

La Covid-19 : Un virus respiratoire avec de multiples impacts sur la santé et la société

La perspective d'un intensiviste

Emmanuel Charbonney, MD PhD



Conflits d'intérêts

- Je soigne des personnes atteintes par la COVID-19
- Je participe à des projets de recherche sur la COVID-19
- Je n'ai pas de lien avec les pharmaceutiques sur le sujet

Contenu

- Quelques éléments scientifiques sur le virus et l'atteinte respiratoire
 - Des notions épidémiologiques
 - Quelques considérations plus globales
 - Une pincée de philosophie
- * Pas d'opinion politique



Vagues d'info, de connaissances, de decisions....
....de patients

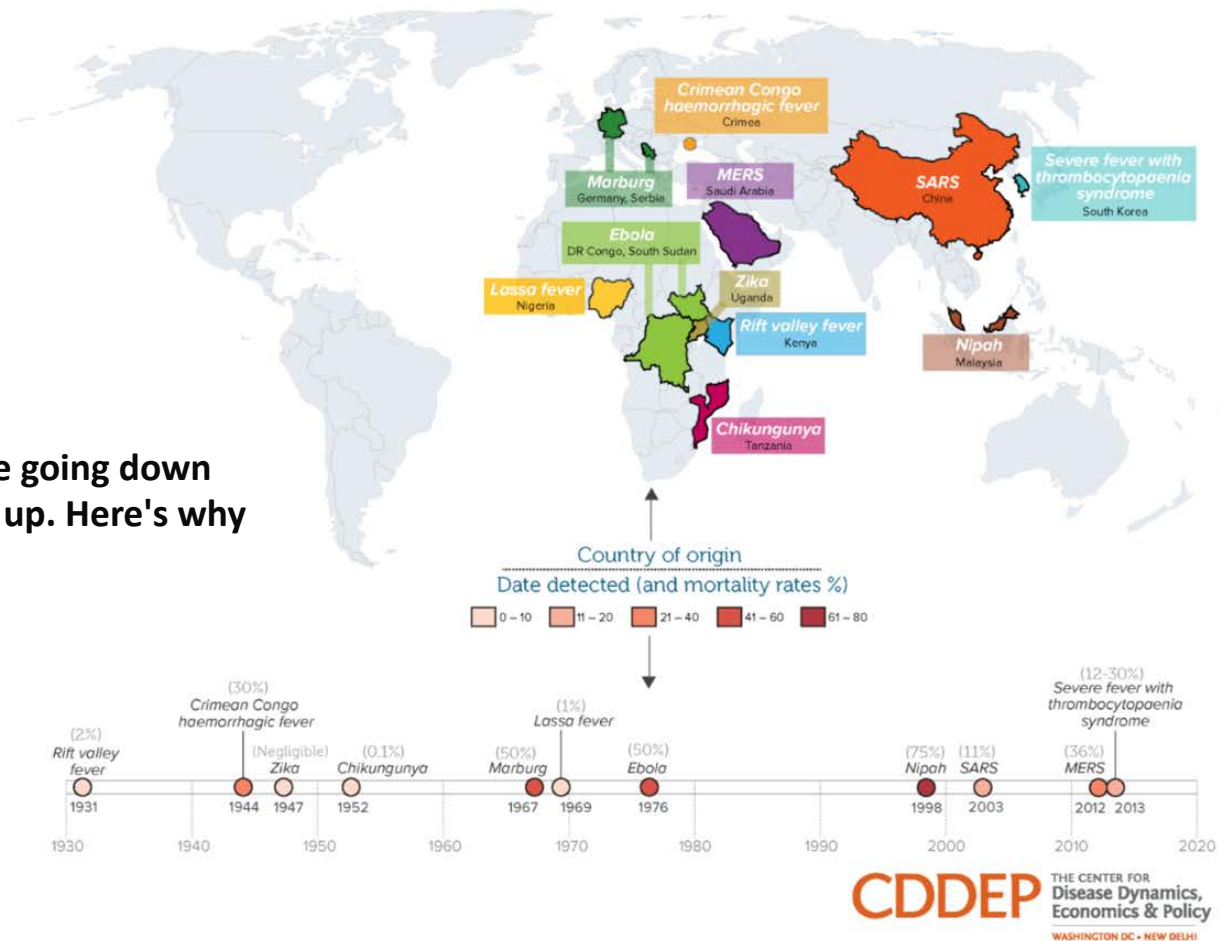


"Thank you for calling. Please hold – on as tight
as you can."

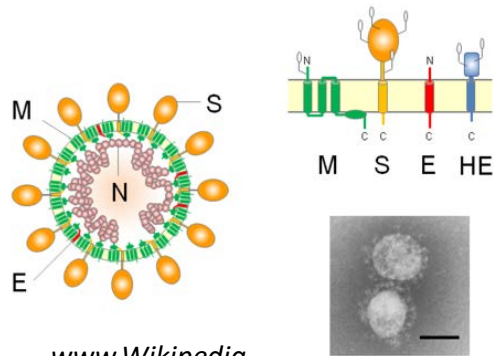
17 mai 2018

The human costs of epidemics are going down
but the economic costs are going up. Here's why

Detection locations and mortality rates of emerging infectious diseases named as needing 'urgent' or 'serious' research attention



SARS-CoV-2 (COVID-19)



www.Wikipedia

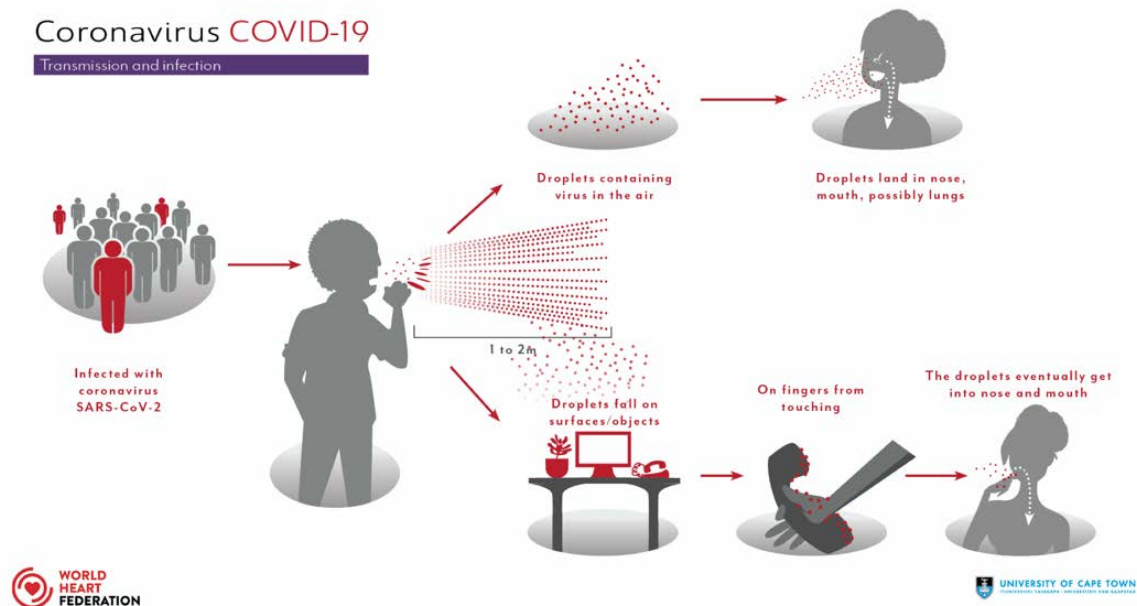
229E (alpha coronavirus), NL63 (alpha coronavirus),
OC43 (beta coronavirus), HKU1 (beta coronavirus)

Coronaviruses infectant les humains:

MERS-CoV (Middle East Respiratory
Syndrome)
SARS-CoV (severe acute respiratory
syndrome)

Coronavirus COVID-19

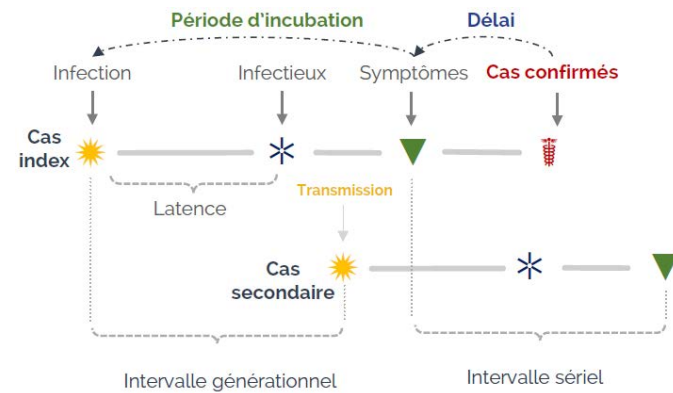
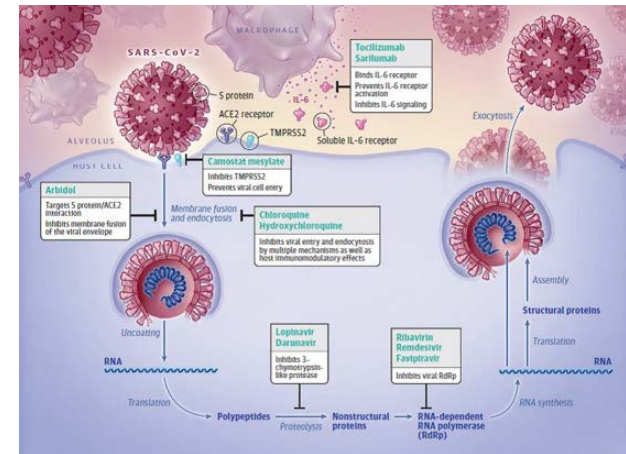
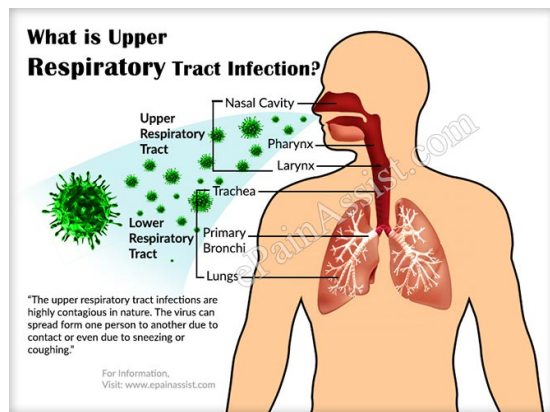
Transmission and infection



<https://www.nature.com/articles/d41586-020-01449-8>

<https://ici.radio-canada.ca/nouvelle/1688791/covid-19-theorie-complot-laboratoire-manipulation-genetique-etude-recherche-preuve>

Le cycle de vie du virus

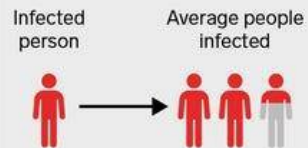


JAMA, 2020; 323(18):1824-1836).

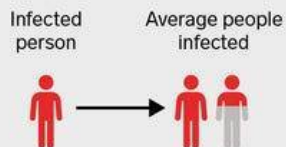
Taux de reproduction (R_t)

The average number of people that one person with a virus infects, based on the R_0 scale

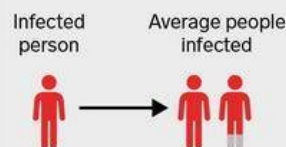
COVID-19: 2–2.5*



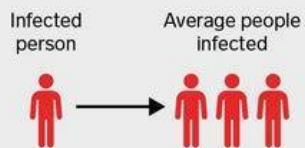
H1N1: 1.2–1.6



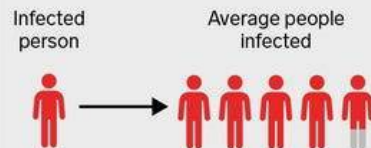
Ebola: 1.6–2



SARS: 2–4



MERS: 2.5–7.2**



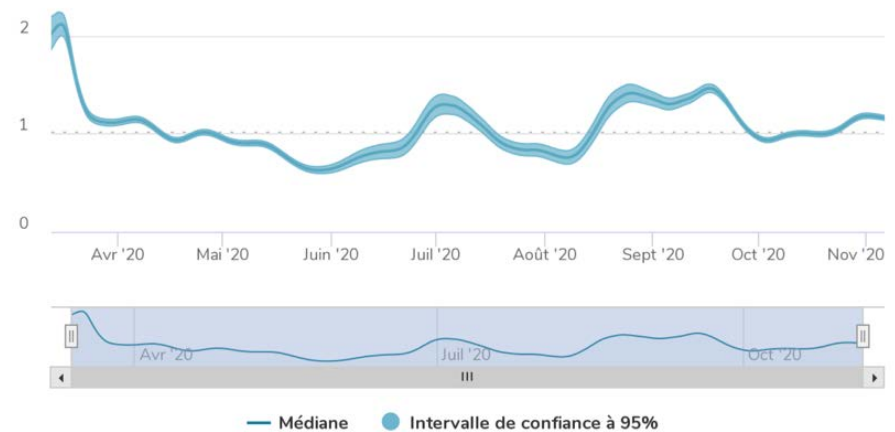
*As of February 28, 2020 ** R_0 calculated solely during the 2015 outbreak in South Korea

Sources: ScienceMag; WHO; Journal of the ISIRV

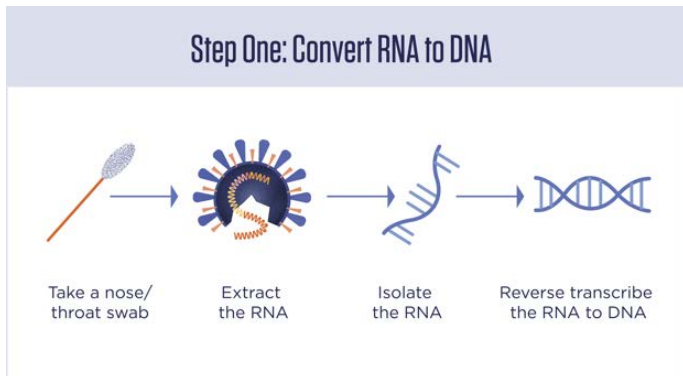
BUSINESS INSIDER

Région 1 : 1000 cas par jour stable. $R_t \approx 1$.
Région 2 : passe de 5 à 10 cas par jour. $R_t \approx 2$.

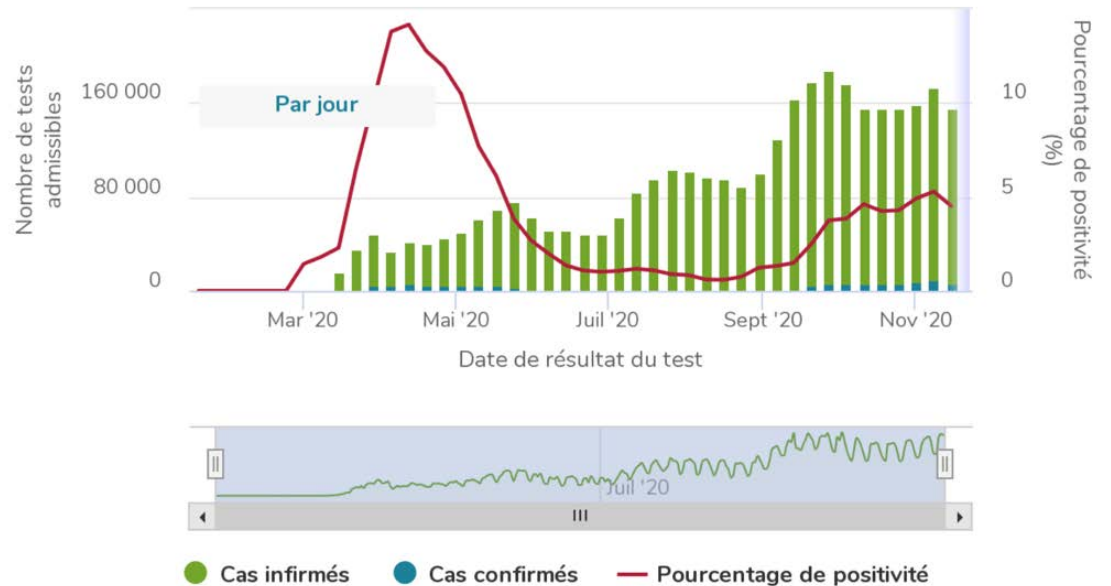
Estimation du taux de reproduction des cas de SRAS-CoV-2 au Québec



Le pourcentage de positivité des tests



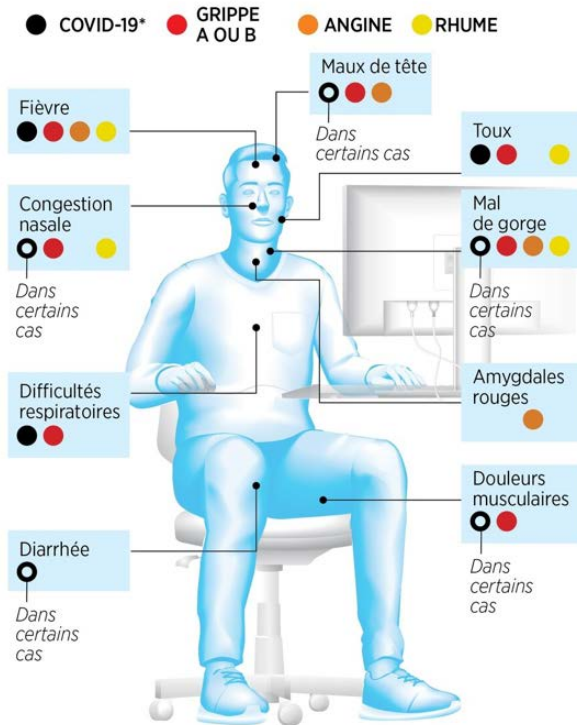
Évolution des nombres de cas confirmés, de cas infirmés et du pourcentage de positivité de COVID-19 au Québec selon la date de résultat du test de laboratoire



Étapes possibles de l'infection par le virus

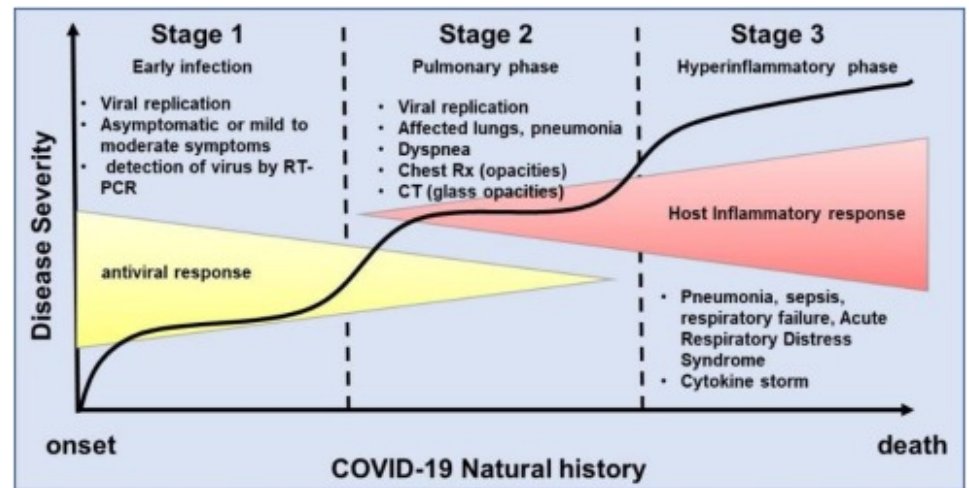
Les principaux symptômes du coronavirus comparés à d'autres maux

Le Parisien



* Certaines personnes sont atteintes de la maladie mais ne développent pas de symptômes.

LP/INFOGRAPHIE



Biomedicine & Pharmacotherapy
 Volume 129, September 2020, 110493

Ce à quoi on fait face aux Soins intensifs

- Défaillance de l'organe respiratoire et manque d'oxygène (=hypoxémie)



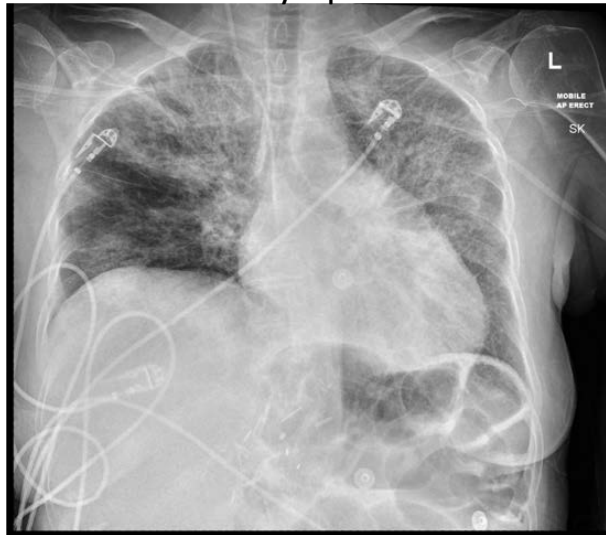
- Pneumonie, qui endommage les poumons, induisant un œdème et une inflammation excessive, pouvant mener à une fibrose (=cicatrice trop importante)

L'évolution respiratoire

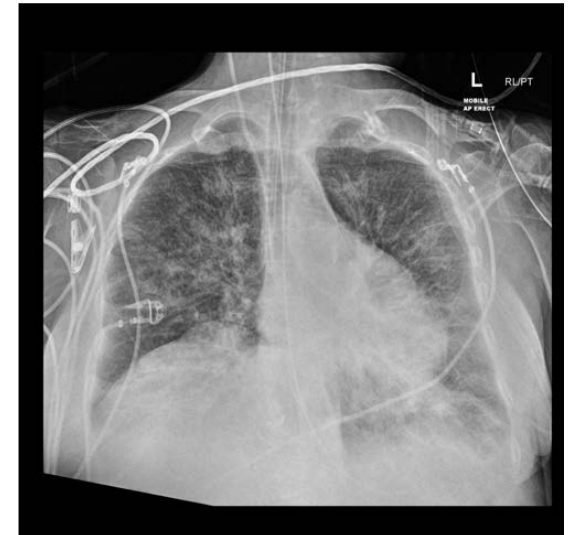
J1 des symptômes



J8 des symptômes



J9 des symptômes



Case courtesy of Dr Seamus O'Flaherty, Radiopaedia.org, rID: 75637

Besoin en Oxygène

COVID-19

HOW DOES IT AFFECT YOU?

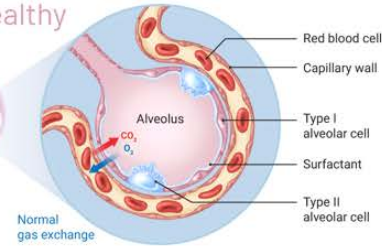
Coronavirus Disease 2019 (COVID-19) is a pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2, also called SARS-CoV-2. Despite the widespread awareness regarding COVID-19, many are still unaware about how it affects the human body.



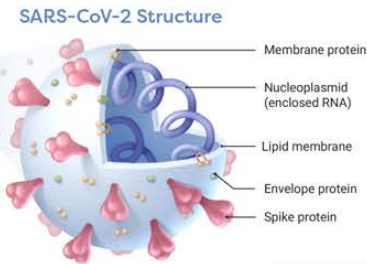
SARS-CoV-2 starts its journey in the nose, mouth, or eyes and travels down to the alveoli in the lungs. Alveoli are tiny sacs of air where gas exchange occurs.

Designed by Avesta Rastan
www.azuravesta.com
@azuravesta
@azuraviz

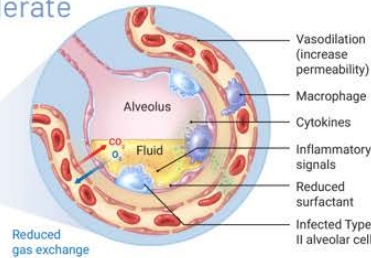
Healthy



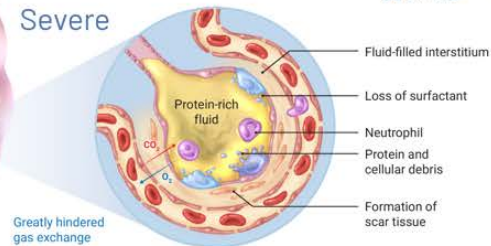
Infected



Moderate



Severe



Impaired Gas Exchange

When the immune system attacks the area of infection it also kills healthy alveolar cells. This results in three things that hinder gas exchange:

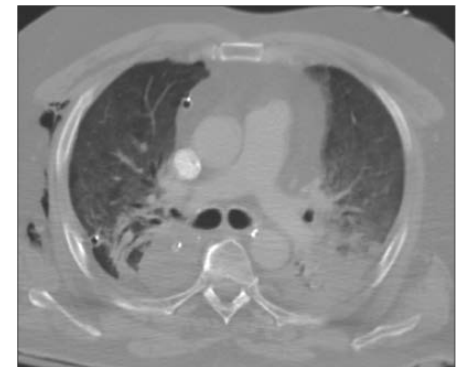
- 1) Alveolar collapse due to loss of surfactant from Type II cells
- 2) Less oxygen enters the bloodstream due to lack of Type I cells
- 3) More fluid enters the alveolus

Definition Clinique du SDRA (ARDS)

- **Définition de Berlin (Ranieri VM et al. JAMA 2012):**
 - Dans les 7 jours après élément déclenchant (majorité $\leq 72h$)
 - Infiltrats radiologiques bilatéraux, consistant avec un œdème pulmonaire
 - hypoxémie aiguë ($PaO_2/FiO_2 \leq 300$ mmHg)
 - pression expiratoire positive (PEEP) de ≥ 5 cmH₂O
 - non entièrement expliqués par une insuffisance cardiaque ou une surcharge volémique
- Sévérité selon le PaO_2/FiO_2 (ratio PF)
léger < 300 , modéré < 200 , sévère < 100



<https://archive-ouverte.unige.ch>



SDRA Historique

- Ashbaugh DG et al. Acute respiratory distress in adults. Lancet 1967; 2: 319-23.

“subgroup of patients who appeared to respond to initial resuscitation, but later succumbed to respiratory distress.”

*Lancet 2016, History of acute respiratory distress syndrome
Volume 4, Issue 7, P547-548*

A l'autopsie: apparence de membranes hyalines



Danang lung



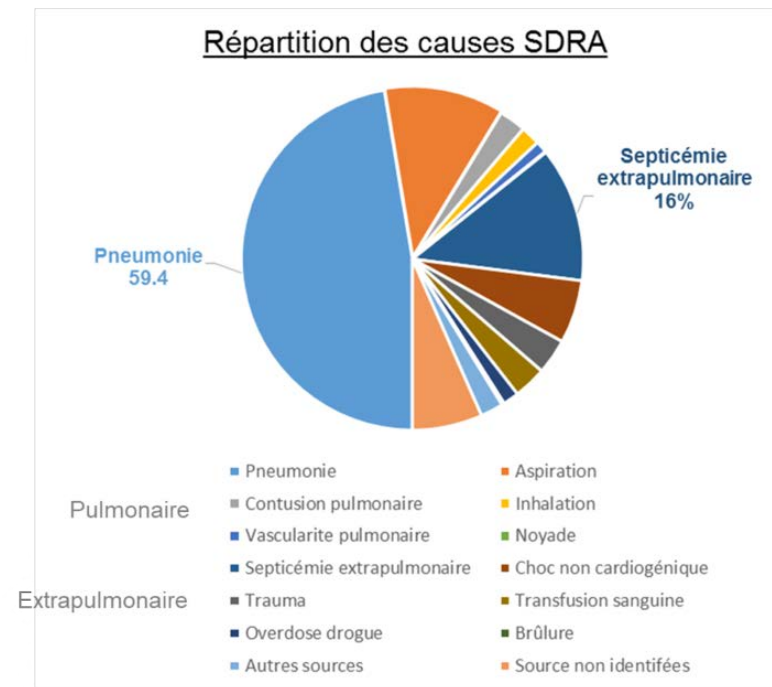
Causes du syndrome de détresse respiratoire aiguë (SDRA/ARDS)

Causes directes

- Pneumonie (bactérienne, virale, autres)
- Aspiration de liquide gastrique
- Contusions pulmonaires
- Presque noyade/ inhalation de fumée
- Ischémie/Reperfusion, DPG post-transplantation

Causes extra-pulmonaires

- Septicémie (infections majeurs avec inflammation)
- Trauma non-thoracique /choc hémorragique
- Pancréatite
- Intoxications
- Transfusion de produits sanguins
- Bypass cardio-circulatoire
- Brûlure majeure



Bellani G et al. JAMA - J Am Med Assoc 2016;315(8):788–800

Diapo adaptée de Emmanuelle Brochiero

Traitement de la cause et du support d'organe



Médicament efficace

TRAITEMENTS/MÉDICAMENTS

Partager: [f](#) [t](#) [v](#) [in](#) [e](#)

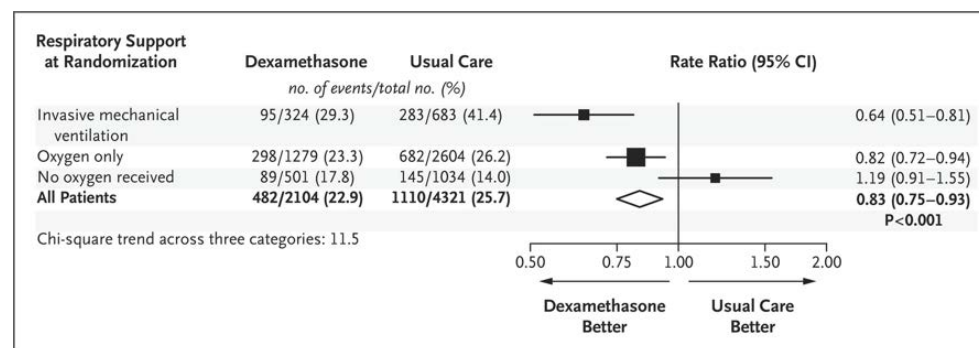
COVID-19 : La dexaméthasone est efficace dans le traitement des cas graves

par Cédric Ayisa · 25 septembre 2020 · 1013 vues · 6 min

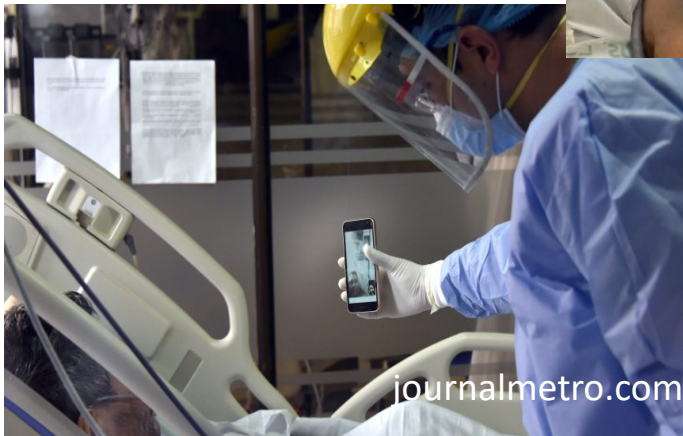


<https://www.faitscovid19.ca>

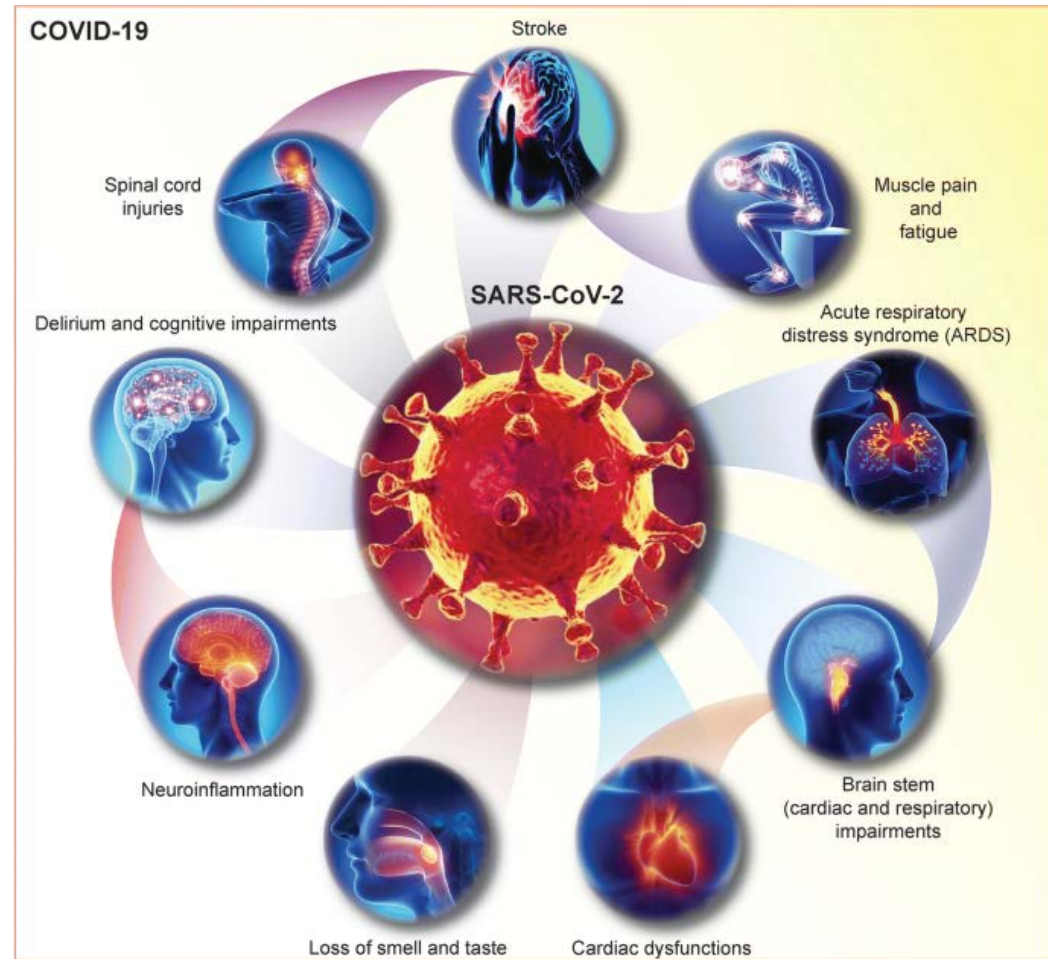
(RECOVERY) trial. N Engl J Med. 2020 Jul 17;NEJMoa2021436
6 mg Dexamethasone pendant 10 jours

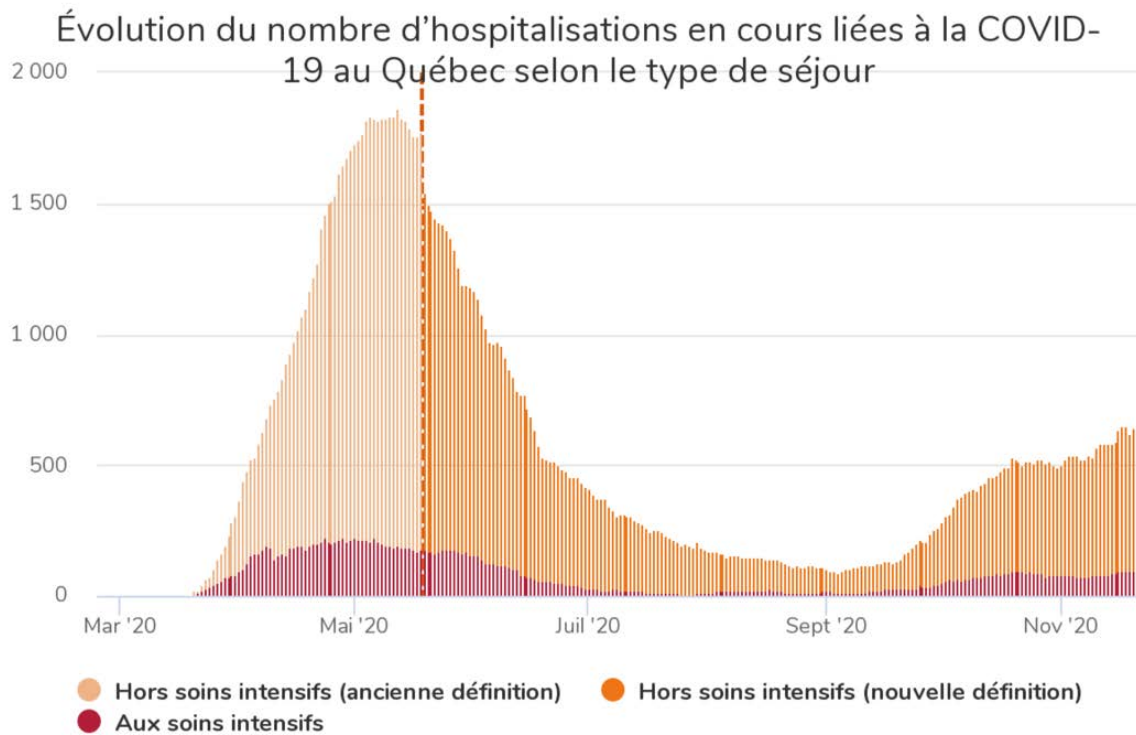


Les équipes, la personne soignée et la famille

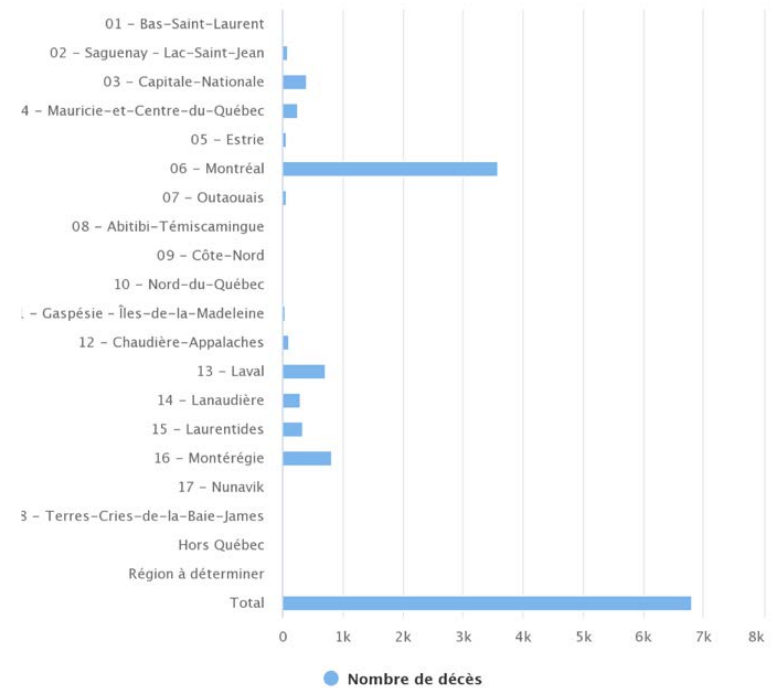


Atteintes multiples du virus





<https://www.inspq.qc.ca/covid-19/donnees>



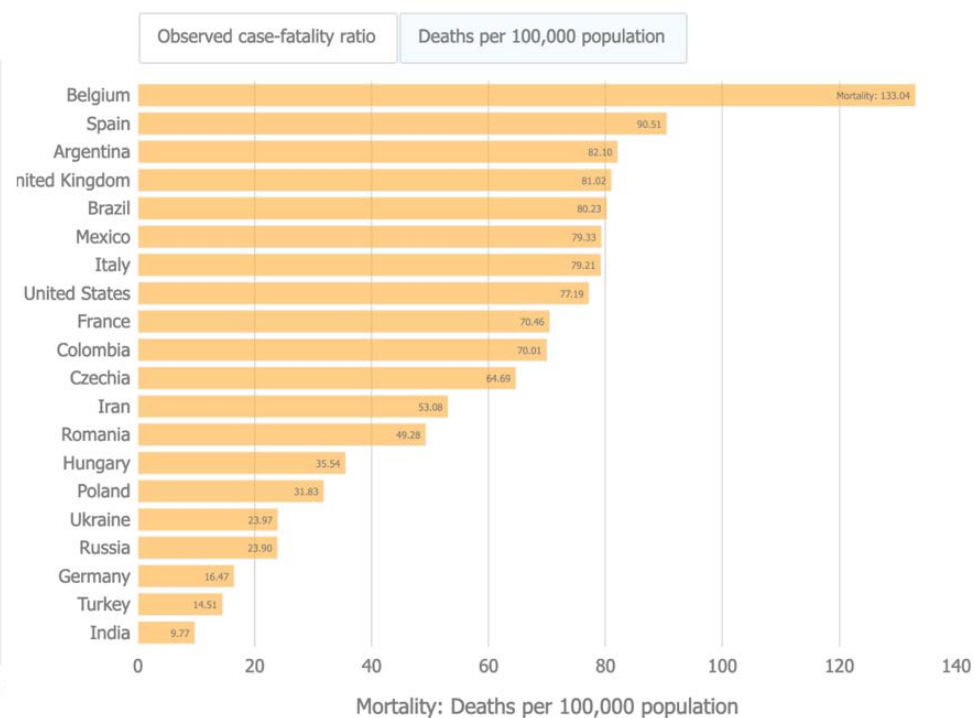
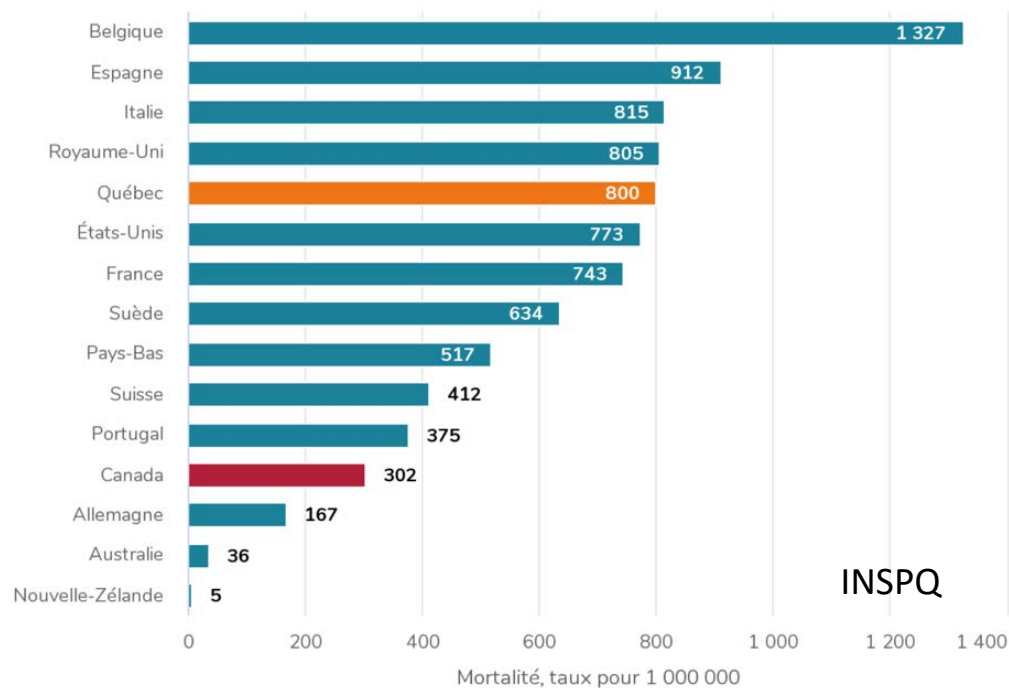
Les chiffres et statistiques.....

JOHNS HOPKINS
UNIVERSITY & MEDICINE

**CORONAVIRUS
RESOURCE CENTER**

Difficulté de comptabiliser les cas, les décès

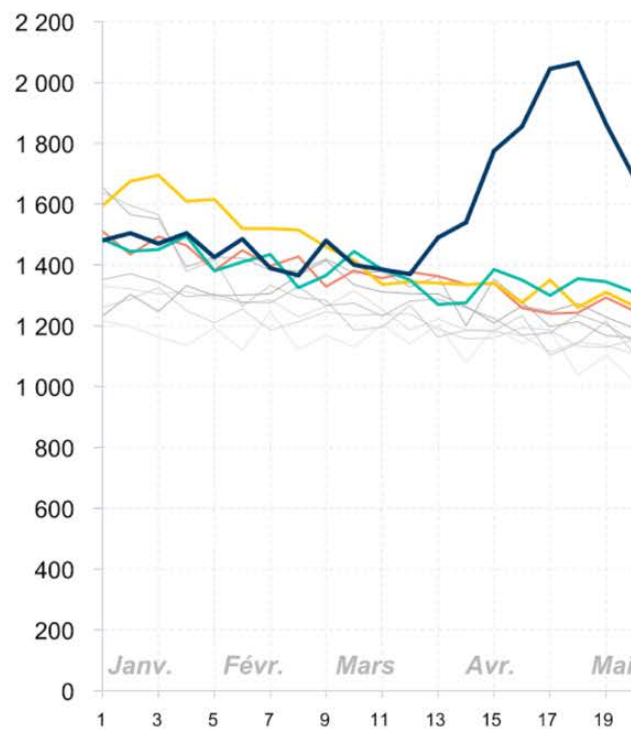
Décès selon certains pays sélectionnés, taux pour 1 000 000



L'excès de mortalité

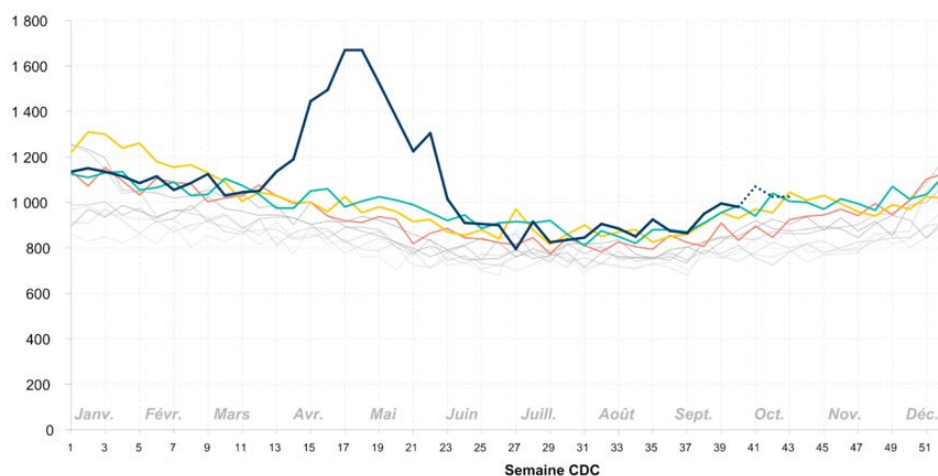
Nombre de décès (n)

Total



Nombre de décès (n)

70 ans et plus



Semaine CDC

Institut
de la statistique

Québec



Coronavirus: Le Marteau et la Dance

Did this early...

Failed at this early on

Cheap

Expensive

Have done little of this

Will eventually have to pay with this

...to avoid this

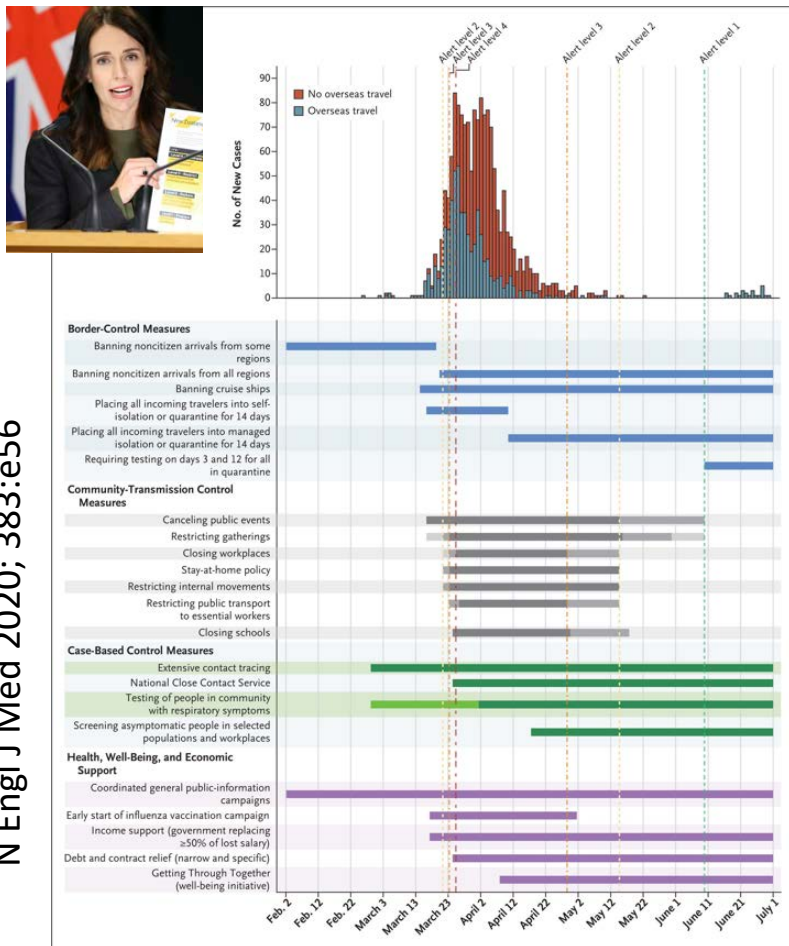
Forced to pay with this

Measures (Non-Pharmaceutical Interventions, NPIs)		China	Singapore	South Korea	Taiwan	Italy	Spain	France	US	UK
Government	Authority from national CDCs, central coordination	Yes	Yes	Yes	Yes	Yes			No	Yes
	Declaring state of emergency	Yes		Yes		Yes	Yes	Yes	Yes	Yes
	Anonymized detailed information shared publicly to avoid speculation		Yes	Yes		No			No	
Education	Educating population on Personal NPIs	Yes			Yes	Yes	Yes		Yes	Yes
Detection & Isolation	Intensive testing	Yes	Yes	Yes	Yes	Yes	Yes		No	Yes
	Complementary detection methods	Yes	Yes	Yes	Yes	Yes	Yes		No	Yes
	Surveillance system (all suspicious deaths and illnesses)	Yes	Yes	Yes		Yes			No	Yes
	Drive-through testing stations		Yes	Yes		No			No	Yes
	Mobile apps to track interaction			Yes		No			No	No
	(Strict) Contact tracing		Yes	Yes	Yes	No			No	No
	Temperature and health screening (airports, stations etc)	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
	Mass fever screening (Thermal temperature scanners)	Yes	Yes	Yes	Yes	Yes	Yes		No	Yes
	Case isolation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Household quarantine	Yes		Yes	Yes	Yes	Yes	Yes	No	Yes
Home isolation of suspect cases			Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Home quarantine of those living in the same household as suspect cases	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Public Decontamination	Disinfection (transport, streets etc)	Yes			Yes	No			No	No
	Hazardous waste management									
Healthcare Resources	Surge critical care bed capacity	Yes			Yes	No	No		No	No
	Providing supplies (soap, hand sanitizers, masks etc)		Yes	Yes	Yes (started 1/20)	No	No		No	No
	Additional money for health professionals (MDs and nurses)	Yes			Yes	Yes	Yes		No	No
	Call for volunteers (among medical students)				Yes	Yes	Yes		Yes	No
Social distancing/Isolating cases	Social distancing of the elderly and others at most risk of severe disease	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Voluntary home quarantine	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Quarantine of particular (high risk) neighbourhoods	Yes		Yes		Yes	Yes	Yes	No	No
	Declaration for purpose to be outside in the city	Yes		No		Yes	Yes	Yes	No	No
	Quarantine for returning residents and long-term pass holders	Yes	Yes	No	for some countries	Yes	Yes		No	No
Economics	Postponing some payments (bills, taxes) to avoid people having to go outside		Yes				Yes		Yes	No
	Quarantine Order Allowance Scheme (economic assistance)		Yes						No	No
	Extended medical leave for patients with respiratory symptoms					Yes			No	No
Travel Bans	Stopping non-essential travel (international)	No		No		Yes	Yes	Yes	No	Yes
	Entry restrictions on visitors from certain countries	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Closing borders	Yes	No	No		Yes	Yes	Yes	No	Yes
	Closing cities?	Yes		No	No	Yes	Yes		No	No
Closure	Closing all public schools	No	No	No	No	Yes	Yes	Yes	No	Yes
	Closing private schools and universities	Yes		No	No	Yes	Yes	Yes	Yes	No
	Closing churches			No		Yes	Yes	Yes	No	No
	Closing bars and other social venues			No	No	Yes	Yes	Yes	No	No
	Stopping mass gatherings >250	Yes		Yes		Yes	Yes	Yes	Yes	Yes
	Stopping mass gatherings >50			No		Yes	Yes	Yes	No	Yes
	Closure of all non-essential business	No		No	No	Yes	Yes	Yes	No	No

Source: Matt Bell, Elena Baillie, Genevieve Gee, Tomas Pueyo

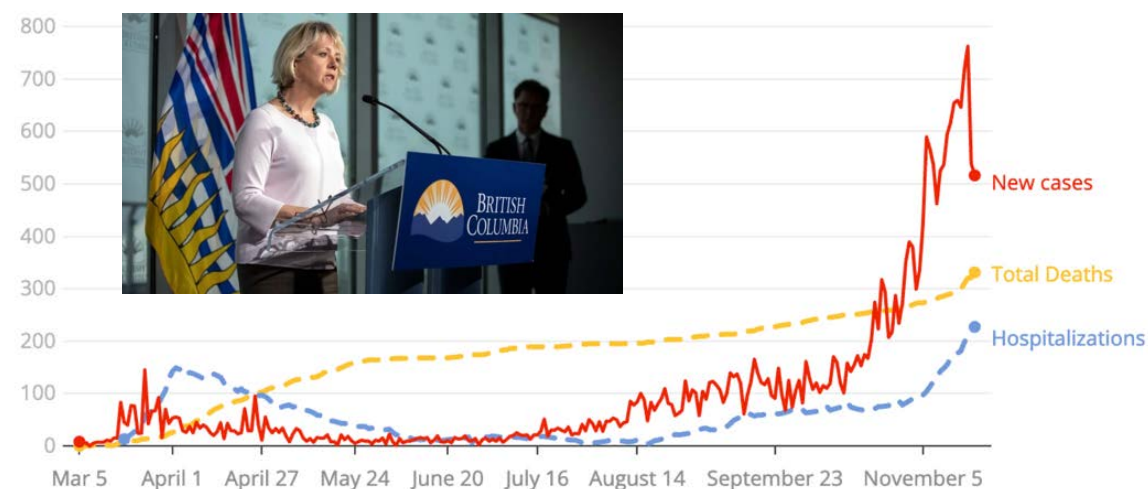
<https://tomaspuoyo.medium.com/coronavirus-the-hammer-and-the-dance-be9337092b56>

Histoires à succès



COVID-19 cases in B.C. by the numbers

Statistics confirmed by the B.C. government at daily* updates to November 20, 2020



Totals for deaths and hospitalizations on 2-day periods between Saturdays and Mondays from March-May and 3-day periods between Fridays and Mondays from June onward are averaged out.

CBC NEWS

Chart: Justin McElroy • Source: BC Centre for Disease Control

C'était donc plus qu'un simple virus respiratoire.....

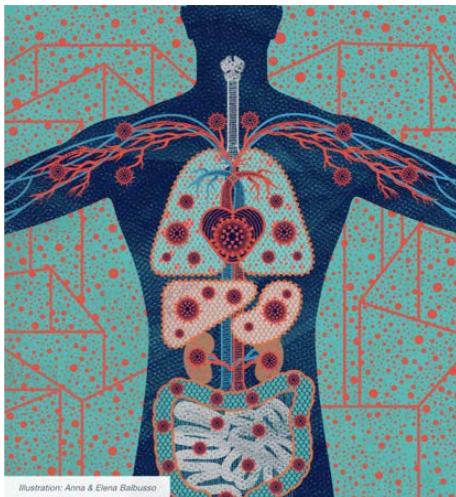


Illustration: Anna & Elena Balbusso

FEATURE

We Thought It Was Just a Respiratory Virus

We were wrong.

By Ariel Bleicher and Katherine Conrad • UCSF Magazine

<https://www.ucsf.edu/magazine/covid-body>

LE JOURNAL DE MONTRÉAL

COVID-19

ACTUALITÉ
COVID-19

La COVID-19, bien plus qu'une maladie respiratoire

f PARTAGEZ SUR FACEBOOK

🐦 PARTAGEZ SUR TWITTER

✉️ AUTRES

AGENCE QMI
Samedi, 1 août 2020 16:51
MISE À JOUR Samedi, 1 août 2020 16:51

SAN FRANCISCO | Considérée au départ comme une maladie respiratoire, on sait aujourd'hui que la COVID-19 est bien plus que ça et des chercheurs de la Californie tentent maintenant d'expliquer pourquoi le virus peut s'attaquer également au cœur, aux intestins ou même au cerveau.

Séquelles à long terme

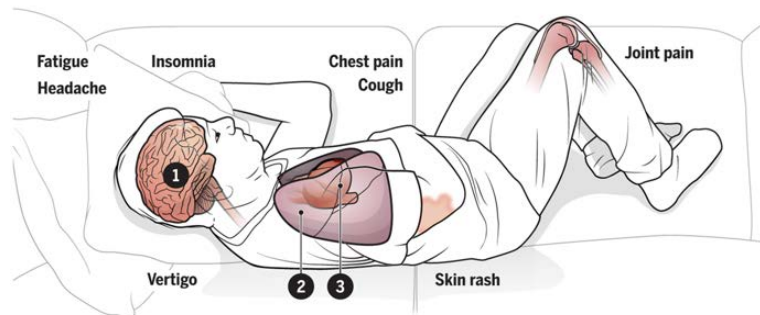
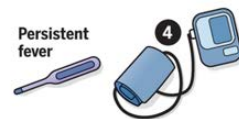


Déficits fonctionnels connu en SDRA

Troubles cognitifs (70 to 100 %) à 5 ans (20 %)
 Troubles de l'humeur, incluant la dépression (20%)
 Désordres post-traumatique (18%)

Pain that lingers

A subset of COVID-19 patients experiences ongoing symptoms and complications such as organ damage, and researchers are proposing reasons for some of them (bottom). Scientists are trying to identify such symptoms, how common they are, how long they last, who's at risk, and how to treat and prevent them.



1 Brain fog

Difficulty thinking can occur after acute COVID-19 infection. The virus may damage brain cells, and inflammation in the brain or body may also cause neurologic complications. Other viral infections can also lead to brain fog.

2 Shortness of breath

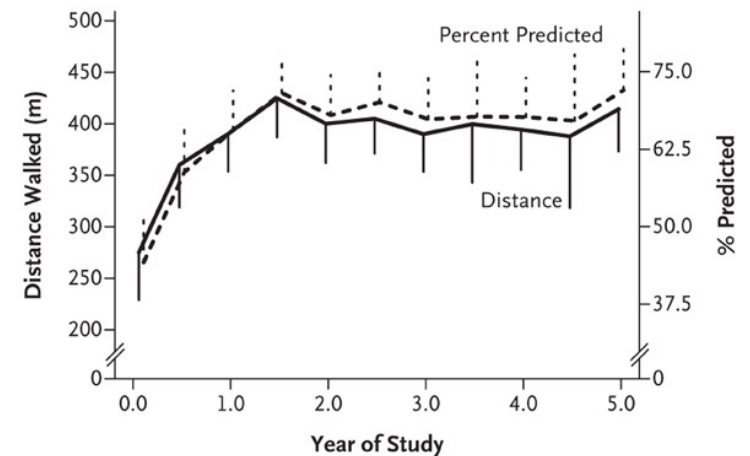
Doctors are eyeing lung and heart complications including scarring. Patients who become critically ill with COVID-19 seem more likely to have lingering shortness of breath, but those with mild cases are also at risk.

3 Heart arrhythmia

The virus can harm the heart, and doctors are concerned about long-term damage. How the heart heals after COVID-19 could help determine whether a patient develops an irregular heartbeat.

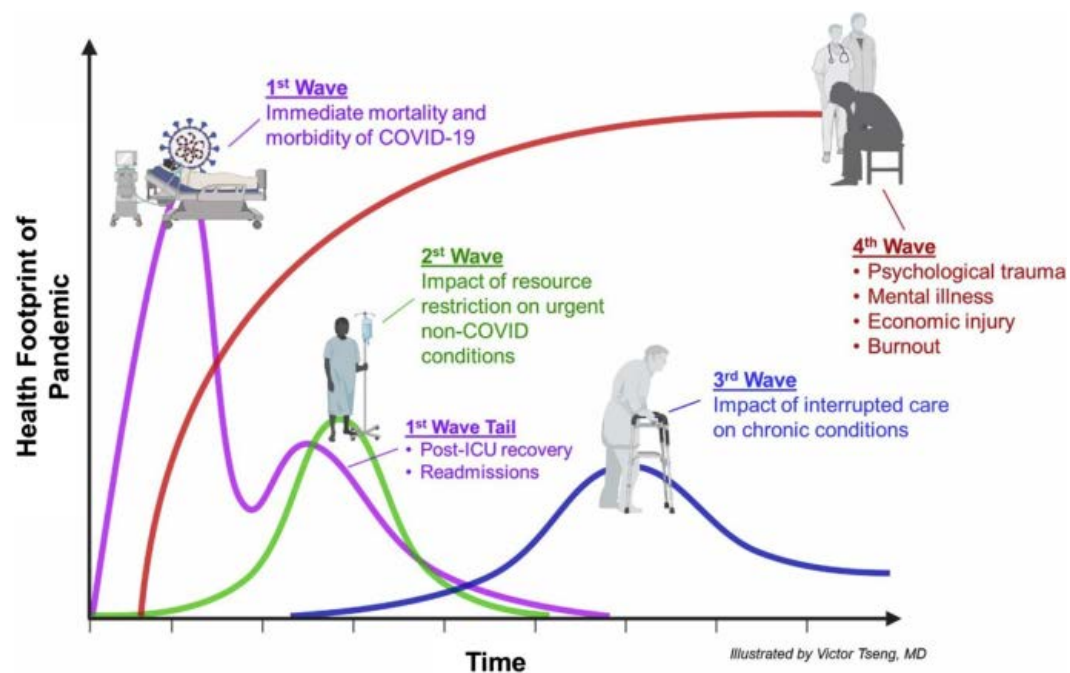
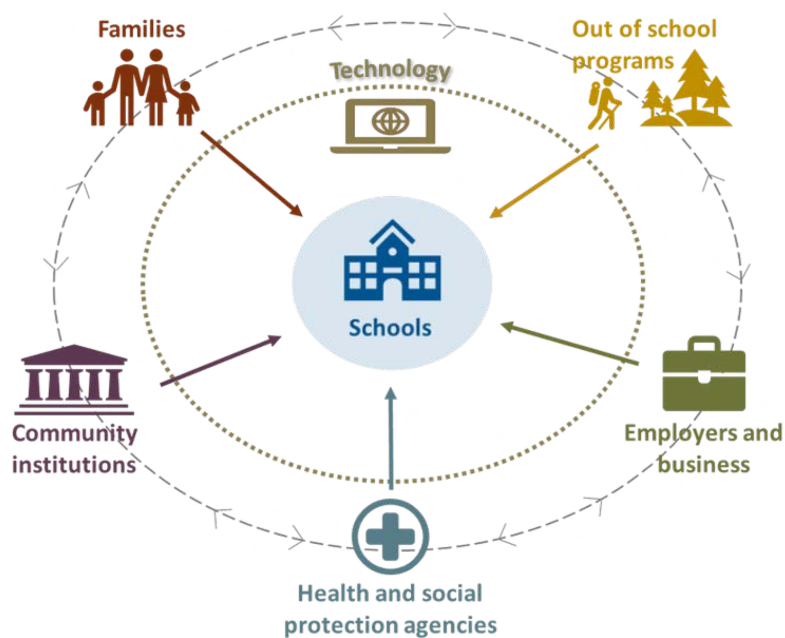
4 Hypertension

Some patients have high blood pressure after an acute infection, even when cases were relatively mild and people were previously healthy, possibly because the virus targets blood vessels and heart cells.



Margaret Herridge , NEJM 2011

L'éducation et la santé

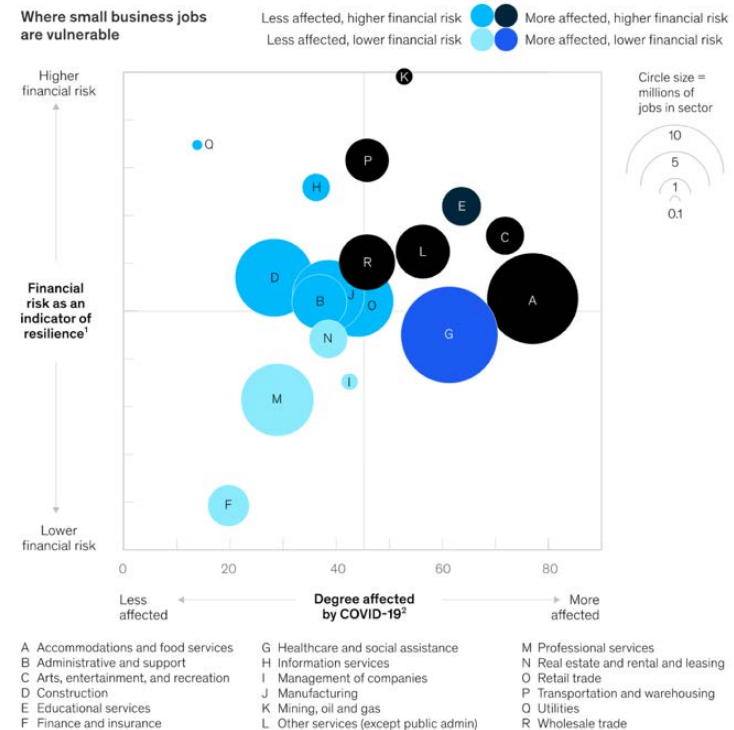


<https://www.brookings.edu/research/beyond-reopening-schools-how-education-can-emerge-stronger-than-before-covid-19/>

L'humain dans son interaction avec son environnement naturel et l'économie



COVID-19 is especially threatening for several sectors.





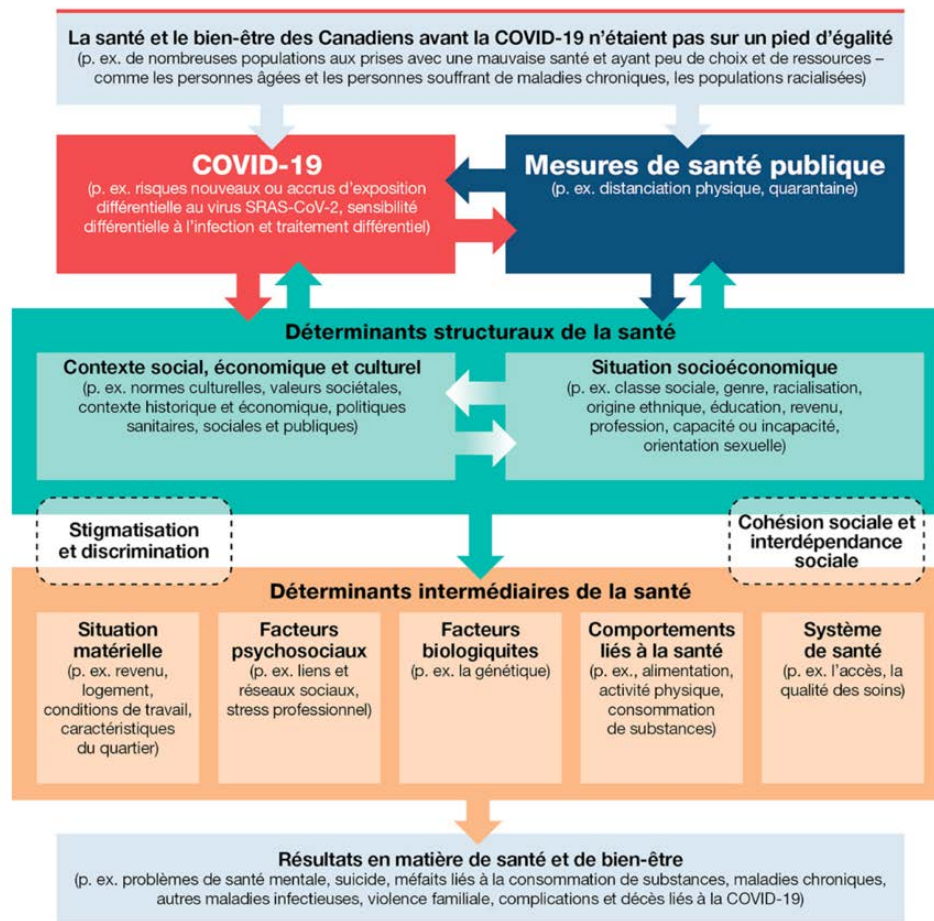
Government
of Canada

Gouvernement
du Canada

Du risque à la résilience : Une approche axée sur l'équité concernant la COVID-19

<https://www.canada.ca/fr/sante-publique/organisation/publications/rapports-etat-sante-publique-canada-administrateur-chef-sante-publique/du-risque-resilience-approche-equite-covid-19.html>

Figure 5 : Répercussions directes et indirectes de la COVID-19



Merci de votre attention



emmanuel.charbonney@umontreal.ca

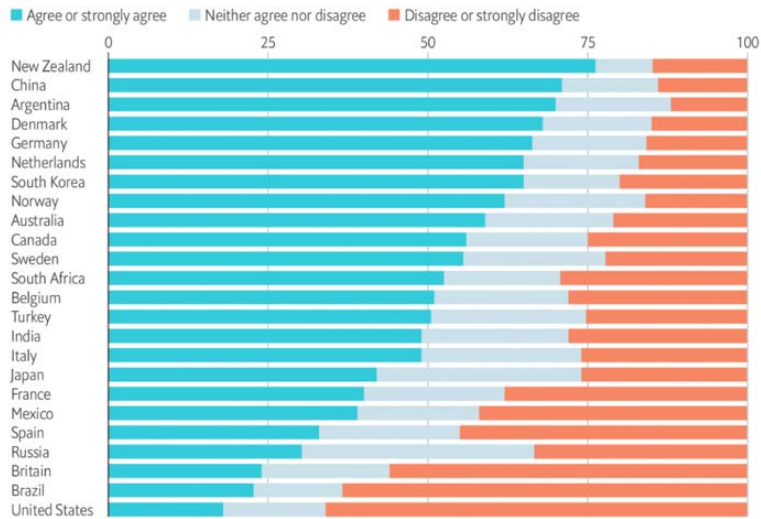
Suivre la Science

Are governments following the science on covid-19?

According to a new survey, many scientists believe they are being ignored

The scientific method?

Policy makers have taken scientific advice into account during covid-19, % responding
Survey of each country's scientists*, May-June 2020



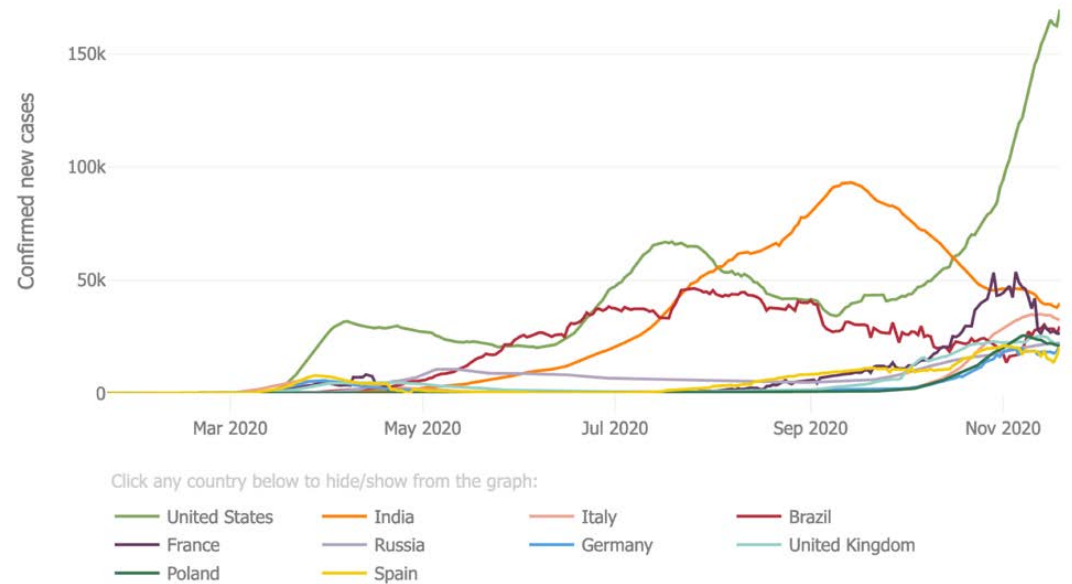
Source: Frontiers in Public Health

*25,307 researchers affiliated with Frontiers, a Swiss publisher of scientific journals

The Economist

DAILY CONFIRMED NEW CASES (7-DAY MOVING AVERAGE)

Outbreak evolution for the current 10 most affected countries



Click any country below to hide/show from the graph:

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