gouttelettes environnantes et leurs contacts avec les muqueuses.	Dispositif médical de classe I A usage unique Jetable après utilisation	Type I : efficacité de filtration bactérienne > 95% Type II : efficacité de filtration bactérienne > 98% Type IIR : efficacité de filtration bactérienne > 98% et résistant aux éclaboussures	Au maximum 4h*	NF EN 14683 :2019	Normes américaines ASTM F2100- 19 (level 1/level2/level3) (résistance au fluide) et ASTM F2101- 01 (pour le niveau de filtration) Normes chinoises YY/T 0969-2013 et YY 0469-2011 (type I)
Cible	Professionnels de santé, patients hospitalisés, patients ambulatoires à risque de formes graves de Covid-19, autres professionnels selon l'évaluation du risque dans les mêmes indications que les masques grand public de cat.1 (USN1).					

Masque à usage médical	Type I	Type II	Type IIR
Efficacité de filtration bactérienne du média filtrant	≥95% des particules de taille moyenne 3 µm	≥98% des particules de taille moyenne 3 µm	≥98% des particules de taille moyenne 3 µm
Résistance respiratoire	<40Pa/cm²	<40Pa/cm²	<60Pa/cm²
Pression de la résistance aux projections de sang synthétique	NON-	Non-	Oui≥ 16 kPa

Avis HCSP 29 oct 2020 : https://www.hcsp.fr/explore.cgi/avisrapportsdomaine?clefr=944

Types masques : FFP2

Appareil de protection respiratoire	Définition	Statut	Type	Durée utilisation	Normes Européennes	Normes étrangères de masques utilisés pour les mêmes usages*
	Il permet de protéger son porteur contre le risque d'inhalation de tous types de gouttelettes et particules en suspension dans l'air pouvant contenir des agents infectieux. Il se présente sous différentes formes : masques à plis, masque coque, masque bec de canard.	Équipement de protection individuel – EPI Usage unique	FFP1 filtrant au moins 80 % des aérosols (soit une pénétration inférieure à 20 %), FFP2 filtrant au moins 94 % des aérosols (soit une pénétration inférieure à 6 %), FFP3 filtrant au moins 99 % es aérosols (soit une pénétration inférieure à 1 %).	Jusqu'à 8 heures ou plus pour les FFP marqués R, mais il est difficilement supporte au-delà de quelques heures	NF EN 149 : 2001+A1 :2009	Norme américaine NIOSH 42 CFR 84 (N95, P95 et R95 / N99, N100, P99, P100, R99, R100) Norme chinoise GB2626-2019 (KN95 ainsi que KP95 / KN100 ainsi que KP100) Norme coréenne KMOEL - 2017-64/1ère classe Norme australienne et néo-zélandaise AS/NZS 1716 :2012 (P2 / P3) Norme japonaise Japan JMHLW- Notification 214, 2018 (DS2, DL2 / DS3, DL3) Norme brésilienne ABNT/NBR 13698 :2011 (PFF2 / PFF3) Norme mexicaine NOM-116-2009 (N95, P95, R95 / N99, N100, P99, P100, R99, R100)

*normes équivalentes uniquement pour filtration et respirabilité. Les masques doivent être conformes aux exigences européennes et porter un marquage spécifique (cf. INRS ED 6392).

Avis HCSP 29 oct 2020 : https://www.hcsp.fr/explore.cgi/avisrapportsdomaine?clefr=944

Dans la réalité

- Comparing the fit of N95, KN95, surgical, and cloth face masks and assessing the accuracy of fit checking (O'Kelly, PLOSOne 2021)
  - 7 participants, N95 ou KN 95, fit check

Dans la réalité

- Comparing the fit of N95, KN95, surgical, and cloth face masks and assessing the accuracy of fit checking (O'Kelly, PLOSOne 2021)
  - 7 participants, N95 ou KN 95, fit check
  - Tous capable d'identifier les lacunes du KN95
  - 100% de bonne prédiction d'une mauvaise protection
  - 35% de bonne prédiction d'une bonne protection

Dans la réalité

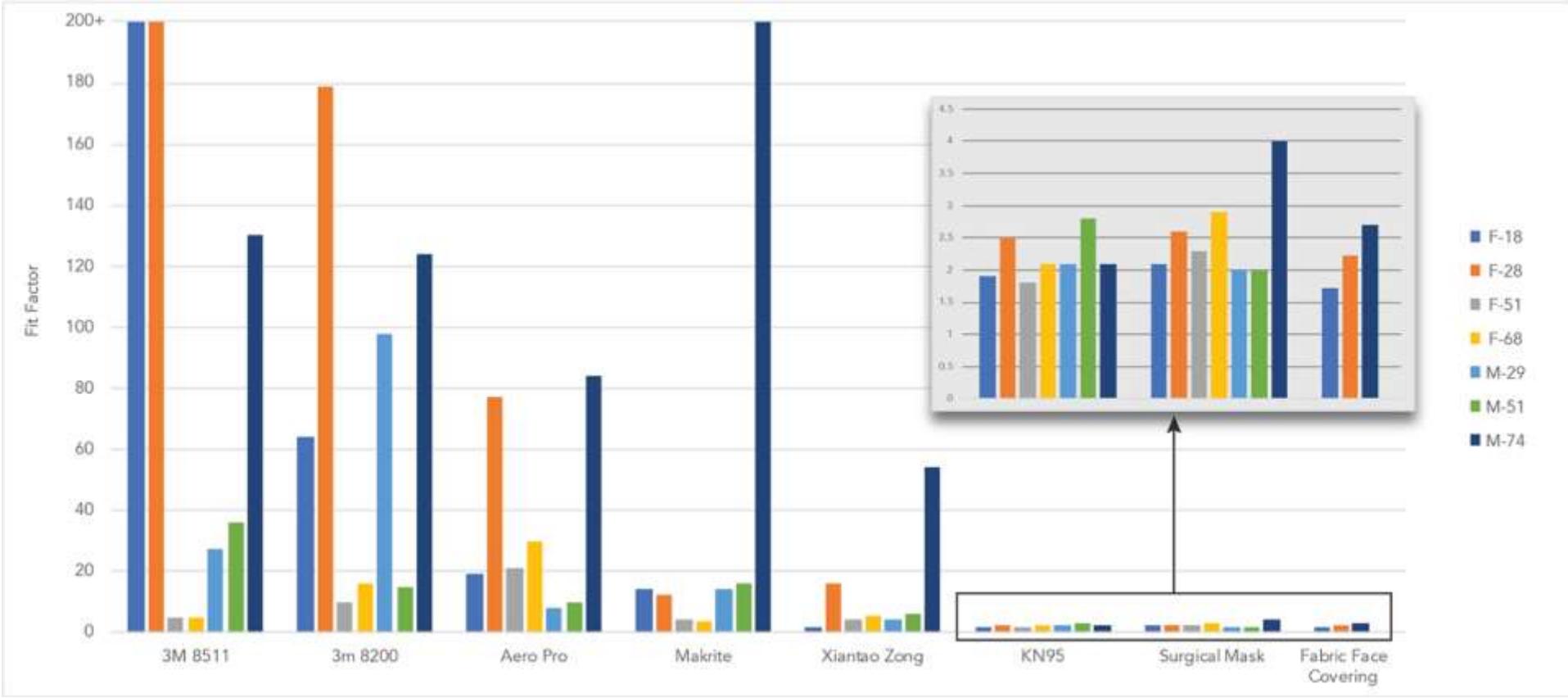


Fig 3. The fit factor achieved by a set of volunteers while wearing different varieties of masks. Protection when wearing an N95 respirator was high only if the respirator properly fit the participant. Fit factors for KN95 respirator, surgical masks, and cloth masks were similar.

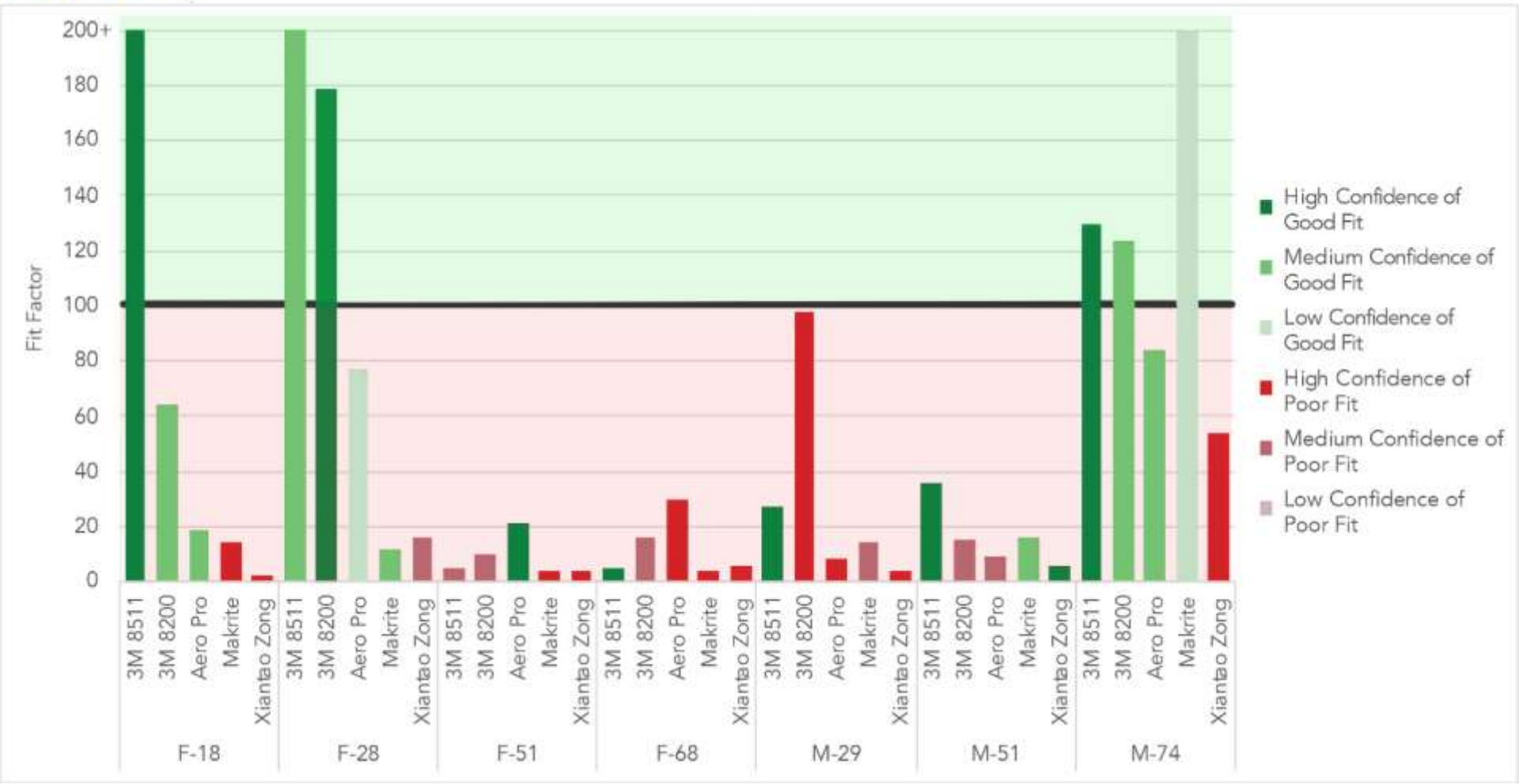
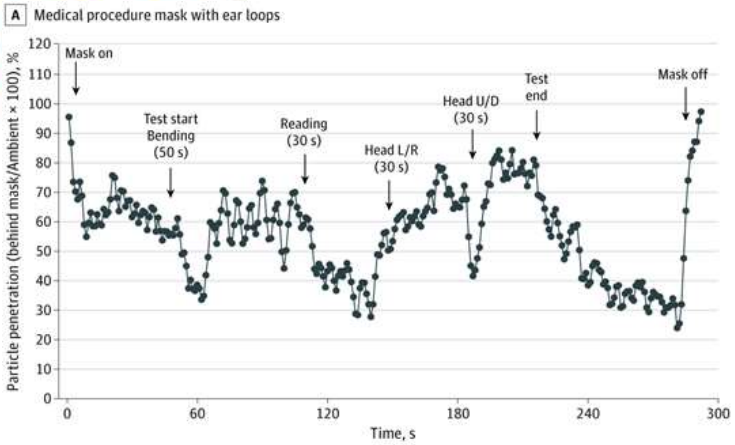
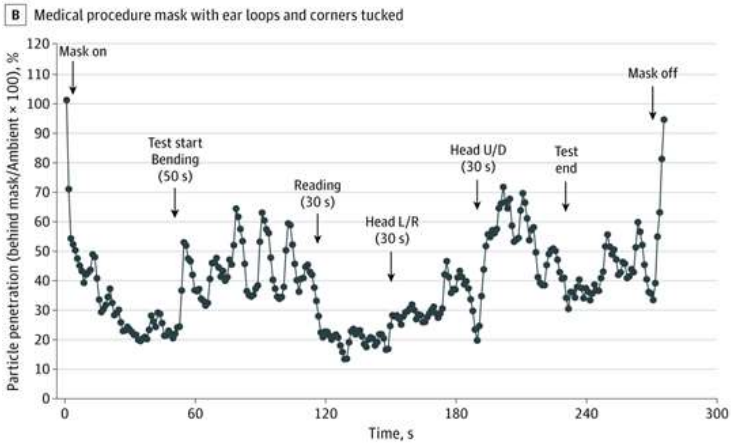


Fig 6. Participants' fit-check predictions with the quantitative mask fit factor organized by participant. Fit factor results are color coded to represent the participants' fit check results with green representing a belief of fit and red representing a belief the mask did not fit. Depth of color represented confidence with lighter shades representing low confidence in the fit check results and darker shades representing a high confidence.

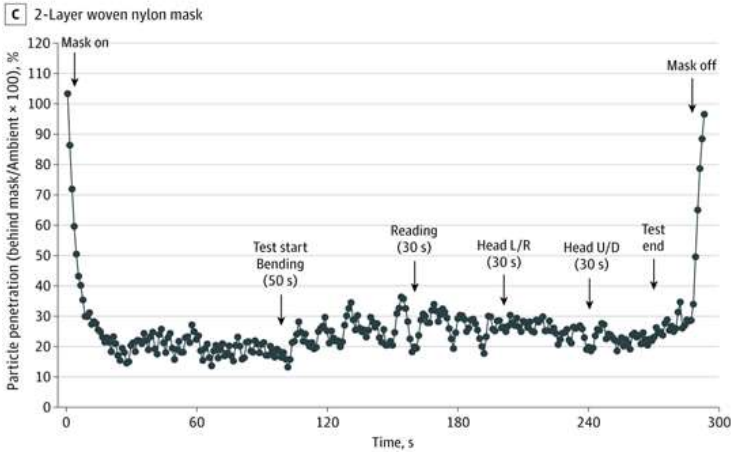
Masques pour se protéger



Overall % FFE
Mean (SD) over all tests,
38.5% (11.2%)



Overall % FFE
Mean (SD) over all tests,
60.3% (11.1%)



Overall % FFE
Mean (SD) over all tests,
74.4% (4.8%)

The overall FFE for a medical procedure mask with ear loops (A), medical procedure mask with the ear loops tied and mask corners tucked against the wearer's face (B), and 2-layer woven nylon mask with an aluminum nose bridge and 1 nonwoven filter insert (C) was 38.5%, 60.3%, and 74.4%, respectively. *Particle penetration* (y-axes) is defined as particle concentration behind the mask expressed as a percentage of the ambient particle concentration and is calculated during repeated-movement tests (bending at the waist, reading aloud, looking left and right, and looking up and down). The overall percentage of FFE is defined as 100 × (1 − behind the mask particle concentration / ambient particle concentration)

Clapp, JAMA 10 dec 2020

Table. Face Mask FFE Against Submicron Particle Penetration

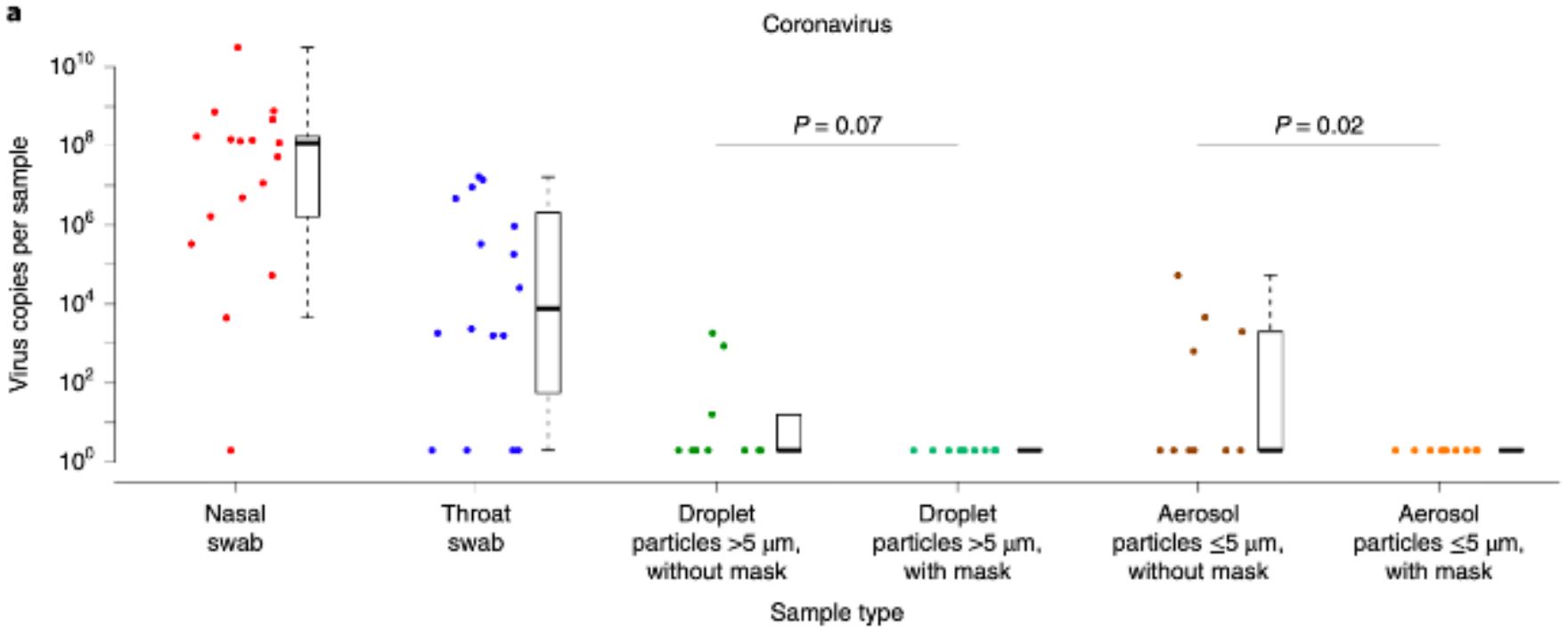
Consumer-grade face masks	Condition	% FFE (SD)[a]
2-Layer woven nylon mask with ear loops		
Without aluminum nose bridge	New	44.7 (6.4)
With aluminum nose bridge	New	56.3 (6.5)
With aluminum nose bridge and 1 nonwoven insert	New	74.4 (4.8)
With aluminum nose bridge, washed (no insert)	Washed 1 time	79.0 (4.3)
Cotton bandana		
Folded surgeon general style	New	49.9 (5.8)
Folded "bandit" style	New	49.0 (6.2)
Single-layer woven polyester gaiter/ neck cover (balaclava bandana)	New	37.8 (5.2)
Single-layer woven polyester/nylon mask with ties	New	39.3 (7.2)
Nonwoven polypropylene mask with fixed ear loops	New	28.6 (13.9)
3-Layer woven cotton mask with ear loops	New	26.5 (10.5)
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, JAMA 10 dec 2020

Effet des masques pour protéger les autres

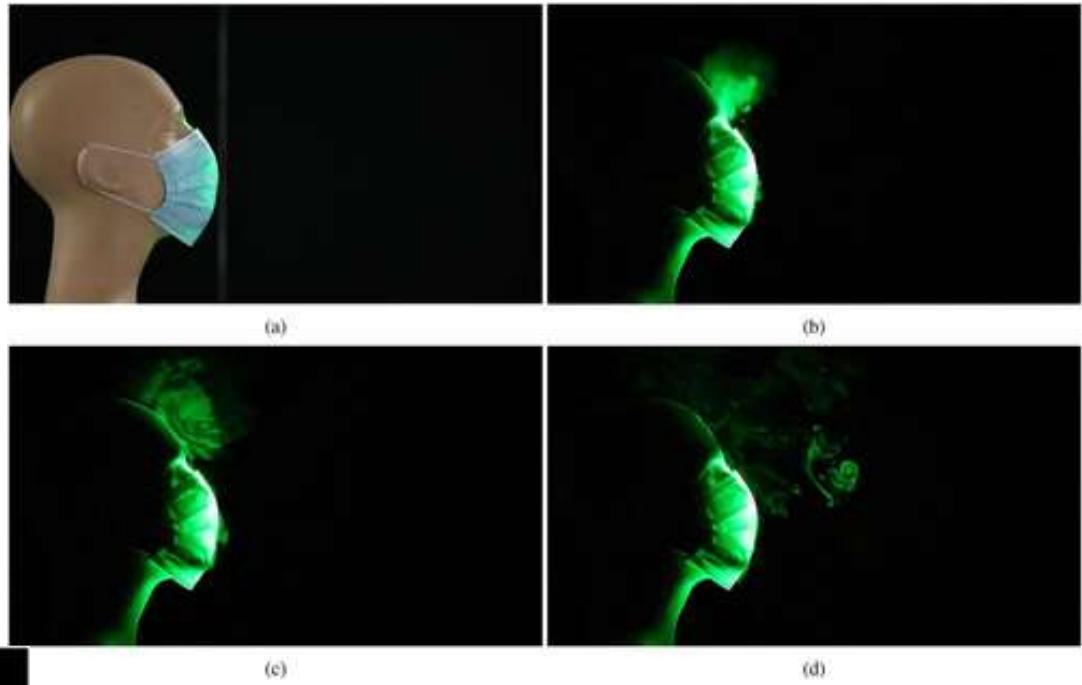


Leung, Nature medicine may 2020

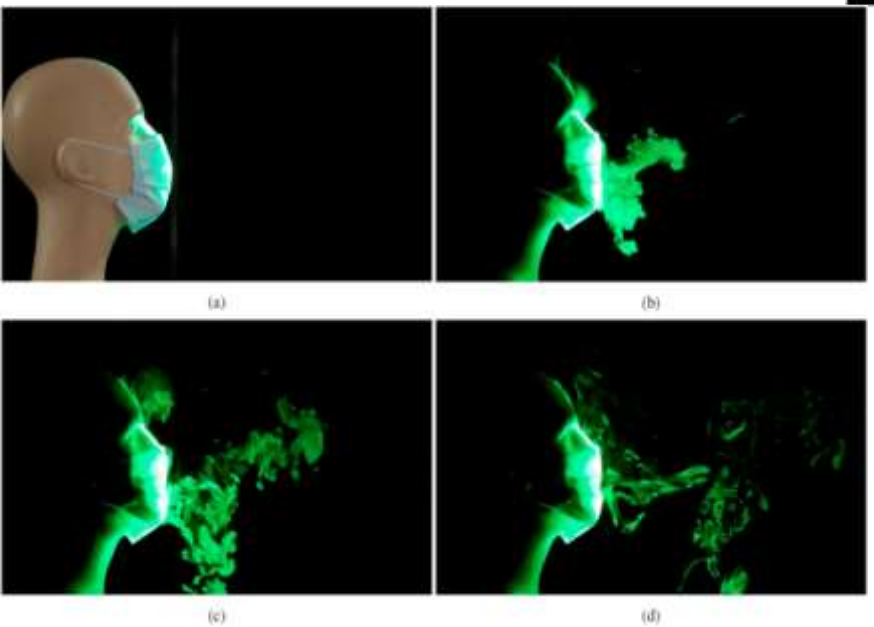
Mais différences entre masques

Visualization of droplet spread when a regular N95-rated mask is used to impede the jet. (a) Prior to emulating a cough/sneeze, (b) 0.13 s after the initiation of the emulated cough, (c) after 0.33 s, and (d) after 0.83 s. Multimedia view: https://doi.org/10.1063/5.0022968.4

Verma et al., Phys. Fluids (2020); doi: 10.1063/5.0022968



Brand B

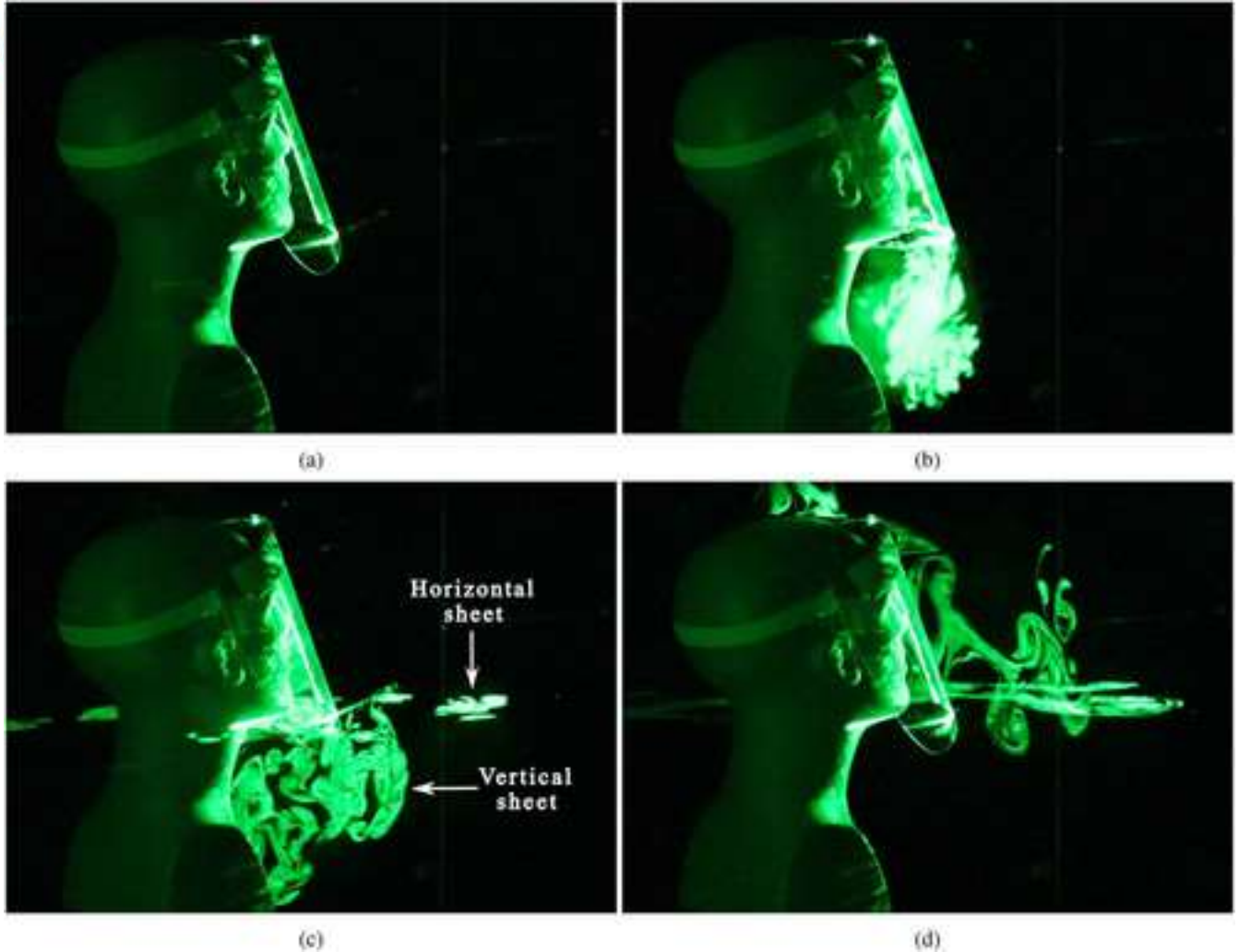


Brand A

Visualization of droplet spread when a surgical mask is used to block the jet. (a) Prior to emulating a cough/sneeze, (b) 0.5 s after the initiation of the emulated cough, (c) after 0.83 s, and (d) after 3.13 s. Multimedia view: https://doi.org/10.1063/5.0022968.6

Verma et al., Phys. Fluids (2020); doi: 10.1063/5.0022968

Il y a pire



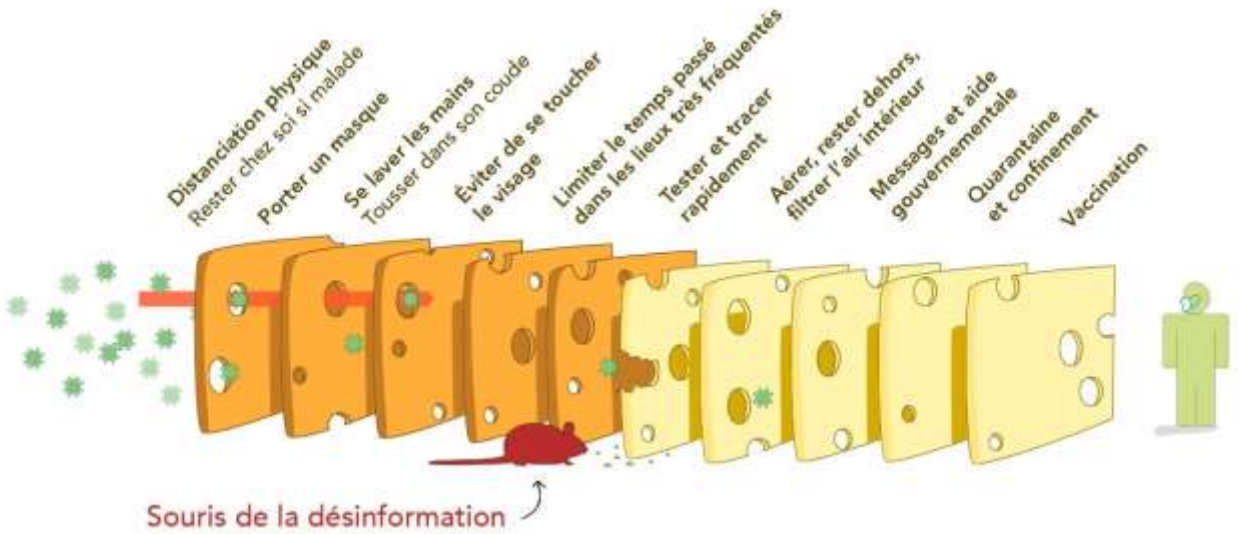
Near-field view of the droplet spread when a face shield is used to impede the emerging jet. (a) Prior to emulating a cough/sneeze, (b) 0.57 s after the initiation of the emulated cough, (c) after 3.83 s, and (d) after 16.57 s. The ejected plume is illuminated by both a vertical and a horizontal laser sheet. Droplets illuminated by the horizontal laser sheet can be observed in (c) and (d). Multimedia view: https://doi.org/10.1063/5.0022968.1

La question de la transmission

- Une incompréhension mutuelle
- Aerobiologistes & spécialistes des particules
  - Particules micrométrique ou < 1µm
    - Produites par respiration / parole
  - Masque chirurgical peu efficace « in vitro »
  - Diffusion à distance
    - Ex clusters en chorale
- Hygiénistes / épidémiologistes
  - Pas de preuve de contamination à distance
  - Pas de supériorité du masque FFP2 sur le chirurgical études en vie réelle
  - Les sacro-saints AGP (aerosol generating procedures)
- Conséquence pratique
  - Isolement air vs isolement gouttelettes
- Mon avis ? Transmission aérosol prouvée, masque FFP2 le plus souvent mal porté et donc pas > masque chirurgical

La méthode du fromage suisse pour se défendre contre la COVID-19

Ou pourquoi un seul type d'intervention n'est pas parfait pour freiner la propagation



Chaque intervention (tranche de fromage) a ses limites (trous).
Chaque couche supplémentaire améliore l'efficacité.
La désinformation limite l'efficacité globale.

Ian M Mackay
virologydownunder.com

COMMENT FAIRE RECONNAÎTRE UNE CONTAMINATION EN MP ?

MERCI DE VOTRE ATTENTION