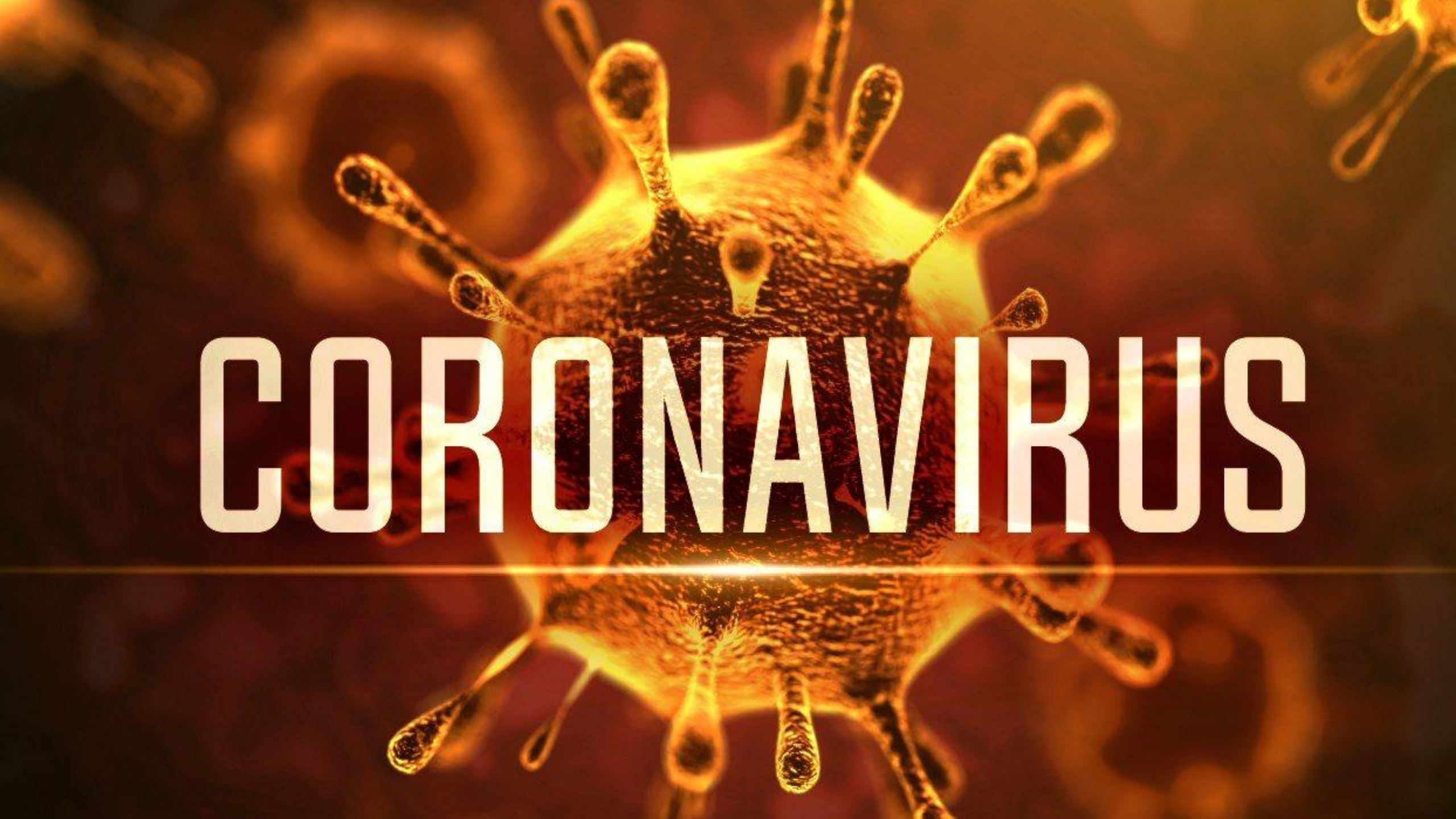
Ventilatie tegen virusverspreiding: een pande-missie

p3 venti

Marc Van Ranst, KU Leuven

"PANDEMICS ARE LIKE A BOX OF CHOCOLATES..."
COVID-19 is
Pandemic
SARS-CoV-2
NET WT. 10.9oz (309g)
Forrest Gump, 1994


CORONAVIRUS

229E

1967

OC43

1970

SARS

2003

NL63

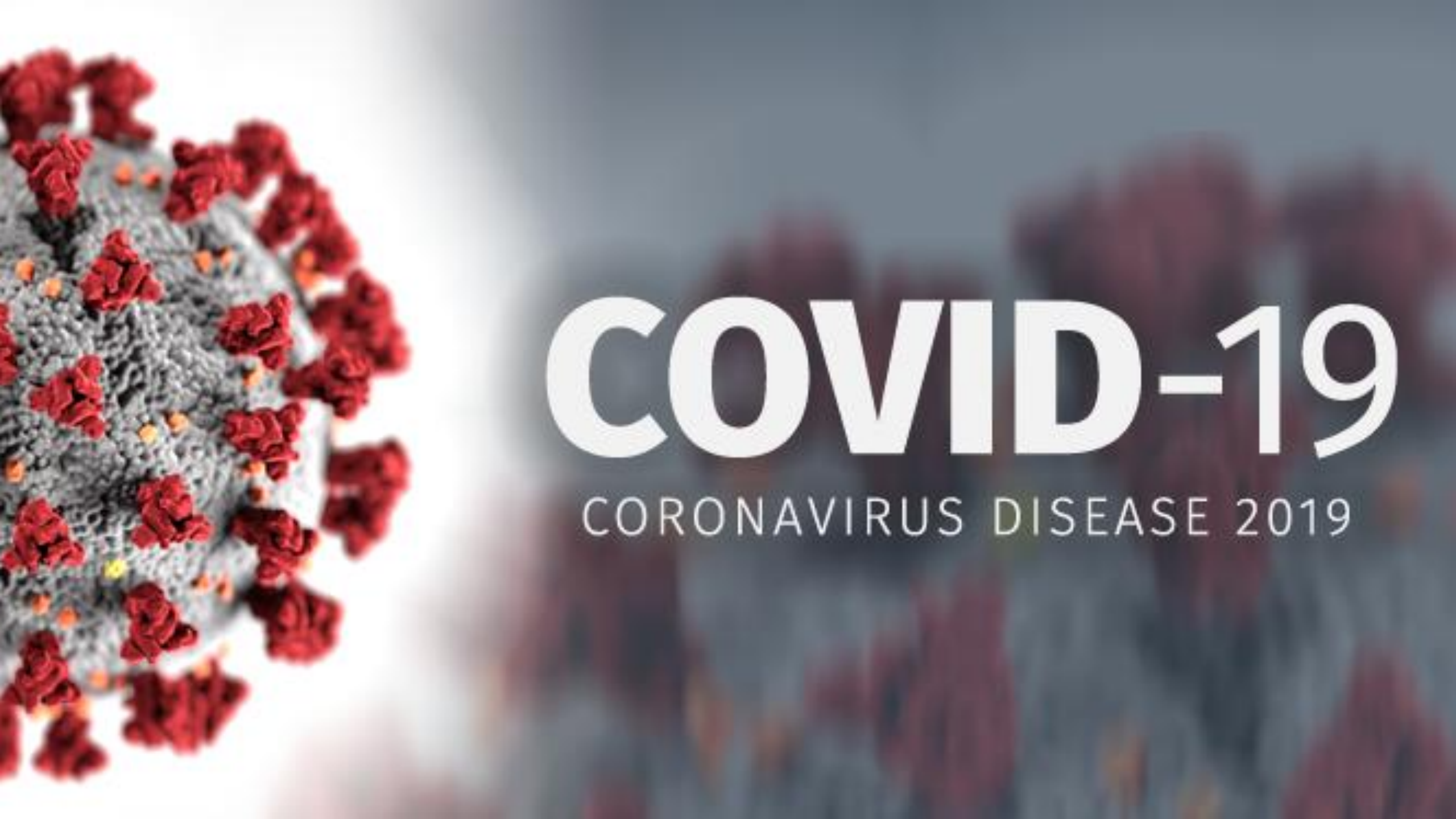
2004

HKU1

2005

MERS

2013


COVID-19
CORONAVIRUS DISEASE 2019

TIMELINE OF THE VARIANTS OF CORONAVIRUS

Sources: WHO, National Collaborating Centre for Infectious Diseases, Centers for Disease Control and Prevention

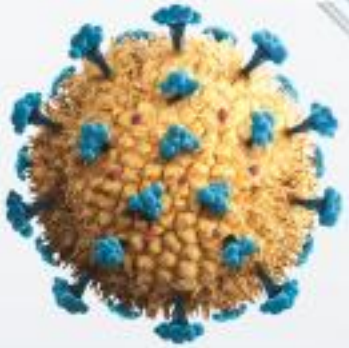
* There are indications that Omicron was already spreading in western Europe before being identified in southern Africa. The RIVM health institute said it found Omicron in samples dating from November 19 and 23.

1 ALPHA B.1.1.7

TYPE OF VARIANT: **Variant of concern**
EARLIEST DOCUMENTED ON: **September 2020**
EARLIEST DOCUMENTED IN: **United Kingdom**
SPIKE MUTATIONS: **11** 50% more transmissible than earlier strains

2 BETA B.1.351

TYPE OF VARIANT: **Variant of concern**
EARLIEST DOCUMENTED ON: **May 2020**
EARLIEST DOCUMENTED IN: **South Africa**
SPIKE MUTATIONS: **10**



3 GAMMA B.1.1.248

TYPE OF VARIANT: **Variant of concern**
EARLIEST DOCUMENTED ON: **November 2020**
EARLIEST DOCUMENTED IN: **Brazil**
SPIKE MUTATIONS: **12**

4 DELTA B.1.617.2

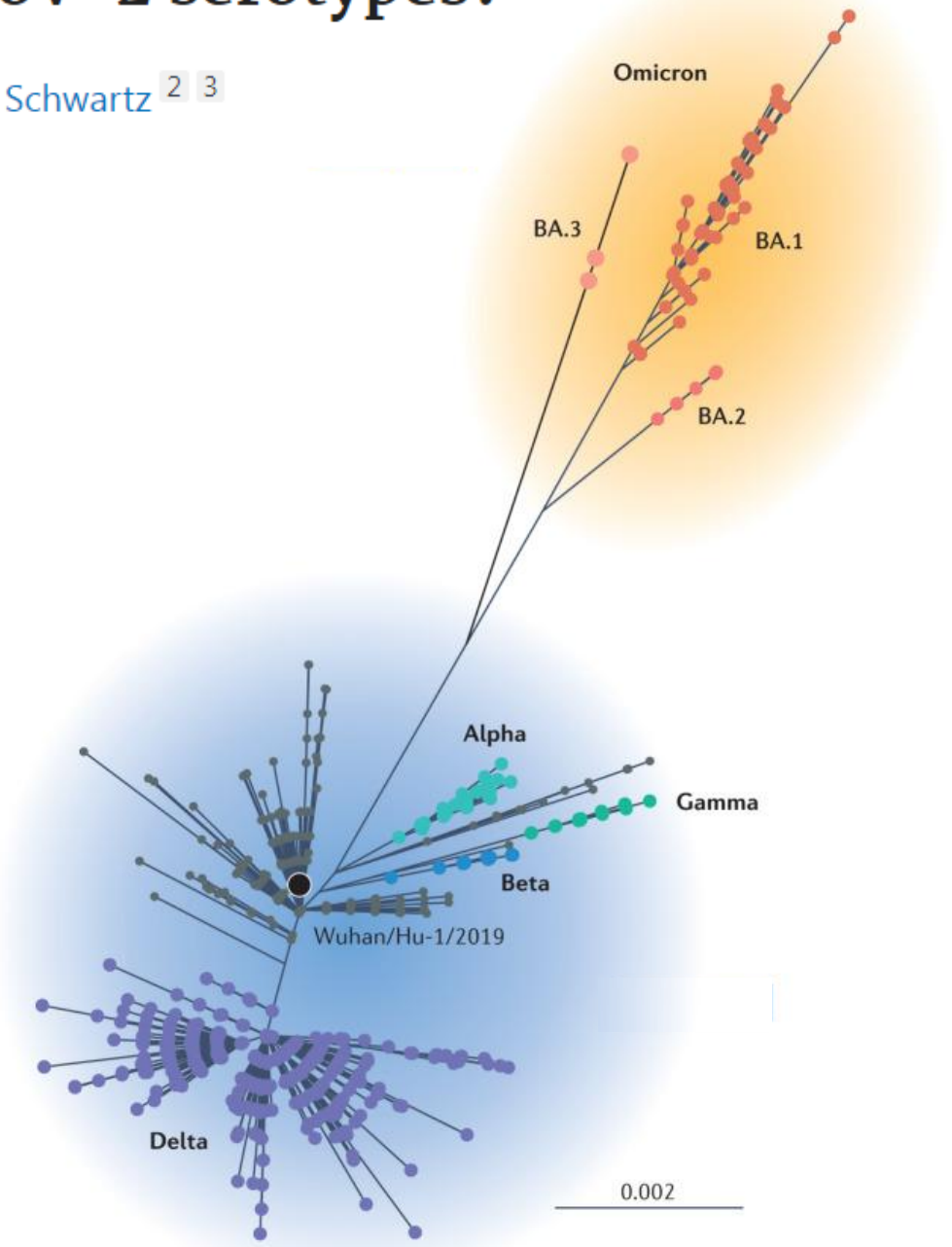
TYPE OF VARIANT: **Variant of concern**
EARLIEST DOCUMENTED ON: **October 2020**
EARLIEST DOCUMENTED IN: **India**
SPIKE MUTATIONS: **10** 60% more transmissible than the Alpha variant

5 OMICRON* B.1.1.5.29

TYPE OF VARIANT: **Variant of concern**
EARLIEST DOCUMENTED ON: **November 24, 2021**
EARLIEST DOCUMENTED IN: **Multiple countries**
South Africa first reported the case*
SPIKE MUTATIONS: **32**

Towards SARS-CoV-2 serotypes?

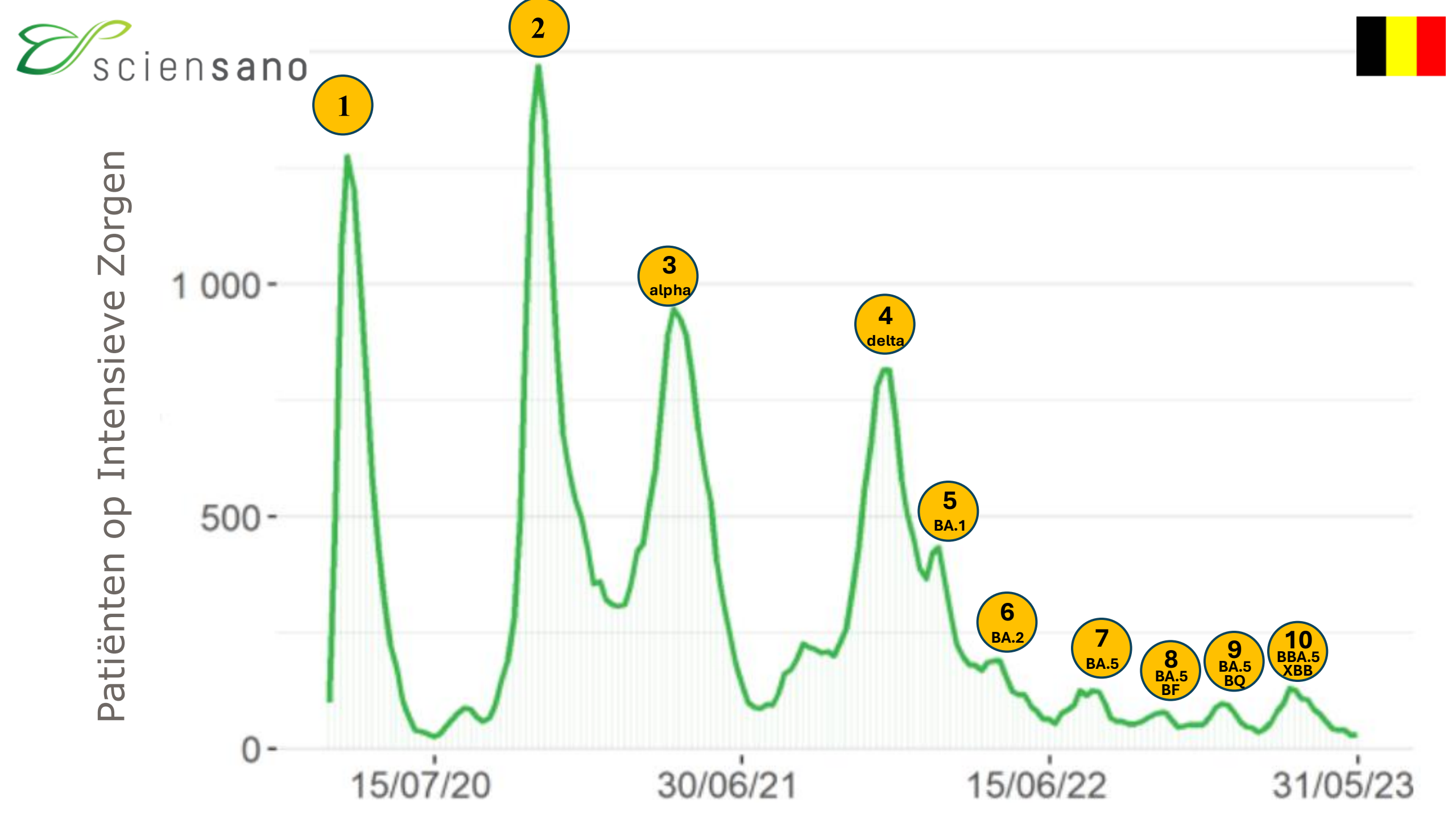
Etienne Simon-Loriere [1], Olivier Schwartz [2 3]



Serotype 2

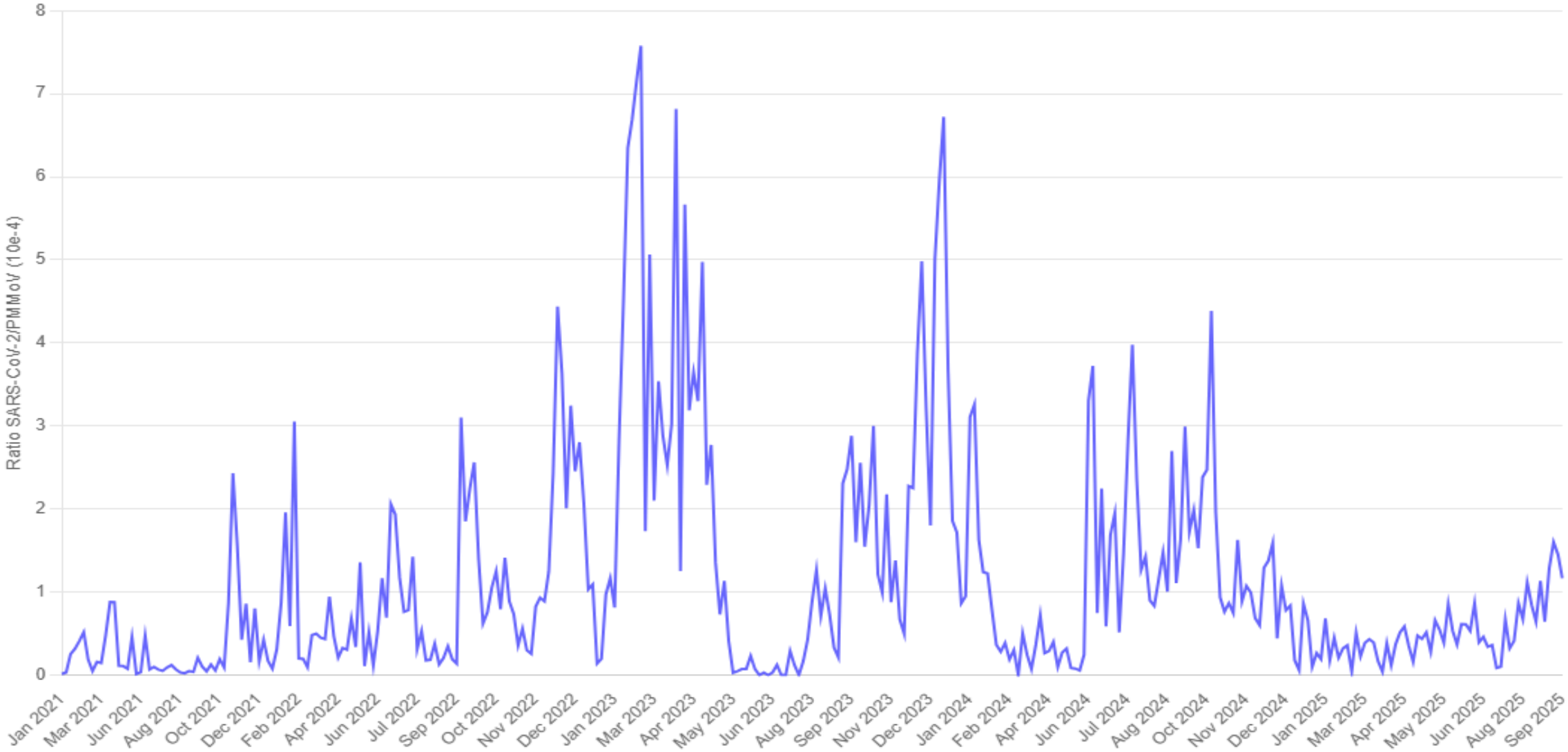
Serotype 1

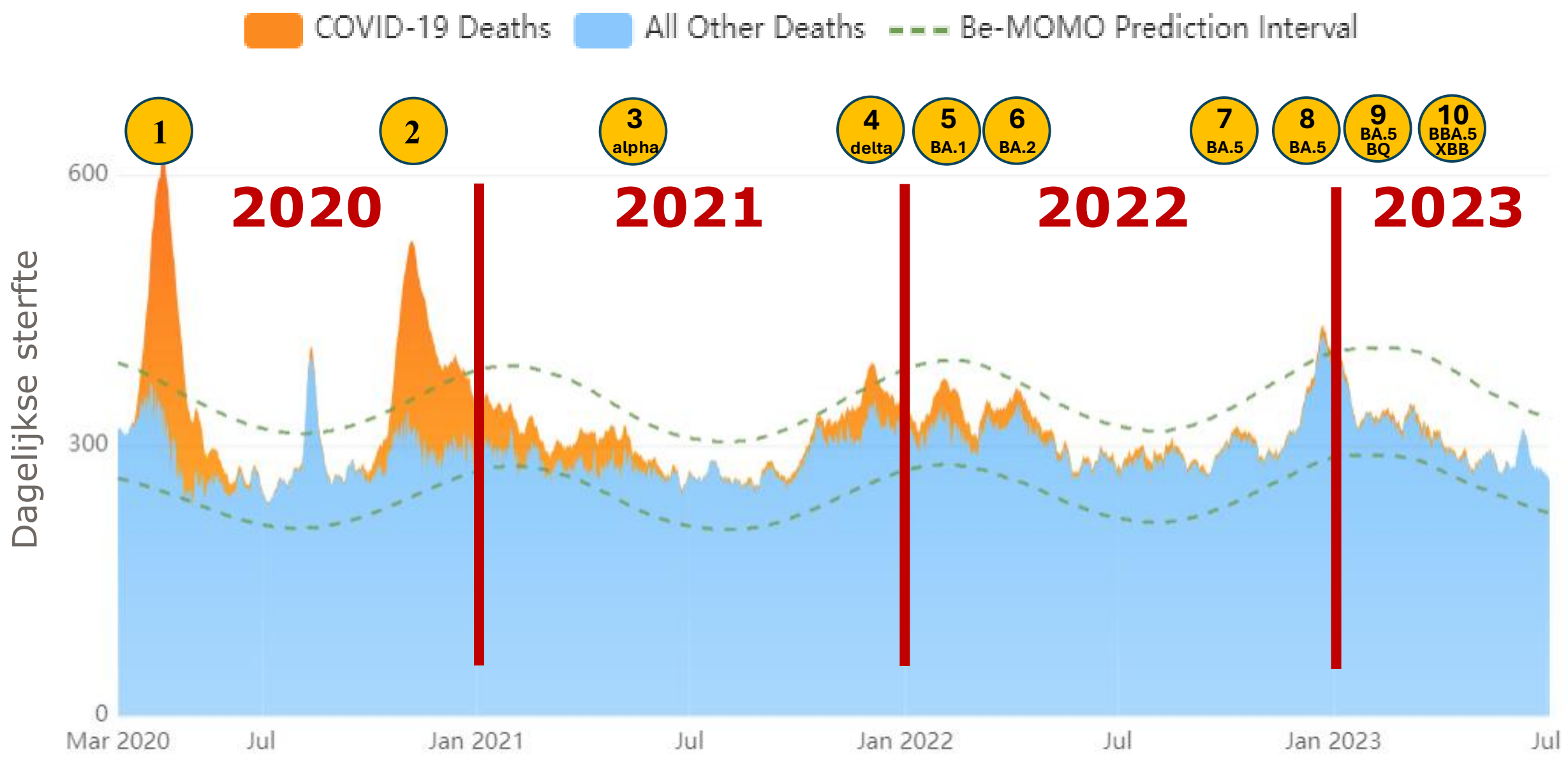
Nat Rev Microbiol . 2022 Apr;20(4):187-188. doi: 10.1038/s41579-022-00708


sciensano
Patiënten op Intensieve Zorgen
1 000
500
0
15/07/20
30/06/21
15/06/22
31/05/23
1
2
3
alpha
4
delta
5
BA.1
6
BA.2
7
BA.5
8
BA.5
BF
9
BA.5
BQ
10
BBA.5
XBB

KU LEUVEN

National Coronavirus Reference Laboratory

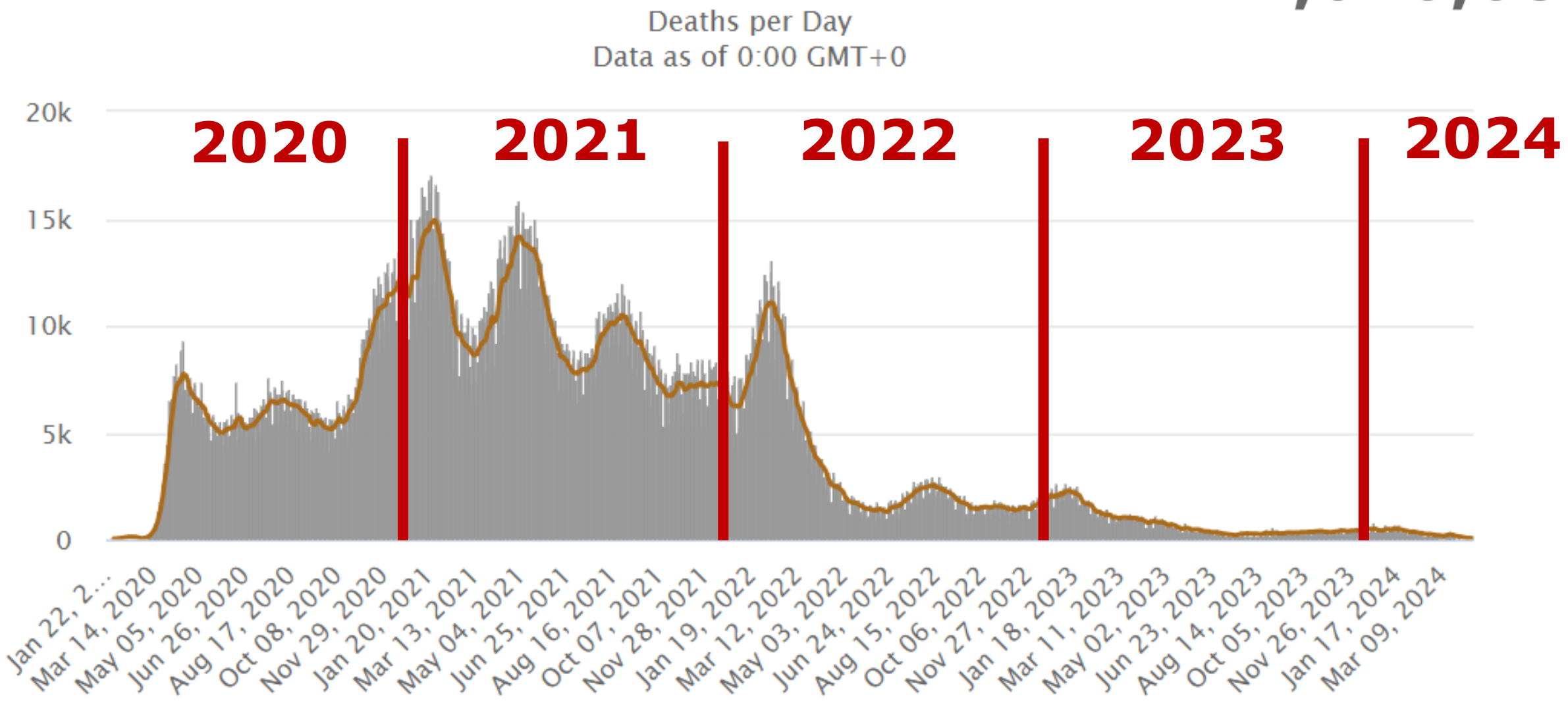



sciensano
COVID-19 Deaths
All Other Deaths
Be-MOMO Prediction Interval
1
2
3 alpha
4 delta
5 BA.1
6 BA.2
7 BA.5
8 BA.5
9 BA.5 BQ
10 BBA.5 XBB
2020
2021
2022
2023
Dagelijkse sterfte
600
300
0
Mar 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul

worldometer

Deaths:

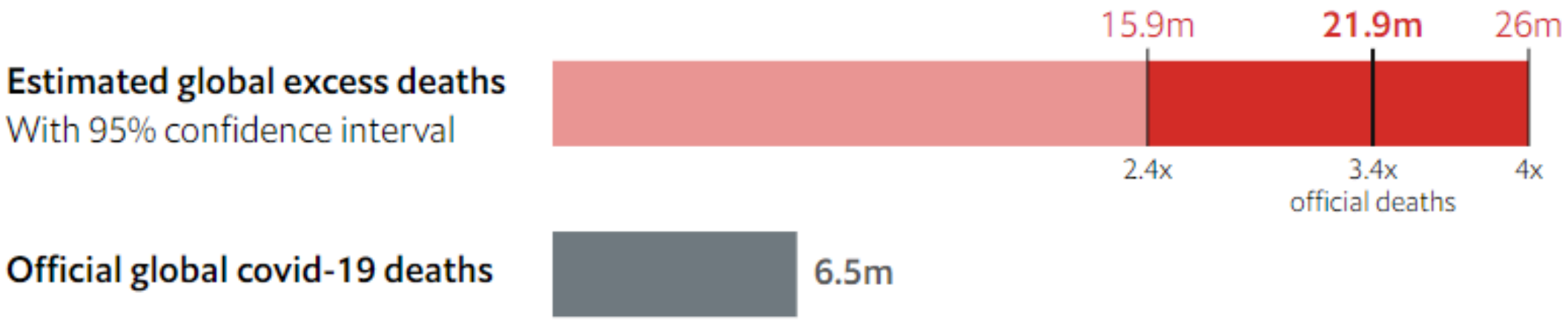
7,010,681



The Economist

The pandemic's true death toll

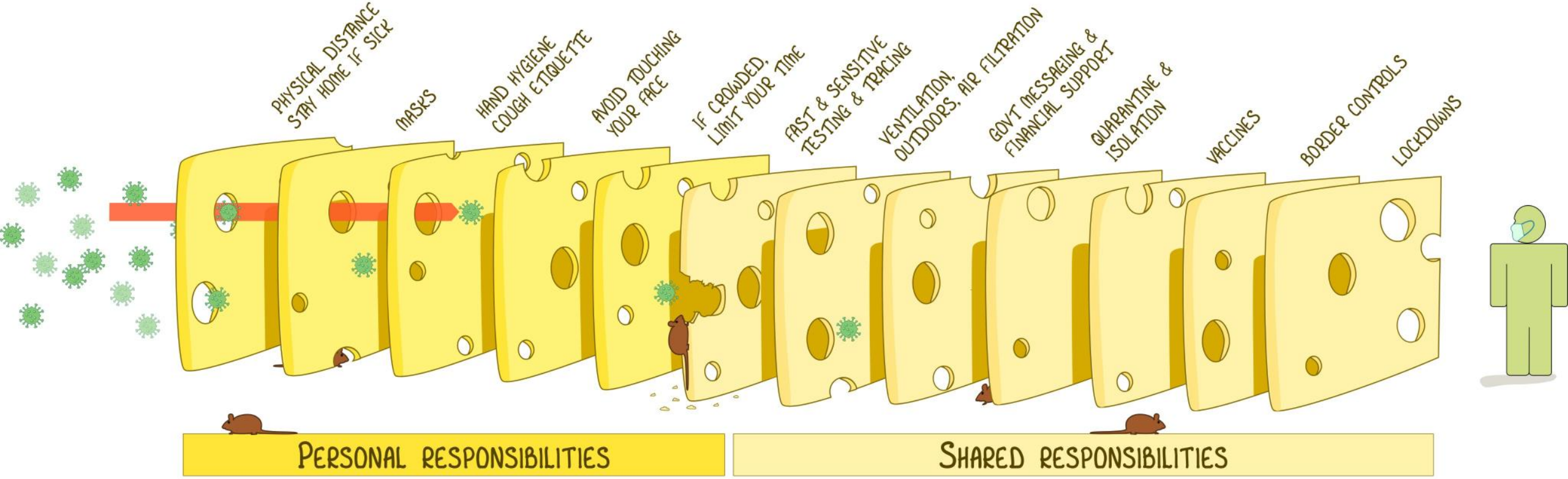
Our daily estimate of excess deaths around the world



www.economist.com/graphic-detail/coronavirus-excess-deaths-estimates (accessed 12 sep 2022)

The Swiss Cheese Respiratory Virus Pandemic Defence

Recognising that no single intervention is perfect at preventing spread



Each intervention (layer) has imperfections (holes).
Multiple layers improve success.

Misinformation mouse

Ian M Mackay
virologydownunder.com
With thanks to Jody Lanard, Katherine Arden & the Uni of Qld
Based on the Swiss cheese model of accident causation, by James T Reason, 1990
version 4.0
update: 26DEC2020

Vaccinatie

Antivirale middelen

Niet-farmaceutische Interventies

Hand hygiëne

Link up with LIFEBUOY *for Health's Sake.*

The Influenza Scourge.

THE father who links up with Lifebuoy Soap links up his whole family with smiling health. There's nothing like Lifebuoy for introducing a wholesome cleanliness everywhere, and destroying the germs of disease and sickness.

Lifebuoy Soap ensures antiseptic cleanliness. See that the children use Lifebuoy Soap before going to school—use it for home cleaning—use it at the office—use it at the toilet and the bath.

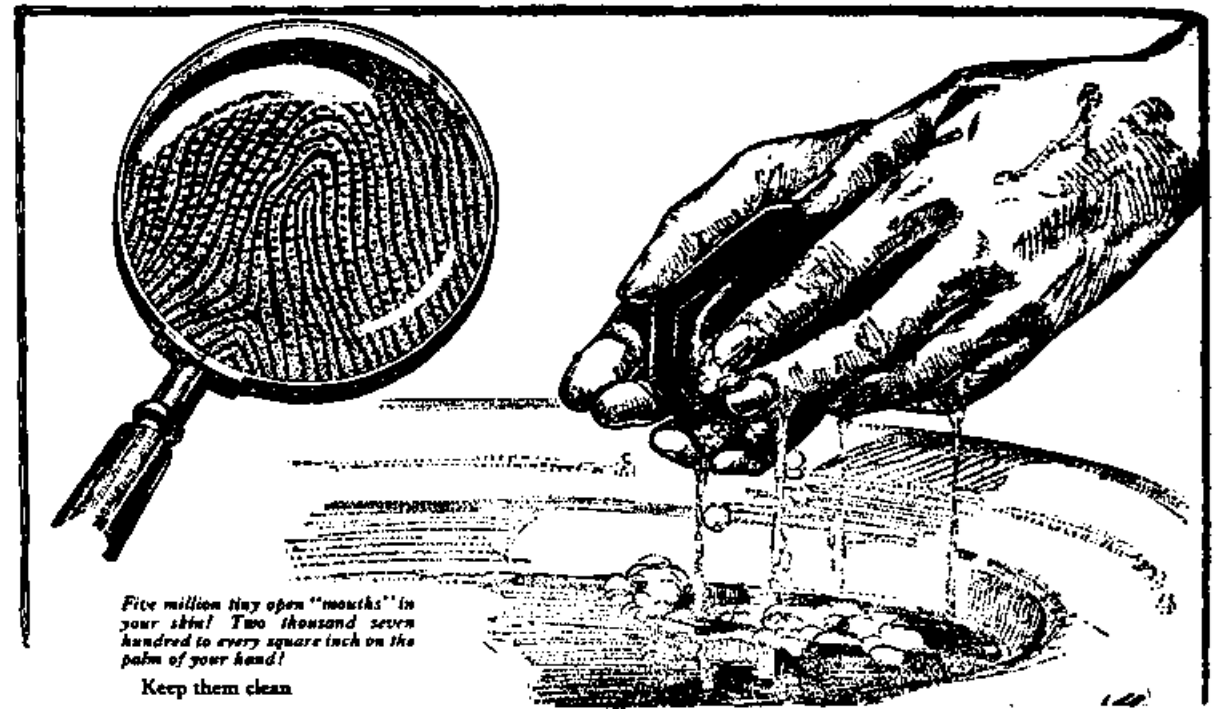
Remember LIFEBUOY SOAP is more than soap, it is a reputable germicide and a sure disinfectant.

LIFEBUOY SOAP

MORE THAN SOAP YET COSTS NO MORE.

LEVER BROTHERS LIMITED, PORT SUNLIGHT.

E 170—34



Five million tiny open "mouths" in your skin! Two thousand seven hundred to every square inch on the palm of your hand!

Keep them clean

The New York City Department of Health gives this warning in its bulletin on how to avoid contracting influenza: *"Don't eat without first washing your hands.'*

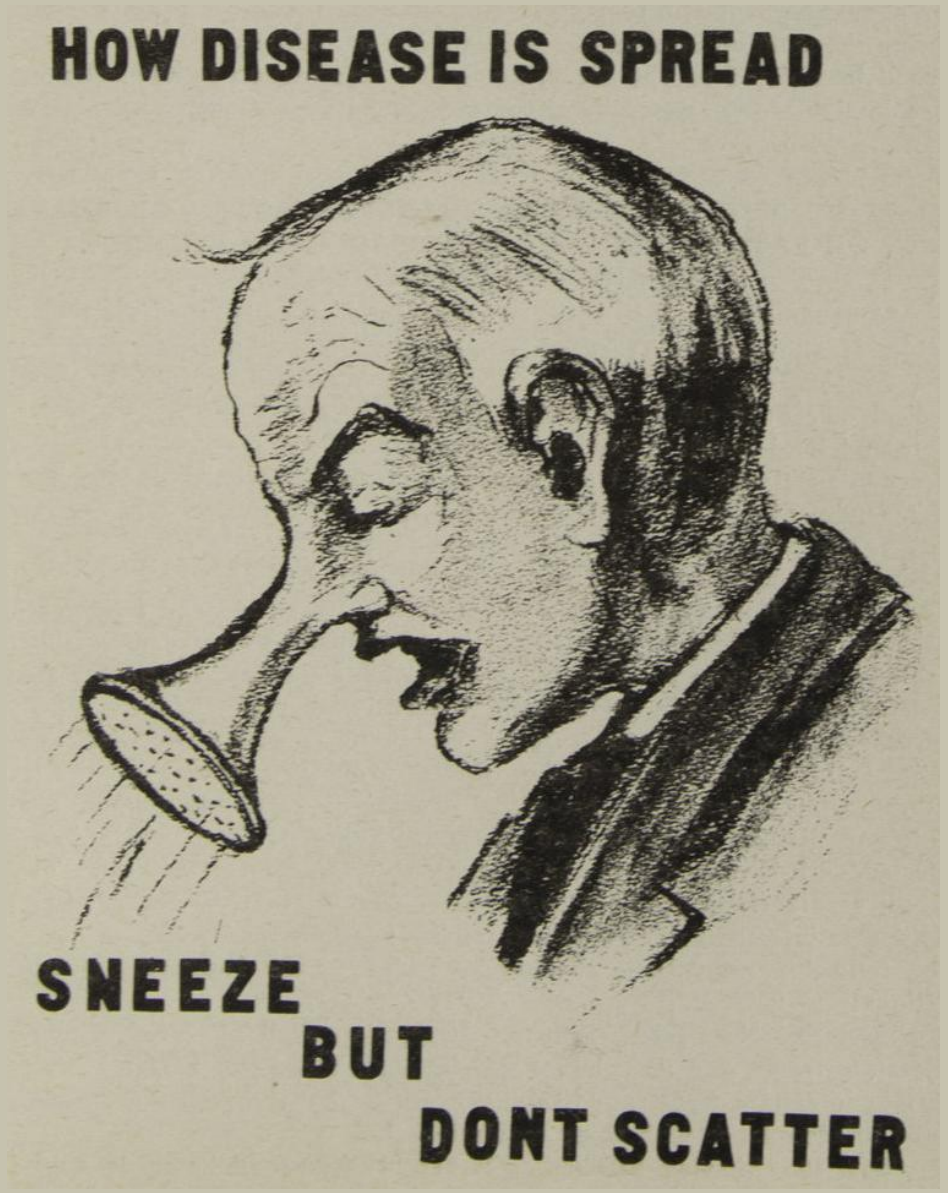
The United States Public Health Service says: *"The disease is spread by the breath and secretions of the body, especially of the nose and throat. For this reason the hands should be washed frequently."*

Hoest hygiëne

WEEKLY BULLETIN
OF THE
DEPARTMENT of HEALTH
CITY OF NEW YORK

Public health is purchasable. Within natural limitations a community can determine its own death rate.

Published weekly by the Department of Health, City of New York, 139 Centre St., New York, N. Y. Entered as Second-Class matter October 16, 1917, at the Postoffice at New York, N. Y. Under Act of March 3, 1879. Subscription, 10 cents per annum.



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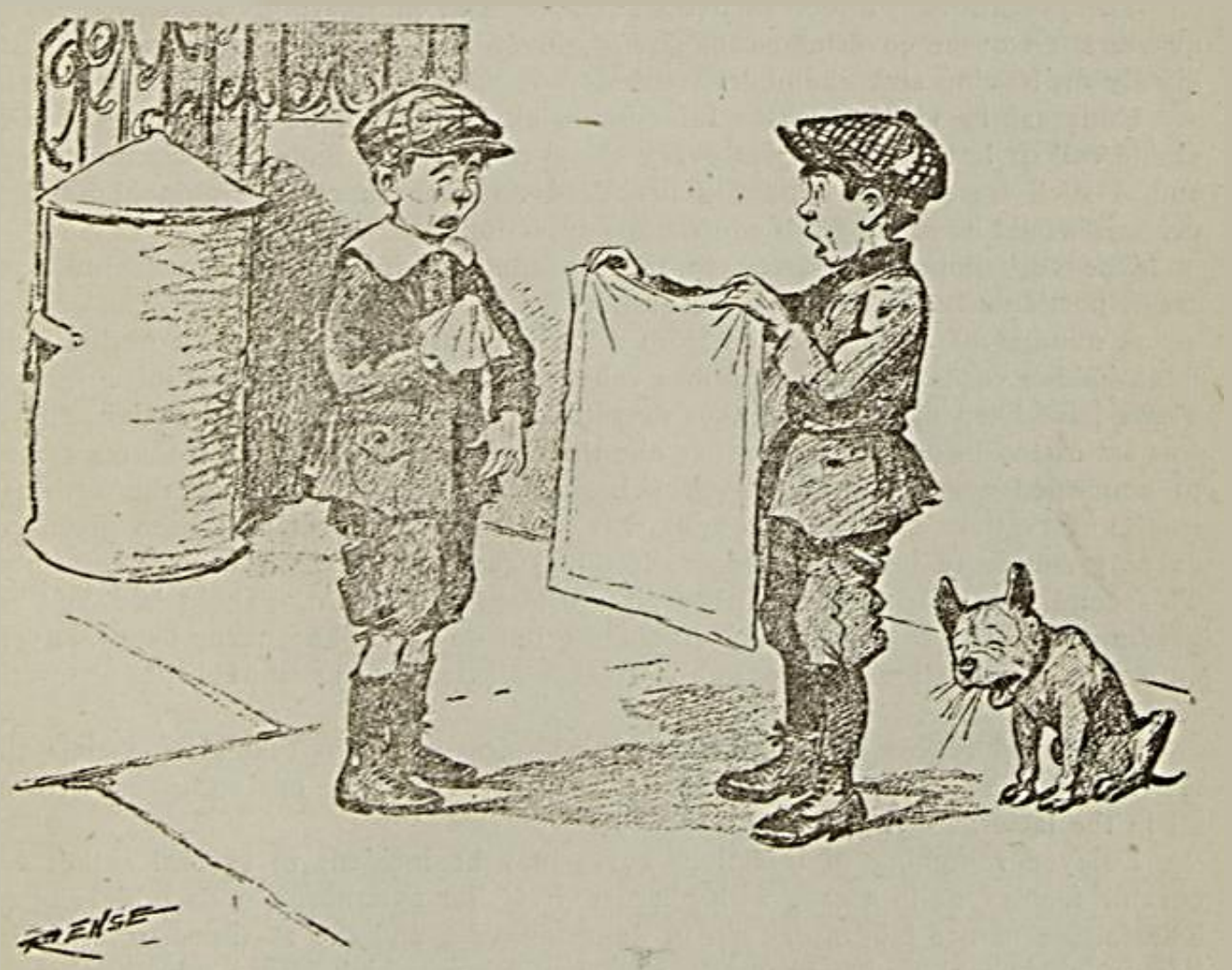
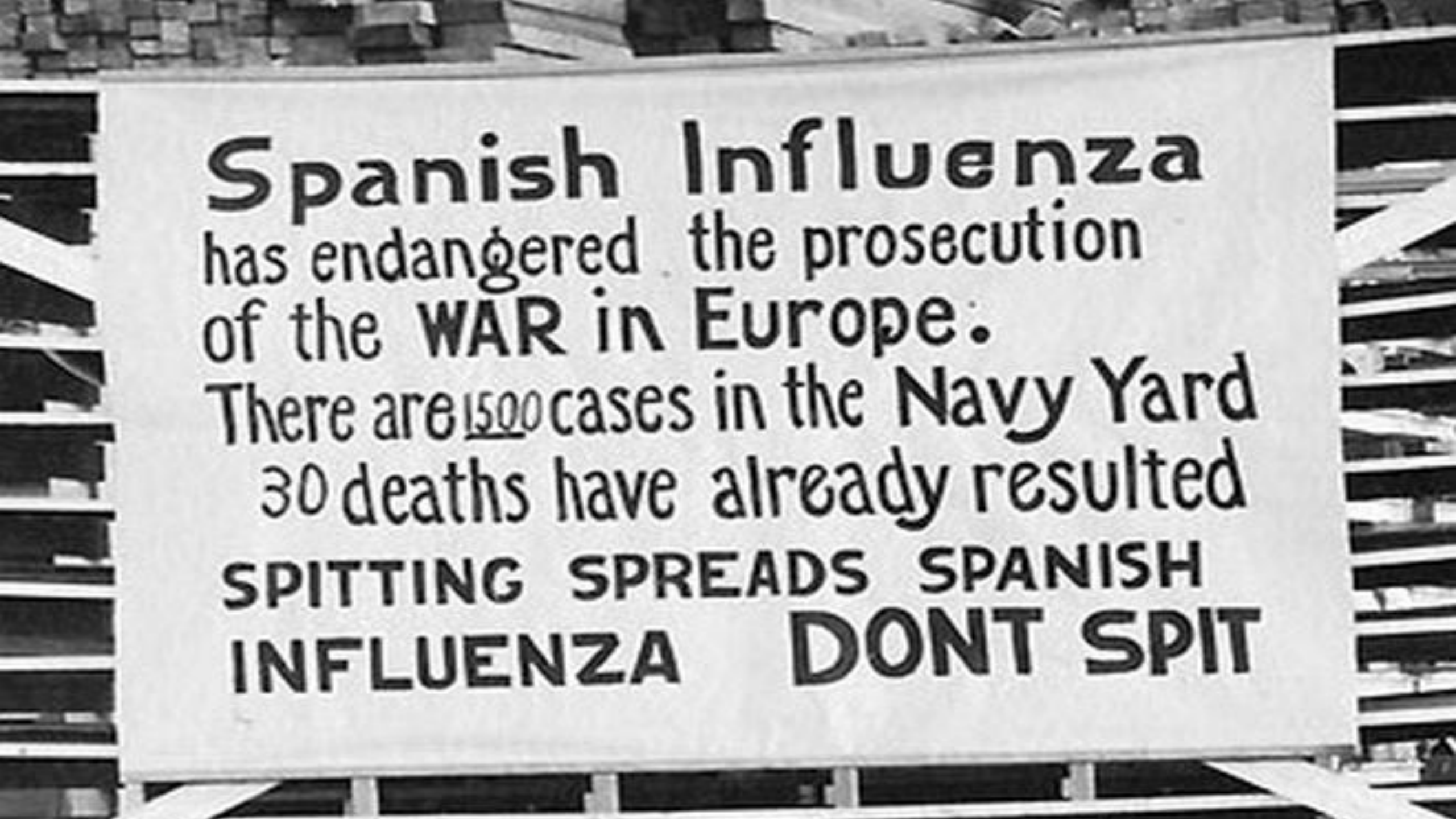


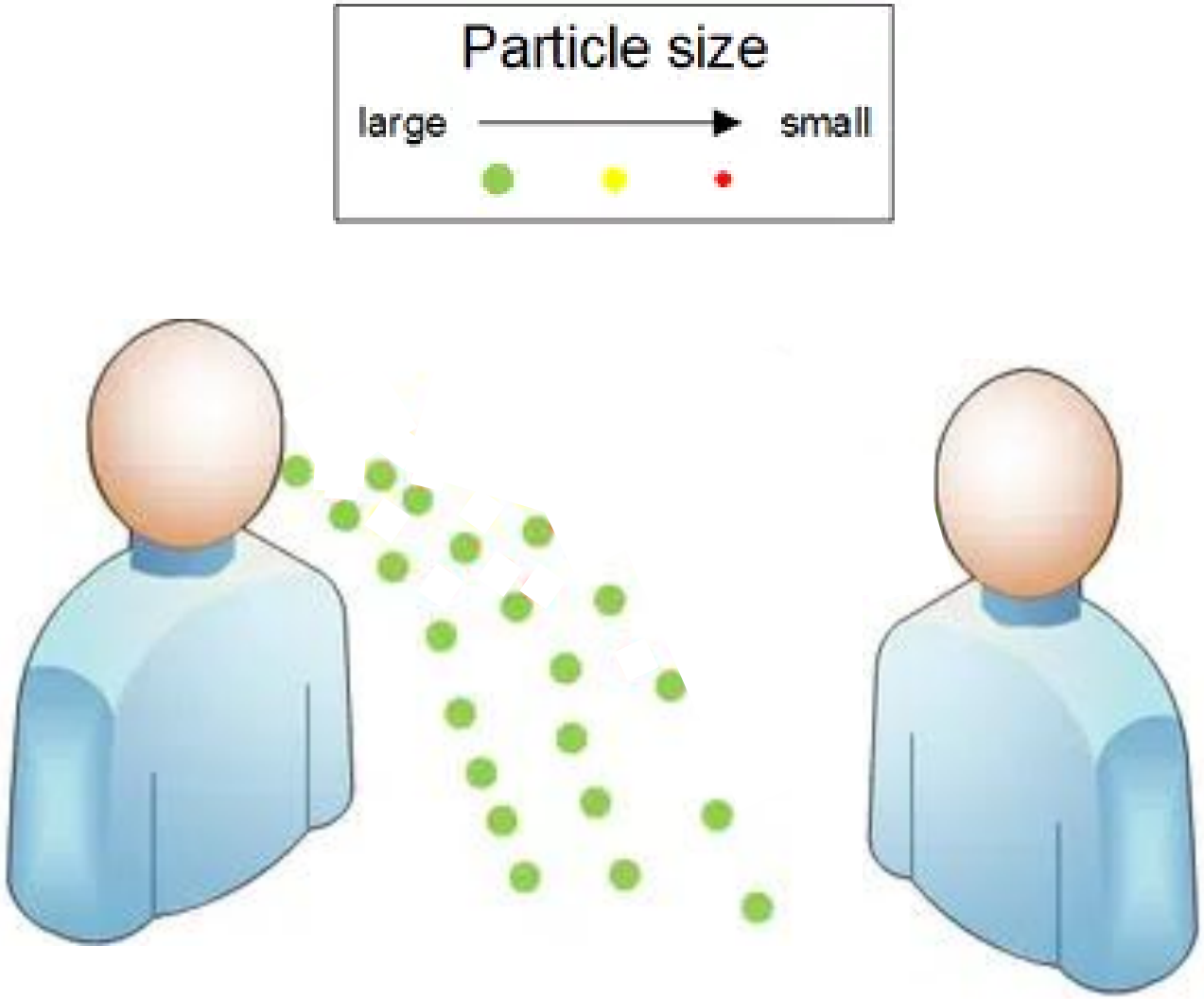
"Did ya get that fer yer birthday? Gee! that's some hankachif."
"Yeh, me mother made it fer me. It's good fer a hundred sneezes."

The World, October 7.

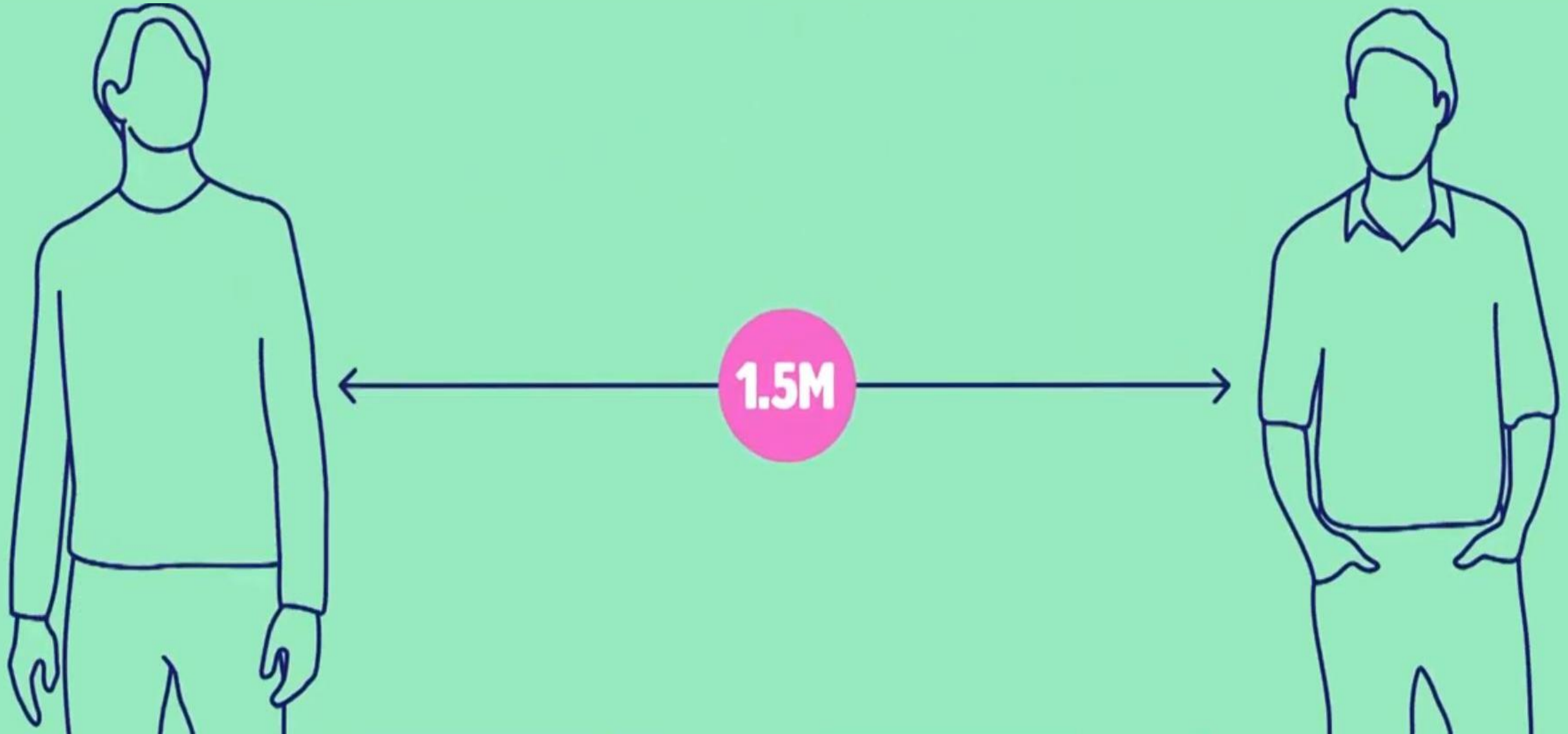
SPITTING
ON SIDEWALKS
PROHIBITED
PENALTY $5 TO $100
DEPT. OF HEALTH
ANDE ROONEY INC MADE IN U.S.A. 1987 ©


Spanish Influenza
has endangered the prosecution
of the WAR in Europe.
There are 1500 cases in the Navy Yard
30 deaths have already resulted
SPITTING SPREADS SPANISH
INFLUENZA DONT SPIT

Afstands-maatregelen

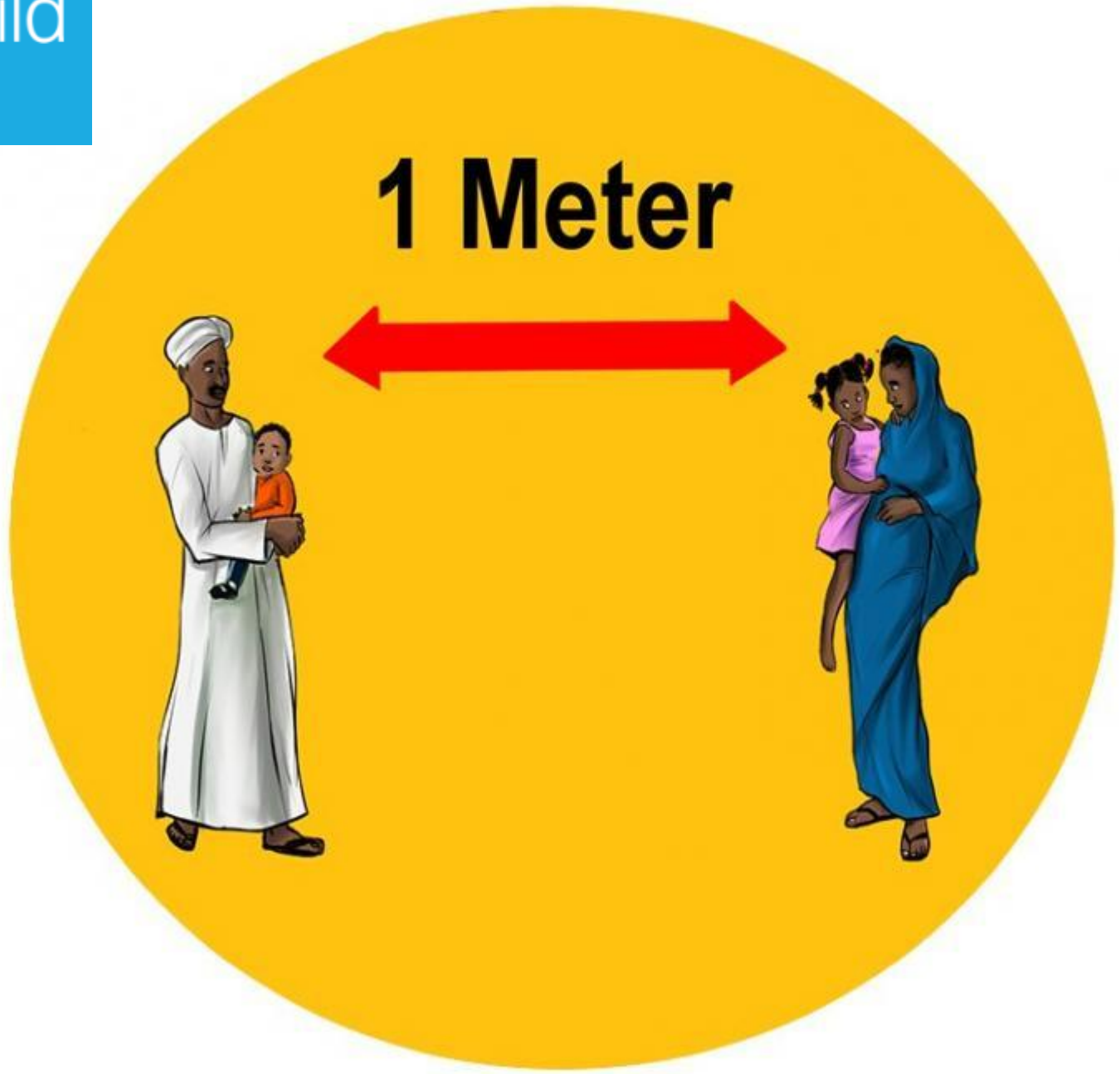


Droplet transmission


1.5M

unicef | for every child

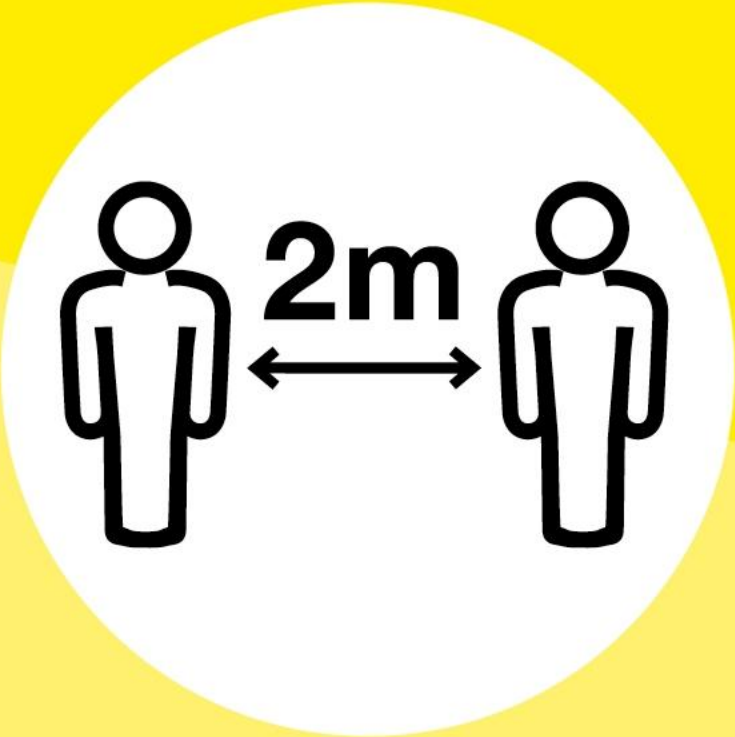
Sudan



Coronavirus COVID-19

Physical Distancing Outside

Coronavirus
COVID-19
Public Health
Advice

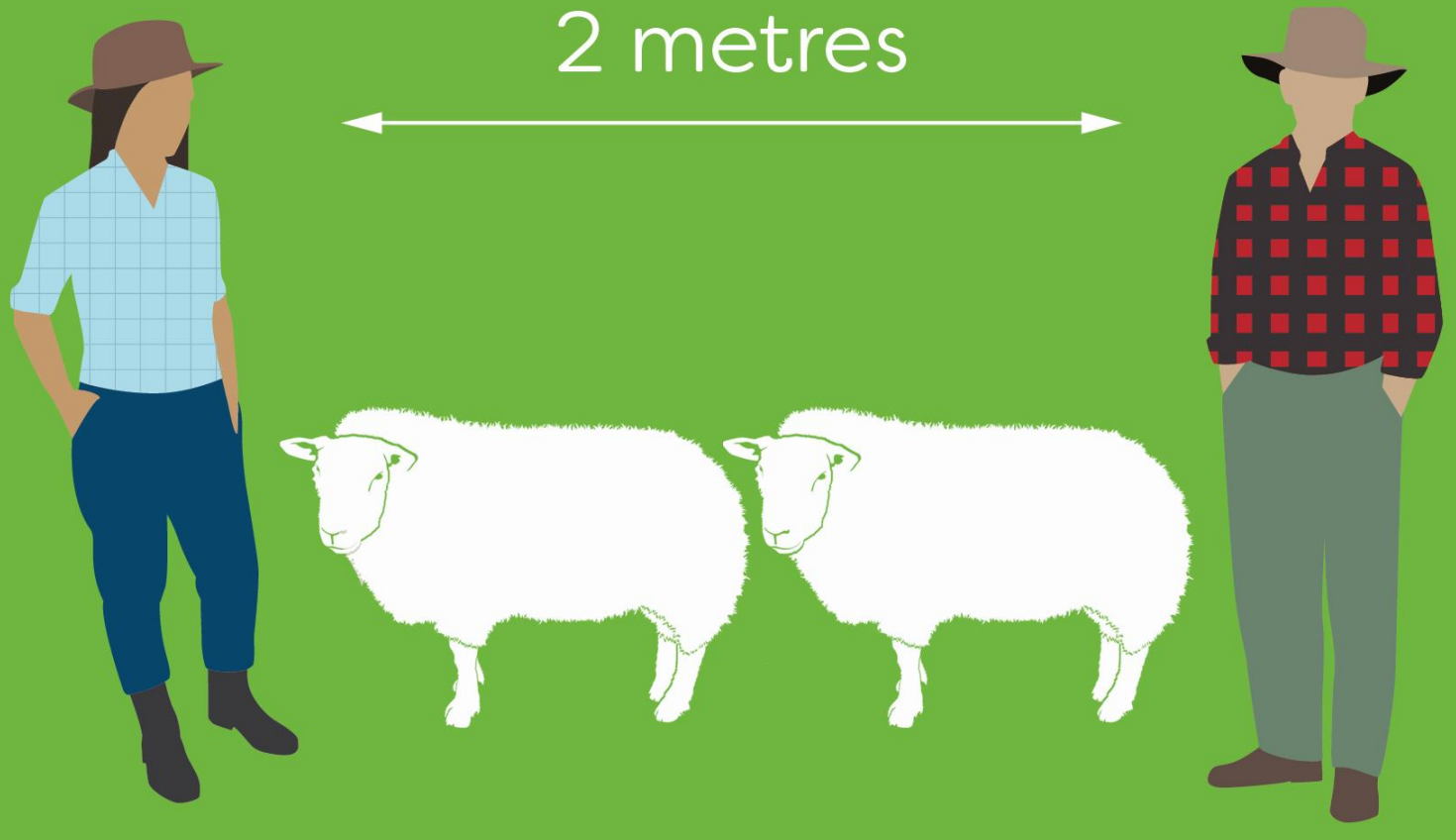


Distance

yourself at least 2 metres (6 feet) away from other people

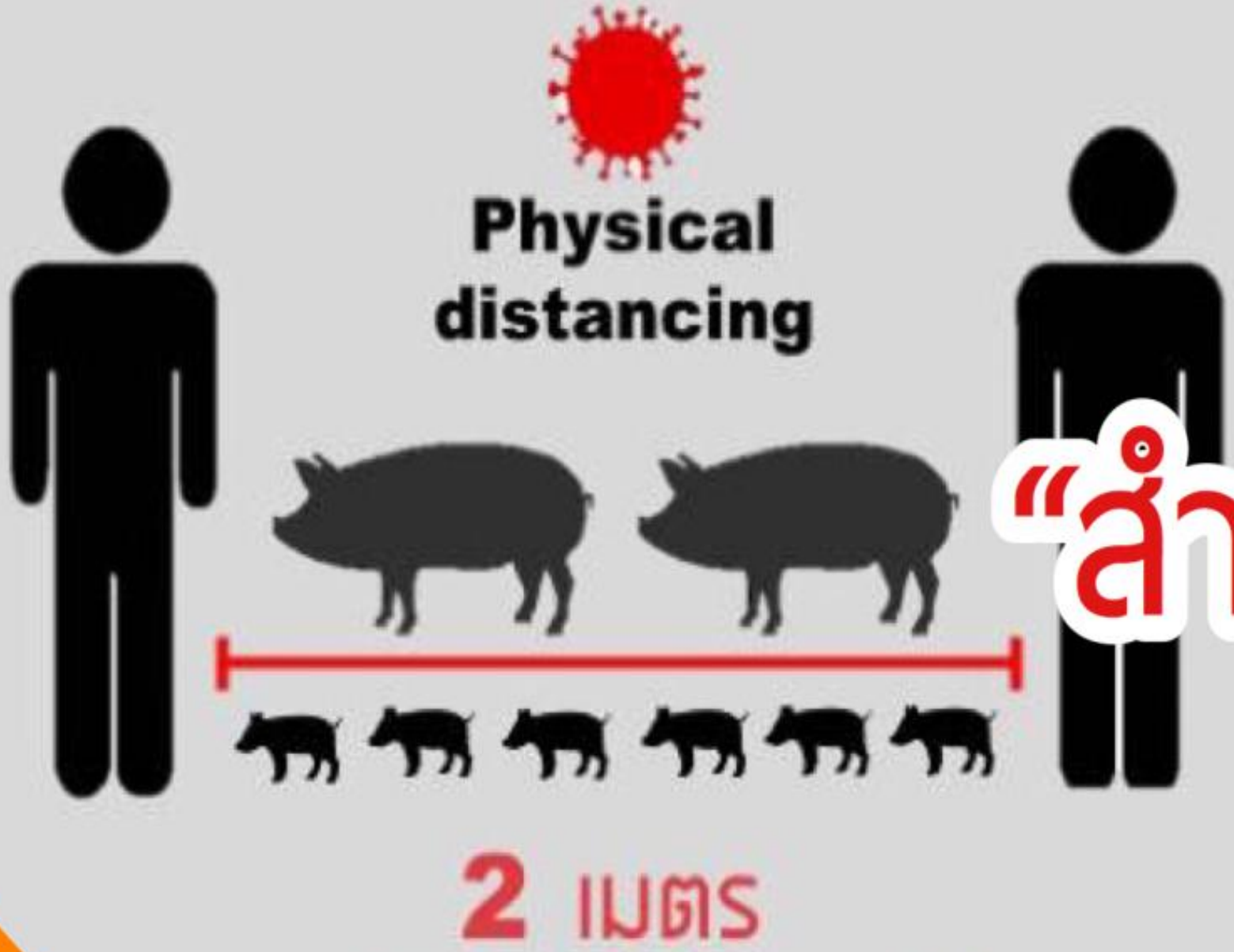
Rialtas na hÉireann
Government of Ireland

Two sheep away.



BEEF + LAMB
NEW ZEALAND

Magazine Online ด้านปศุสัตว์



“สำคัญ”

สุกร

- ปศุศาสตร์ นิวส์ -

Le Grenier à Pain
Covid-19
DISTANCE SOCIALE
Merci de respecter une distance minimum
de 2 baguettes ou de 9 croissants les uns des autres.

MUST QUIT KISSING!

MOBILE, Ala., Oct. 8.—The city commission today adopted recommendations of the committee of public health closing all schools in the city, motion picture houses and theaters on account of the prevalance of an epidemic of Spanish influenza. Public gatherings including Liberty rallies have been ordered stopped. The health authorities have recommended that persons refrain from kissing.

Lockdown

COVID-19: Stringency Index

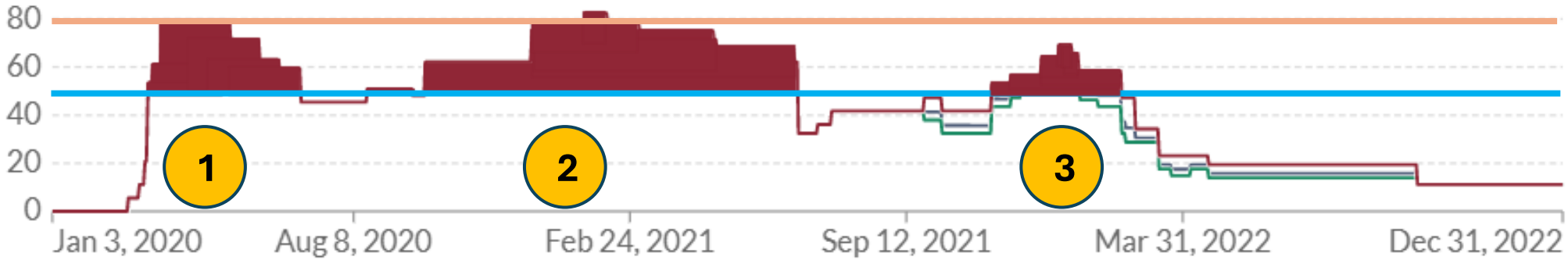
Our World in Data

The stringency index is a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest).

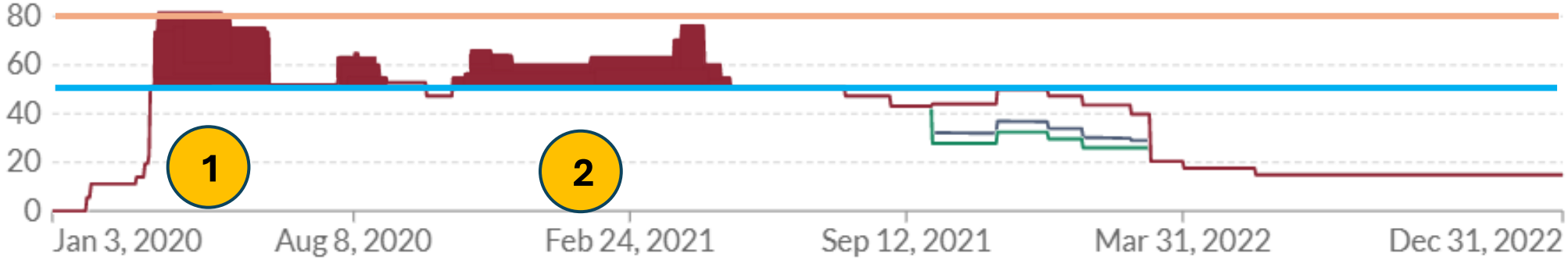
Add country Align axis scales

Non-vaccinated Vaccinated Weighted average of vaccinated and non-vaccinated

Netherlands



Belgium



Source: Hale, T., Angrist, N., Goldszmidt, R. et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nat Hum Behav 5, 529–538 (2021). https://doi.org/10.1038/s41562-021-01079-8

CC BY

All theatres
CLOSED
until further
NOTICE
At request of
MAYOR.

OFFICIAL NOTICE

Notice is hereby given to all persons concerned that by reason of the appearance in epidemic form of Spanish Influenza in the City of Pullman, for civic reasons of public health protection, all public places where people assemble are

CLOSED

This includes schools, all places of amusement, dance halls, pool rooms, churches, Sunday Schools, lodges, conventions, etc.

This order to become effective at noon, Thursday, October 10, 1918. When all danger of epidemic has passed this order will be raised.

Dr. J. L. GILLELAND,
City Health Officer.

THE PULLMAN HERALD, PULLMAN, WASHINGTON, FRIDAY, OCTOBER 11, 1918

DEATH BRINGS WARNING OF INFLUENZA

LEADING NEWSPAPER OF KENTON COUNTY

BAN ON DANCES IS PLACED BY HEALTH OFFICER

PRICE TWO CENTS By Carrier.

Voluntary Flu Ban Urged

Covington health officials will take no new steps toward replacing of the spending every effort to prevent crowds and insure perfect ventila-

SCHOOLS CLOSED; NO SERVICES IN CHURCHES SUNDAY

Every Precaution to Prevent Influenza in Covington.

SIDEWALKS FLUSHED

FLUSHING OR OILING OF STREETS URGED BY COUNCIL OF DEFENSE

hibiting the use of public drinking cups."

NEWPORT GYM CLASSES STOP

Bathing Privileges Are Open to Members.

The military and regular classes of the Newport Gym have been discontinued until further notice. Bathing privileges are open.

The order is due to the influenza situation.

NUMBER 8753. THE OFFICIAL NEWSPAPER OF KENTON AND CAMPBELL COUNTIES

FUNERAL BAN IS ORDERED

The Covington Health Department He had been stationed at Camp and other places frequented by the

COVINGTON 18 LUDLOW-LATONIA

LEADING NEWSPAPER OF KENTON COUNTY

NEWPORT LIBRARY ORDERED CLOSED

No Exchange of Books Until End of the

HENRY YOUTSEY TO RESIDE IN

Wandelen fietsen

Het Nieuwsblad

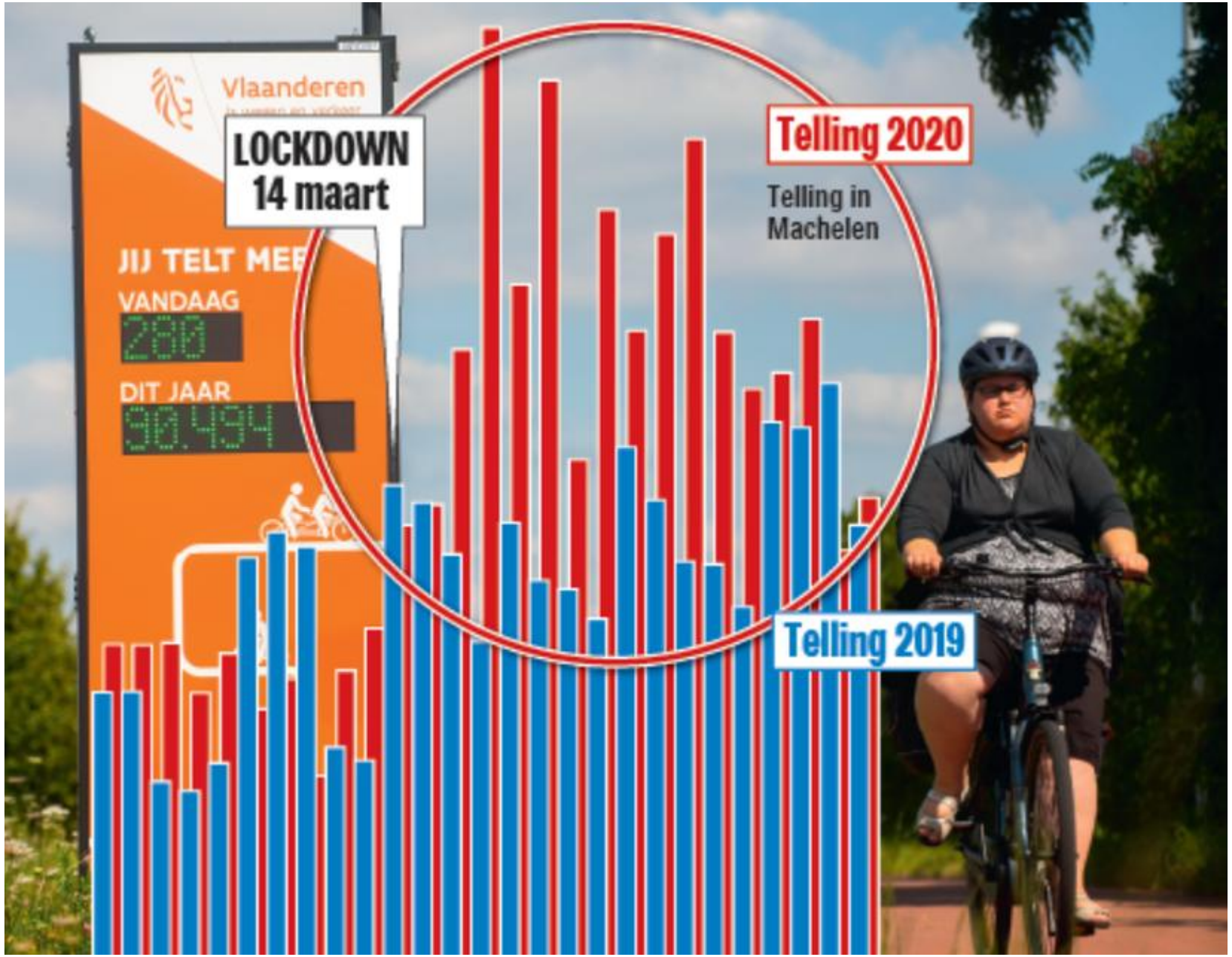
De stijging die wél goed nieuws is: fietstellers door het dak dankzij corona

Het fietstelpunt in Machelen. — © put

We hebben tijdens de strenge maatregelen in maart en april dubbel zoveel gefietst als in dezelfde periode vorig jaar. Dat blijkt uit de vijftien tellers die langs Vlaamse fietspaden staan. Eén teller zag elke zeven seconden een fiets voorbijkomen. En we lijken niet meteen van plan de fiets weer te laten staan.

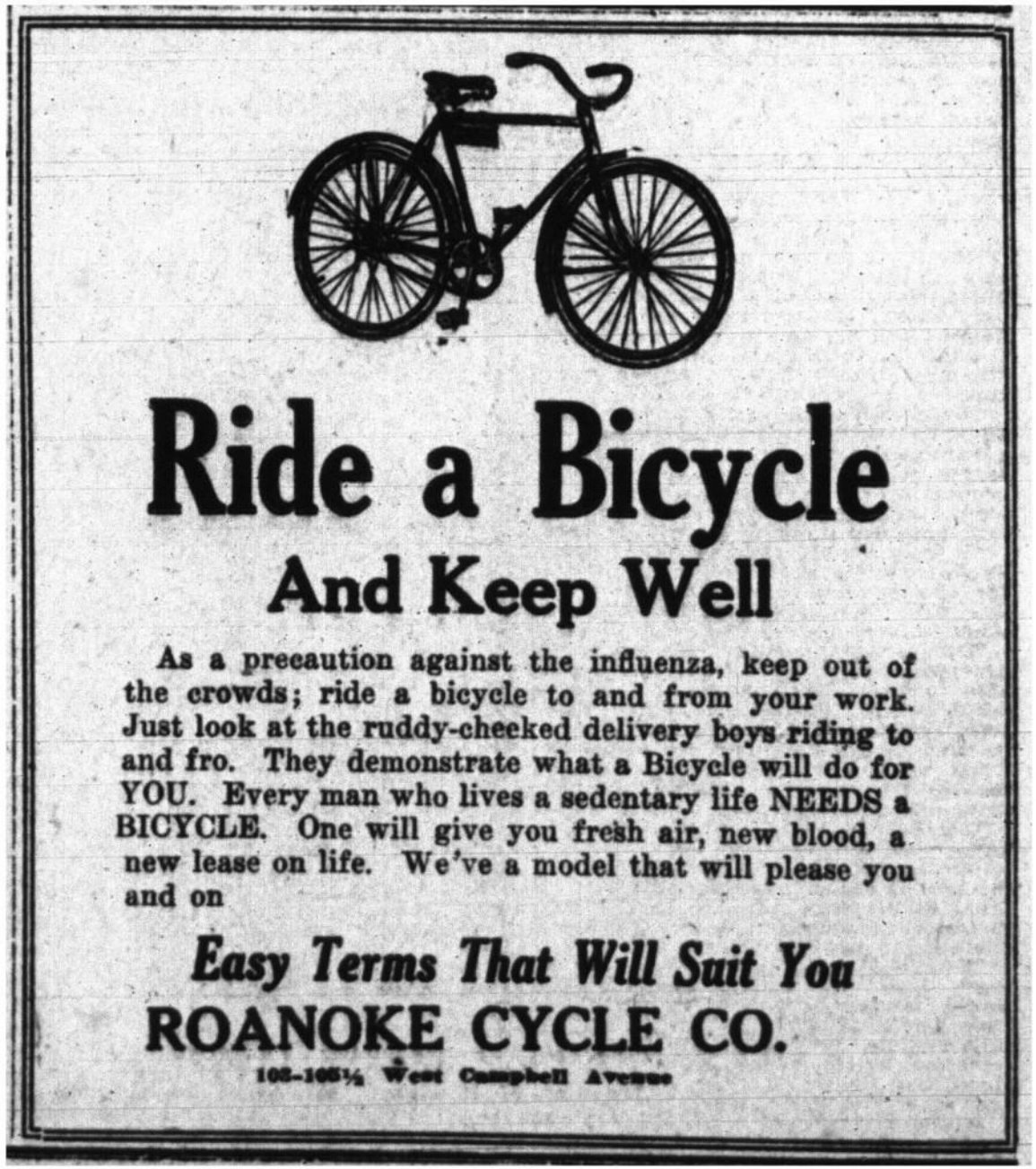
https://www.nieuwsblad.be/cnt/dmf20200722_96001432

Het Nieuwsblad

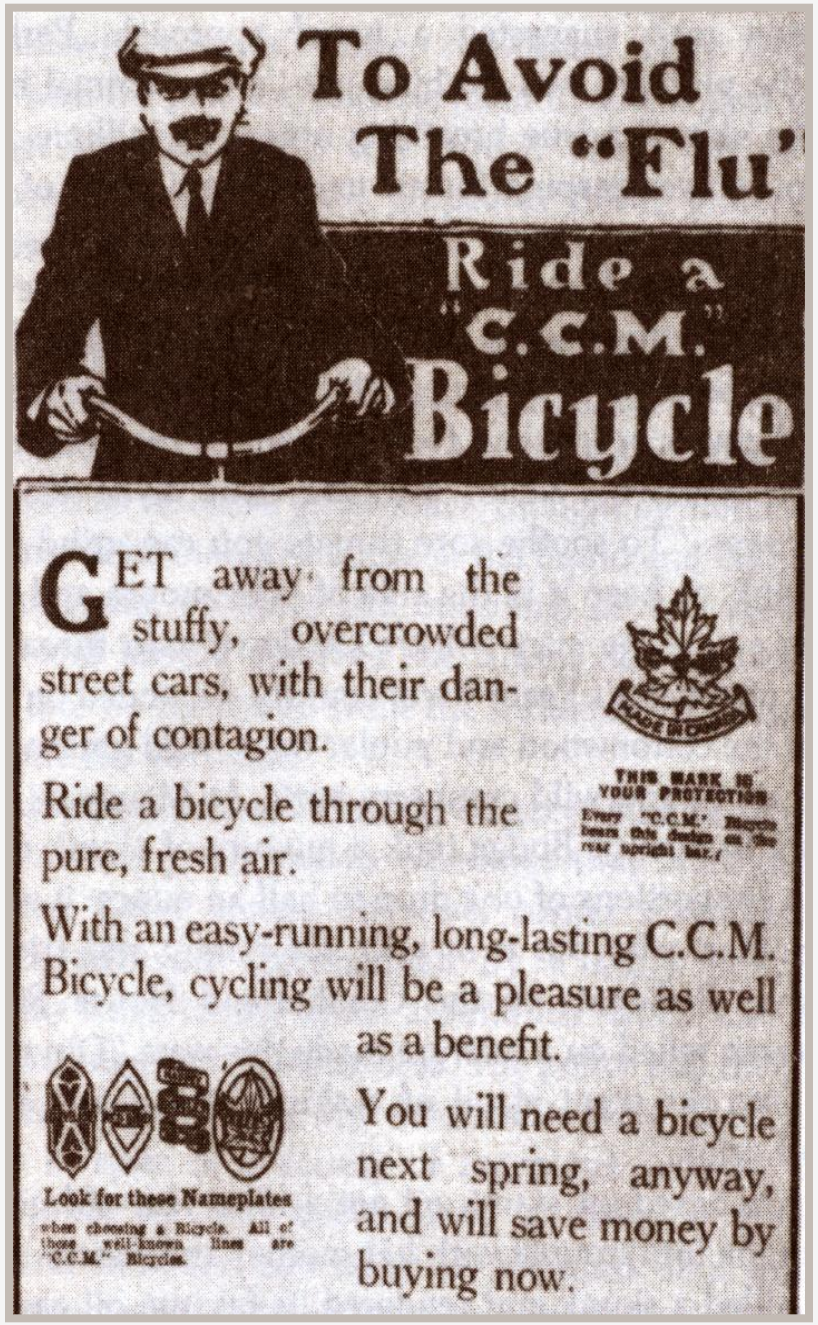


https://www.nieuwsblad.be/cnt/dmf20200722_96001432

1918, women of the Department of War take a morning walk



1918, Roanoke, West Virginia



1918, Canada Cycle & Motor Company

Buiten-activiteiten

Sint-Pietersplein, Gent

3 januari 2021

UC Berkeley, January 30, 1919

Police court, San Francisco, 1918

1918, Physics class (University of Montana, Missoula)

1918, Victoria, Canada

Maskers

How to Make Mask for Prevention of Influenza

1918, Edmonton Bulletin

1918, Oakland Red Cross volunteers

1918, California

1918, Royat (near Cermont-Ferrand), France, movie night for (American)soldiers

May 1919, Popular Science

LADY NICOTINE
BEATS MASK LAW

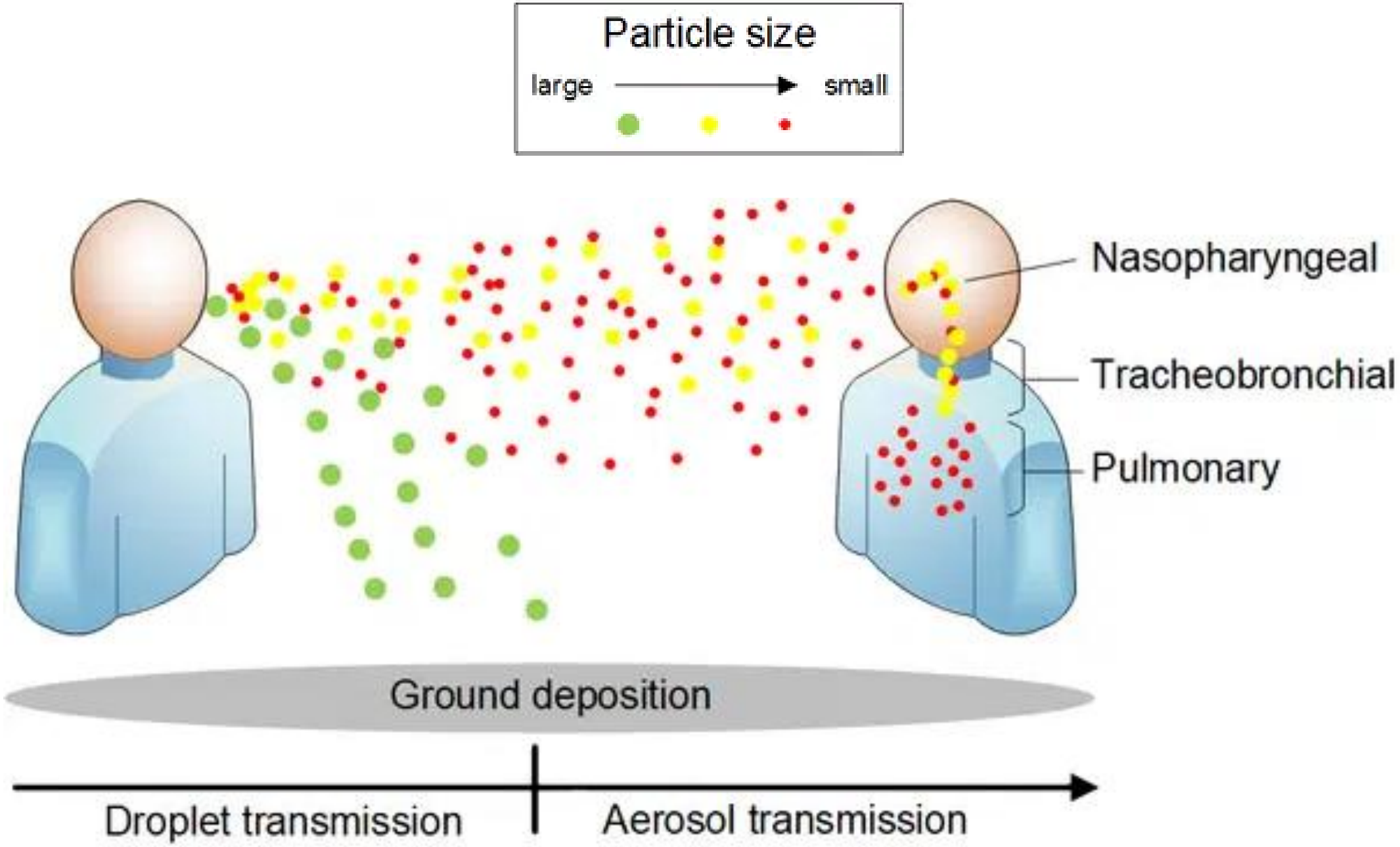
A San Francisco ordinance requires every citizen to wear a mask during the influenza epidemic. This resourceful smoker attached a rubber tube to his cigaret holder, fastened the holder to his coat lapel with an ordinary paper clip and kept up his daily batting average in the cigaret league.

1918, San Fransisco

PBM

Verluchting
Ventilatie
Luchtzuivering

Ventilatie

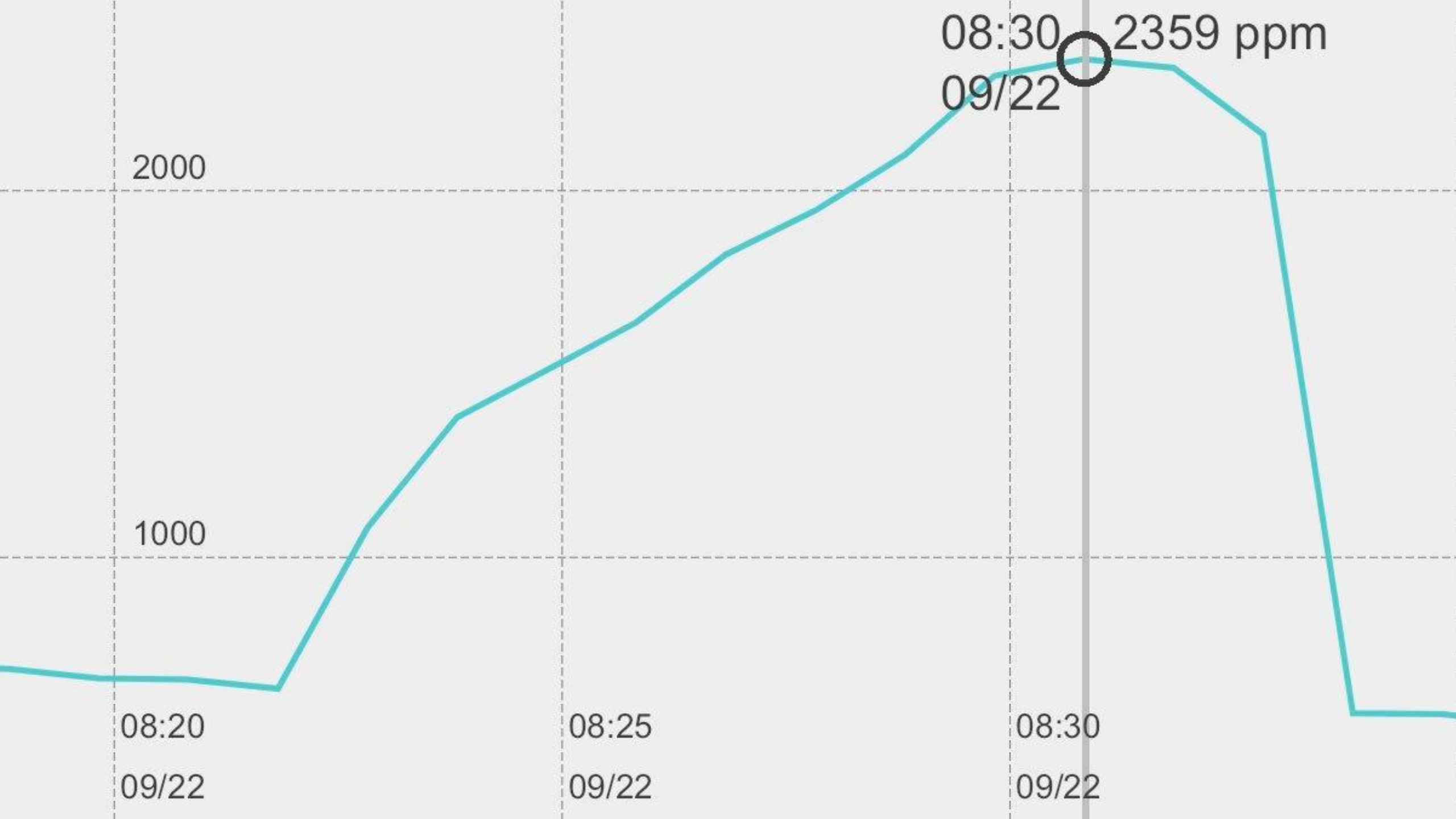

Particle size
large
small
Nasopharyngeal
Tracheobronchial
Pulmonary
Ground deposition
Droplet transmission
Aerosol transmission

24.0°C 53%
683
CO2 ppm
aranet4

19:17
71%
KANTOOR
Carbon dioxide
Current: 591 ppm
Daily lowest: ppm
Daily highest: ppm
448 ppm
01:17
02-24
600
400
-22
02-23
02-24
02-25

19:19
71%
KANTOOR
Temperature
Current: 21,0 °C
Daily lowest: 414 °C 16:51
Daily highest: 639 °C 00:04
24°C
16:56
02-23
20
2-22
02-23
02-24
02

19:19
71%
KANTOOR
Relative humidity
Current: 47 %
Daily lowest: 40 % 14:25
Daily highest: 47 % 04:37
40%
16:57
02-23
40
2-22
02-23
02-24
02


08:30
09/22
2359 ppm
2000
1000
08:20
09/22
08:25
09/22
08:30
09/22

DeMorgen.

Nieuws

Ventilatie wordt belangrijker wapen in strijd tegen corona

De overheid neemt in de strijd tegen het coronavirus extra maatregelen om de ventilatie in binnenruimten te verbeteren. Sinds de heropening op 9 juni zijn cafés, restaurants en fitnesscentra verplicht een voor hun klanten zichtbare CO2-meter in huis te hebben. Horecazaken waar te weinig ventilatie is, moeten investeren in extra verluchting. Dat schrijft De Tijd.

Belga 22 juli 2021, 05:31

https://www.demorgen.be/nieuws/ventilatie-wordt-belangrijker-wapen-in-strijd-tegen-corona~b6cf15d6/

ACTIEPLAN VENTILATIE VOOR DE HORECA

II. CO_2-meters

- ☑ Ik heb ten minste één CO_2-meter in mijn zaak. Een CO_2-meter moet in elke afzonderlijke ruimte die publiek toegankelijk is voor consumptie worden geplaatst.
- ☑ De meter is op een geschikte plaats geïnstalleerd, en niet in de directe nabijheid van een deur of raam.
- ☑ De klanten kunnen de meter en het gemeten CO_2-gehalte zien.
- ☑ De meter staat aan.
- ☑ De werking van de meter wordt elke dag voor de opening van de zaak gecontroleerd.
- ☑ Tijdens de openingsuren van de zaak controleer ik regelmatig het CO_2-gehalte.
- ☑ Ik verbind mij ertoe alle nodige maatregelen te treffen om de drempel van 900 ppm CO_2 in mijn zaak niet te overschrijden. Indien die drempel wordt overschreden, verbind ik mij ertoe het hieronder uiteengezette actieplan uit te voeren.
- ☑ Als de drempel van 1.200 ppm CO_2 wordt overschreden, sluit ik mijn zaak of een deel daarvan.

https://economie.fgov.be/sites/default/files/Files/Entreprises/coronavirus-actieplan-ventilatie-horeca.pdf

Gezond klimaat in de klas met een CO2 meter

Een CO2 meter in iedere klas

volledig betaald door de overheid

PEDAK meettechniek

https://www.pedak.nl/gezond-klimaat-in-de-klas-met-een-co2-meter/

Weyts stuurt richtlijnen rond ventilatie op school bij

© Belga 27/08/2020 12.14u

Vlaams minister van Onderwijs Ben Weyts (N-VA) stuurt de richtlijnen over ventilatie en verluchting in klaslokalen bij. Zo is de aankoop van een CO2-meter aanbevolen en moet minstens de klasdeur op elk moment op een kier blijven staan. "Als de inzichten evolueren, dan moeten wij mee evolueren. Dan nemen we onze verantwoordelijkheid en actualiseren we de draaiboeken", zegt Weyts.

https://www.bruzz.be/politiek/weyts-stuurt-richtlijnen-rond-ventilatie-op-school-bij-2020-08-27

Marc Van Ranst @vanranstmarc · 23 aug. 2021

Stel dat je een CO2-**meter** afschrijft op 5 jaar, dan kost die ongeveer 45 euro per jaar. Stel dat er 25 kinderen in een klas zitten, dan kost een CO2-**meter** 1,80 euro per kind per jaar.
Beste overheid, ik begrijp echt niet dat we dit ik onze scholen niet georganiseerd krijgen!

116 269 1,4K

Marc Van Ranst @vanranstmarc · 25 aug. 2021

Met wat N-VA, VB en PVDA hebben uitgegeven aan advertenties op Facebook en Instagram tijdens de eerste 6 maanden van 2021 (2 miljoen euro) kan je elk van de 2.500 basisscholen in Vlaanderen voorzien van ZES CO2 meters.
Ik denk daar wat van.
(bron: @destandaard)

Facebook en Instagram

Januari tot en met juli 2021

	Partijen	in euro
1	N-VA	1.021.783
2	VB	521.294
3	PVDA/PTB	498.533
4	Groen	180.385
5	Vooruit	169.205
6	Open VLD	147.103
7	CD&V	107.198
8	MR	77.552
9	CDH	39.714
10	Ecolo	14.822
11	PS	11.415

118 193 1,4K

Weyts: 'Geen verplichte CO2-meter, onze 'boots on the ground' controleren waar nodig'

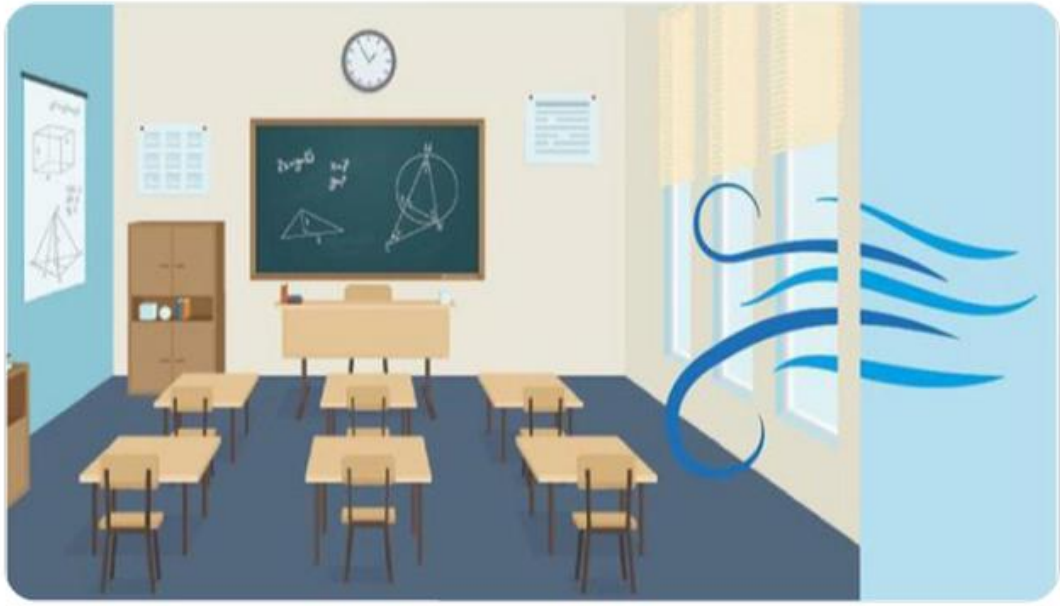
© Belga 30/08/2021 09.57u

© Photonews | 20200826 1719 ZOOM Ben Weyts

https://www.bruzz.be/onderwijs/weyts-geen-verplichte-co2-meter-onze-boots-ground-controleren-waar-nodig-2021-08-30

Marc Van Ranst @vanranstmarc · 14 sep. 2021

Er zijn meer en meer coronagevallen in de scholen. Ik wil nog maar eens pleiten om CO2-meters in alle klassen te installeren zodat men beter beseft wanneer men extra moet ventileren. Het is heel erg spijtig dat men dit nog niet beslist heeft.
(1/2)



34 185 768

Marc Van Ranst @vanranstmarc · 14 sep. 2021

We willen graag onze scholen zoveel mogelijk open houden. We willen zo weinig mogelijk zieke kinderen en zo weinig mogelijk kinderen in quarantaine.
Gevaccineerde volwassenen en goed geventileerde klassen zijn onze belangrijkste verdediging.
(2/2)

6 51 330

Nieuwsblad lezen kost minder dan je denkt.
Lees nu voor de helft van de prijs

Minister Weyts gaat overstag: dan toch verplicht CO2-meter in elke klas

Hannes Cattebeke

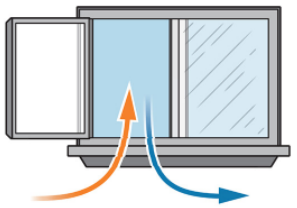
18 november 2021 om 09:55

Science

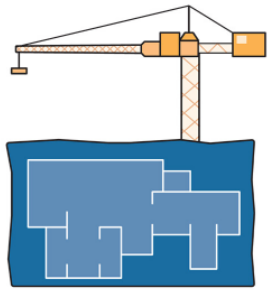
Lessons from the COVID-19 pandemic for ventilation and indoor air quality

LIDIA MORAWSKA, YUGUO LI, AND TUNGA SALTHAMMER

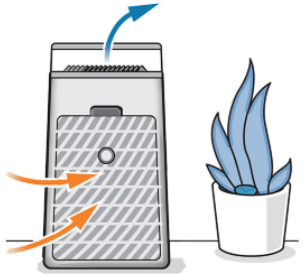
Lesson 1
Interdisciplinary expert knowledge should be the guiding factor in infection risk control and indoor air quality management in general.



Lesson 2
Ventilation must go far beyond advice to "open the window."

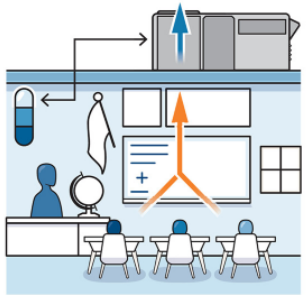


Lesson 3
Better building designs that optimize ventilation performance, with indoor air quality as the focus, should be the guiding principle behind the construction of buildings in the future.



Lesson 4
Equivalent ventilation–for example, filter-based or GUV devices–is useful as a supplement in spaces without adequate ventilation.

Lesson 5
Ventilation control guided by risk assessment tools is unlikely to be a common (everyday) practice in the future. However, these tools have a role in building design.



Lesson 6
Ventilation performance should be monitored at all times when buildings are occupied.

Lesson 7
Indoor air quality must be regulated to protect human health in public spaces.

SCIENCE, 25 Jul 2024, Vol 385, Issue 6707, pp. 396-401

Science

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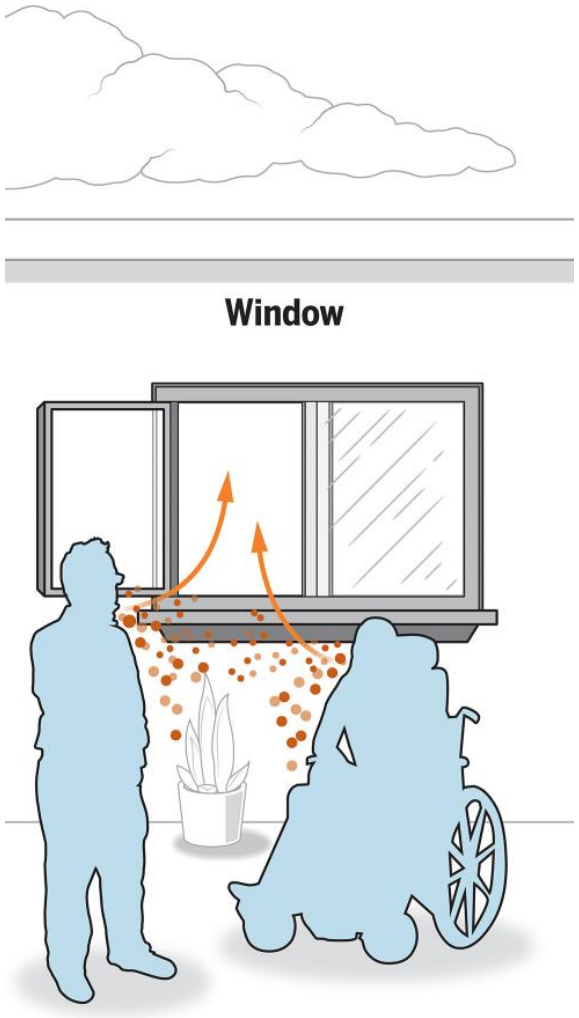

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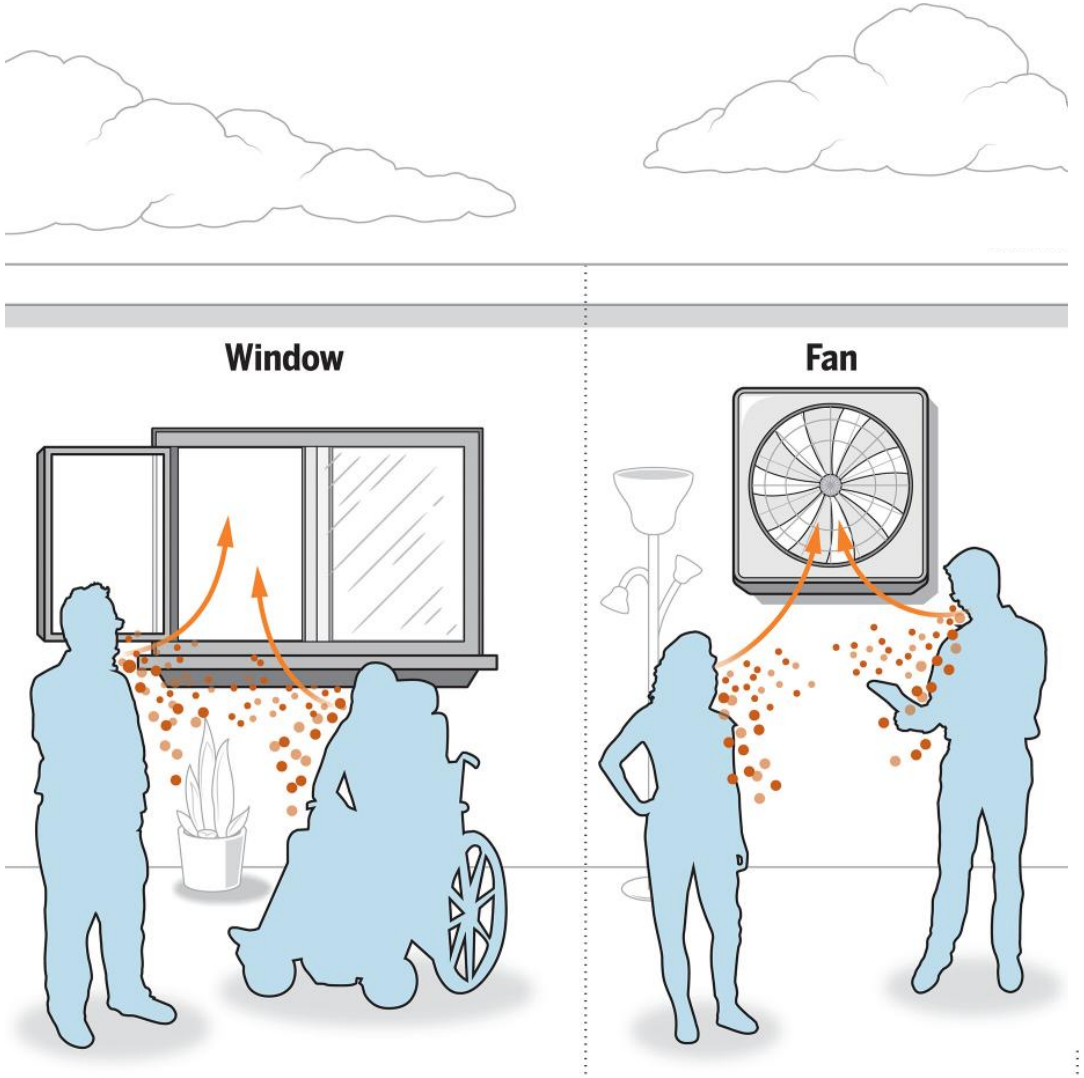

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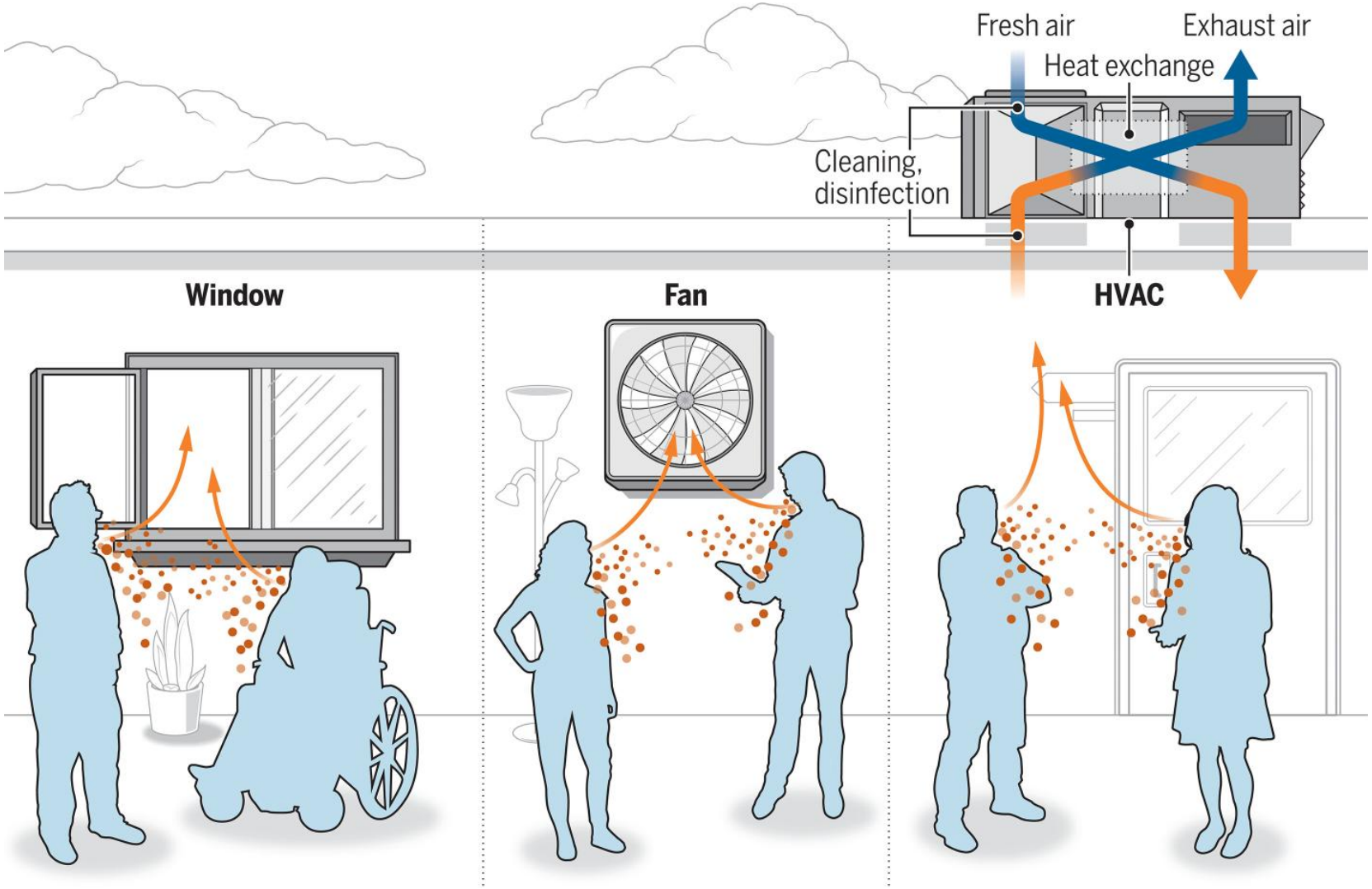

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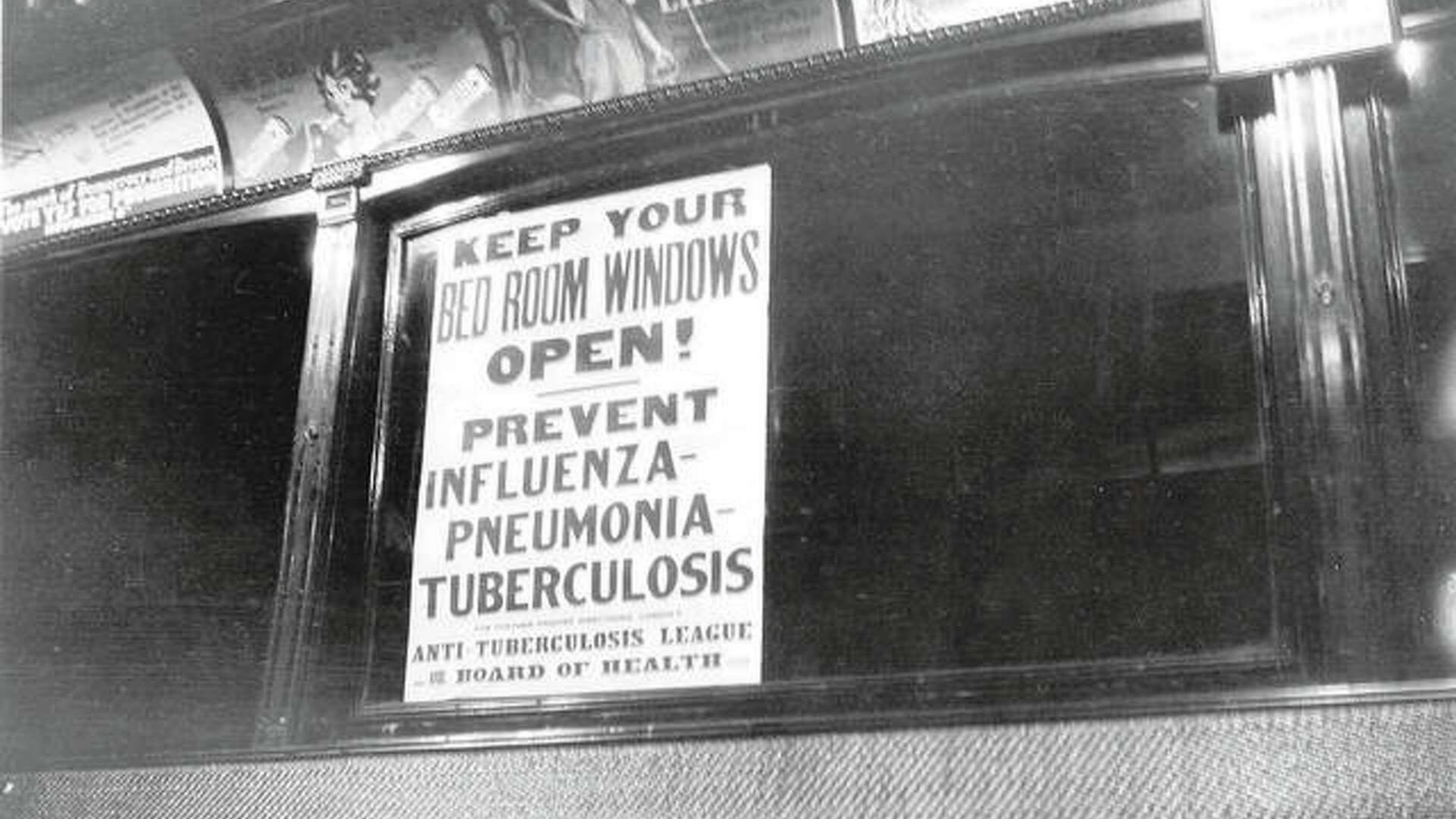

KEEP YOUR
BED ROOM WINDOWS
OPEN!
PREVENT
INFLUENZA-
PNEUMONIA-
TUBERCULOSIS
ANTI TUBERCULOSIS LEAGUE
BOARD OF HEALTH

Published 3 times a week. Subscription 40c per week.
Illustrated Current News, Inc., 902 Chapel Street,
New Haven, Conn.

Entered as second class matter October 20, 1913, at the Post Office at New Haven, Connecticut, under Act. of March 3, 1879.

Vol. 1 No. 788
October 18, 1918

To Prevent Influenza!

Do not take any person's breath.

Keep the mouth and teeth clean.

Avoid those that cough and sneeze.

Don't visit poorly ventilated places.

Keep warm, get fresh air and sunshine.

Don't use common drinking cups, towels, etc.

Cover your mouth when you cough and sneeze.

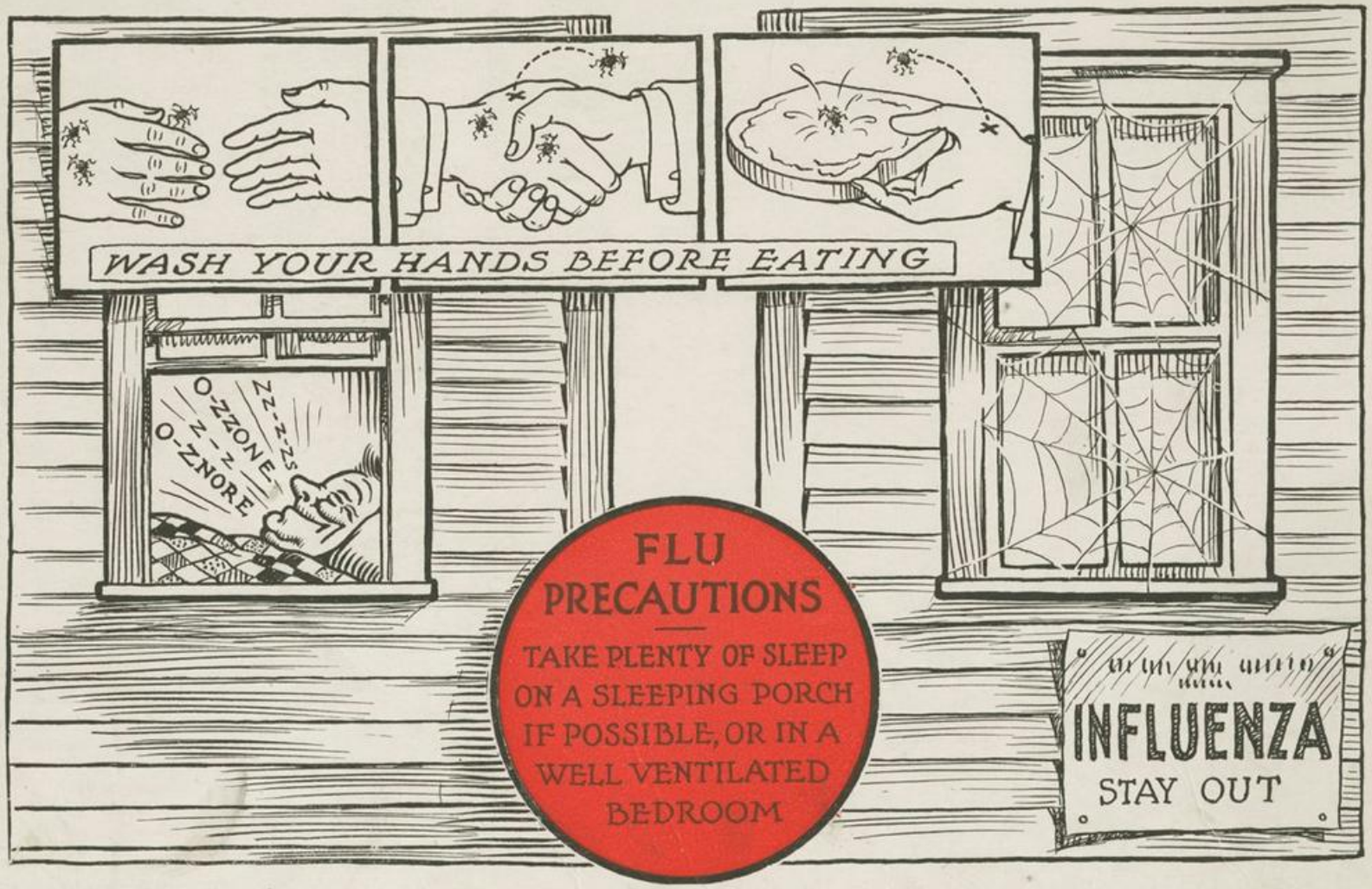
Avoid Worry, Fear and Fatigue.

Stay at home if you have a cold.

Walk to your work or office.

In sick rooms wear a gauze mask like in illustration.

Get the Anti "Flu" Habit

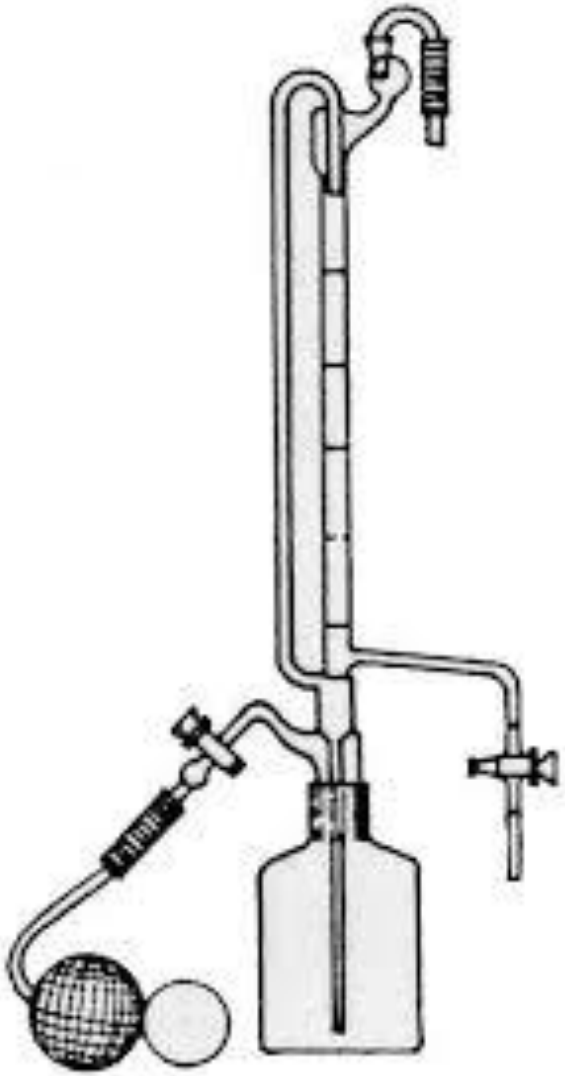


Topeka Health Service

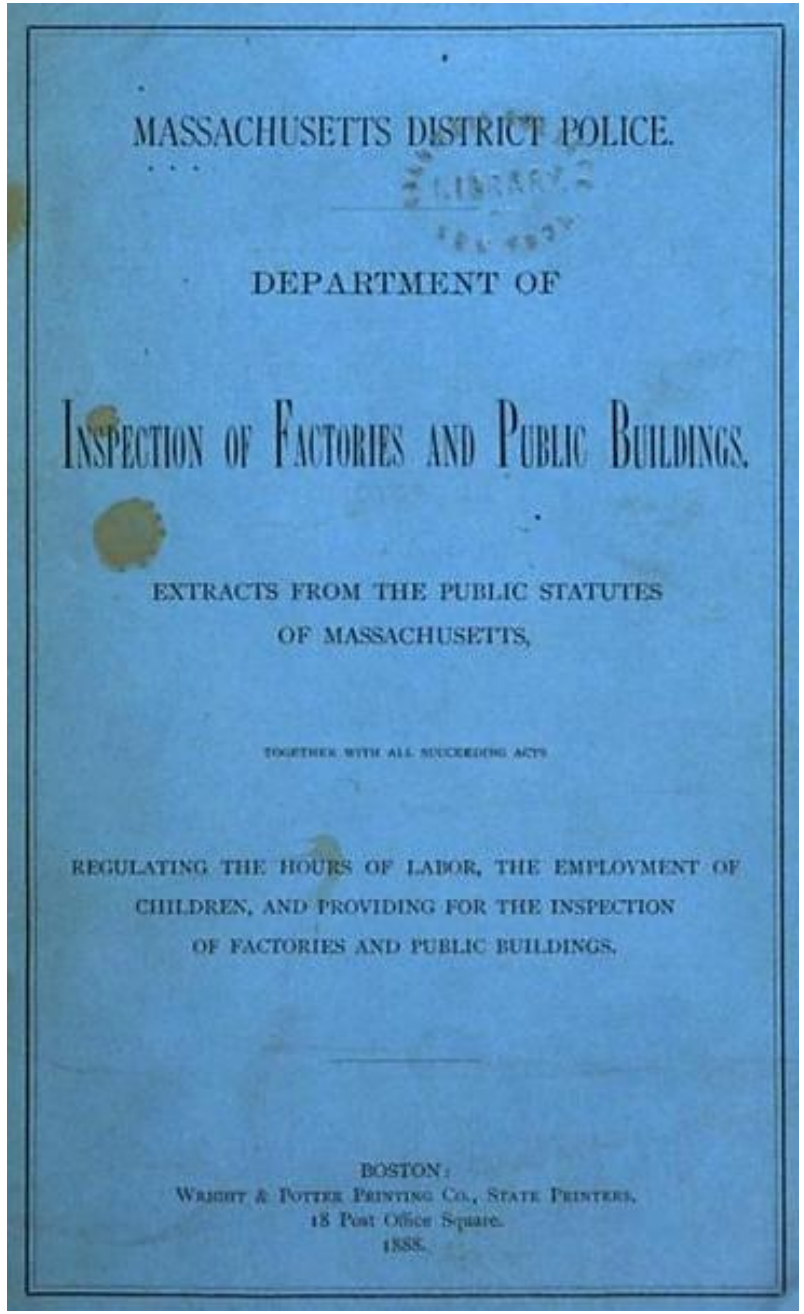
1918, Topeka, Kansas

1858

Max von Pettenkofer
1818-1901



1000 ppm = “Pettenkofer number”



MASSACHUSETTS DISTRICT POLICE.

DEPARTMENT OF

INSPECTION OF FACTORIES AND PUBLIC BUILDINGS.

EXTRACTS FROM THE PUBLIC STATUTES
OF MASSACHUSETTS,

TOGETHER WITH ALL SUCCEEDING ACTS

REGULATING THE HOURS OF LABOR, THE EMPLOYMENT OF
CHILDREN, AND PROVIDING FOR THE INSPECTION
OF FACTORIES AND PUBLIC BUILDINGS.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 Post Office Square.
1888.

[ACTS OF 1888.]

CHAPTER 149.

An Act to cause Proper Sanitary Provisions and Proper Ventilation in Public Buildings and Schoolhouses.

SECTION 1. Every public building and every schoolhouse shall be kept in a cleanly state and free from effluvia arising from any drain, privy, or other nuisance, and shall be provided with a sufficient number of proper water-closets, earth-closets or privies for the reasonable use of the persons admitted to such public building or of the pupils attending such schoolhouse.

SECT. 2. Every public building and every schoolhouse shall be ventilated in such a proper manner that the air shall not become so exhausted as to be injurious to the health of the persons present therein. The provisions of this section and the preceding section shall be enforced by the inspection department of the district police force.

1899

A SIMPLE AND ACCURATE METHOD OF CARBON DIOXIDE DETERMINATION, WITH DEMONSTRATION.

BY G. W. FITZ, M.D., OF HARVARD UNIVERSITY.

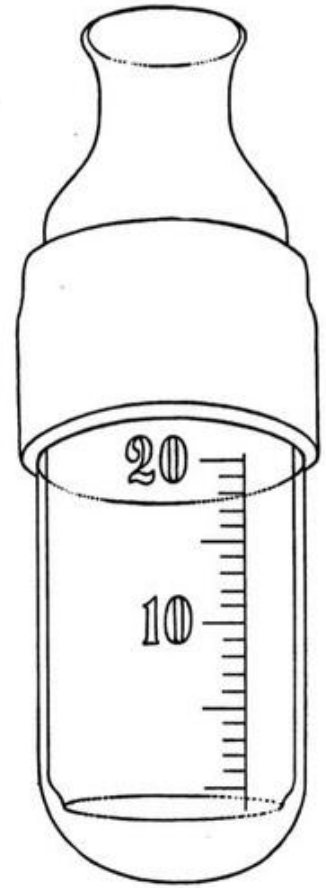
Quantitative methods for the determination of carbon dioxide have long been sought,—formerly, because it was supposed to be the dangerous part of respired air; at the present time, because the amount produced by the processes of vital oxidation is thought to be directly proportional to the quantity of the volatile poisonous elements. The methods in use for its determination have been many. Pettenkofer's method, with recent modifications, is accepted as the most exact, except perhaps certain absorption methods that can only be carried out in a laboratory. The "ready" methods for its determination, however, have been fairly numerous.

Wolpert's method, used by the State police for the examination of school-houses, is one of the earliest. It depends, in principle, on the fact that lime-water becomes milky and opaque through the formation of calcium carbonate by union with the CO_2 of the air tested. A standard opacity is determined by noting when a black spot can no longer be seen through a certain depth of the milky solution. The method is quite inaccurate, varying with the rapidity with which the air is forced through the solution.

The younger Wolpert has devised a method, which is much more accurate, depending upon the neutralization of a standard alkaline solution (sodic carbonate), using phenolphthalein as the indicator. Wolpert has used this for testing the purity of air in contact with the body under the clothing, and for air in adjacent rooms as well as for the ordinary determinations. The method is accurate and convenient. The solution, however, must be made with care, since a varying amount of water of crystallization in the sodium carbonate makes serious variation in the strength of the solution. For ordinary school examinations the method is beyond the technical skill of the teachers, and hence unreliable.

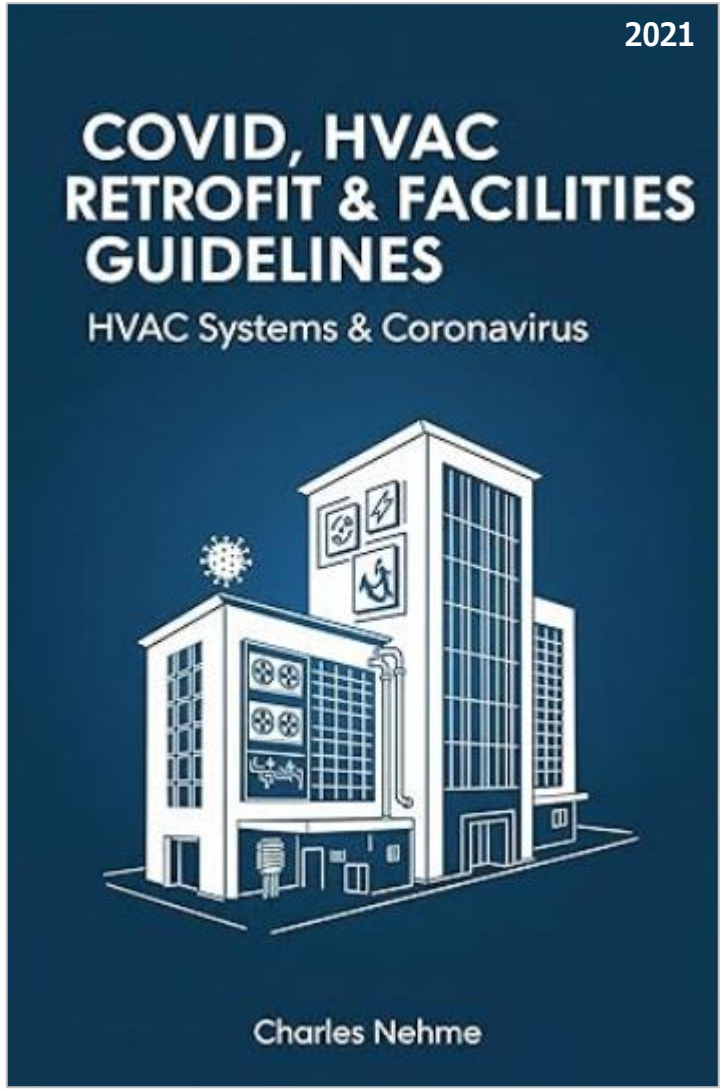
In order to get a simpler method, I made some experiments with

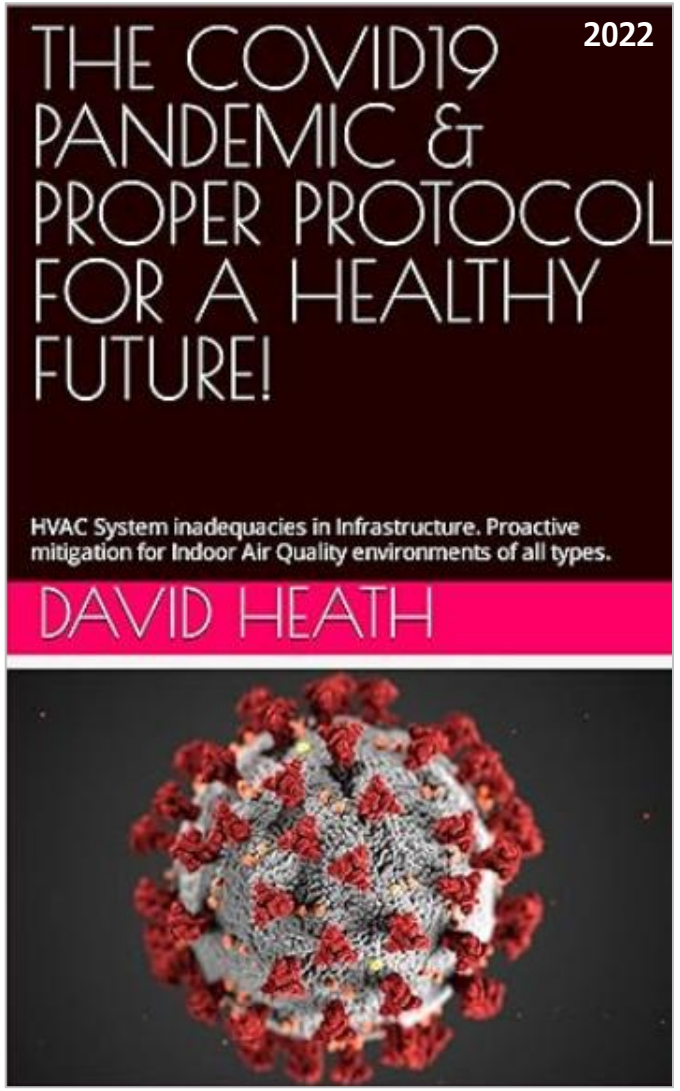
lime-water, to determine how far a saturated solution would serve as a standard solution. I tested a number of saturated solutions from lime bought in different parts of the country, and found that the alkalinity of 100 c.c. was practically uniform in all. It was thus found possible to make a standard solution by merely measuring out a stated amount of a solution of lime-water saturated in the presence of an excess of the hydrate and at ordinary room-temperature.

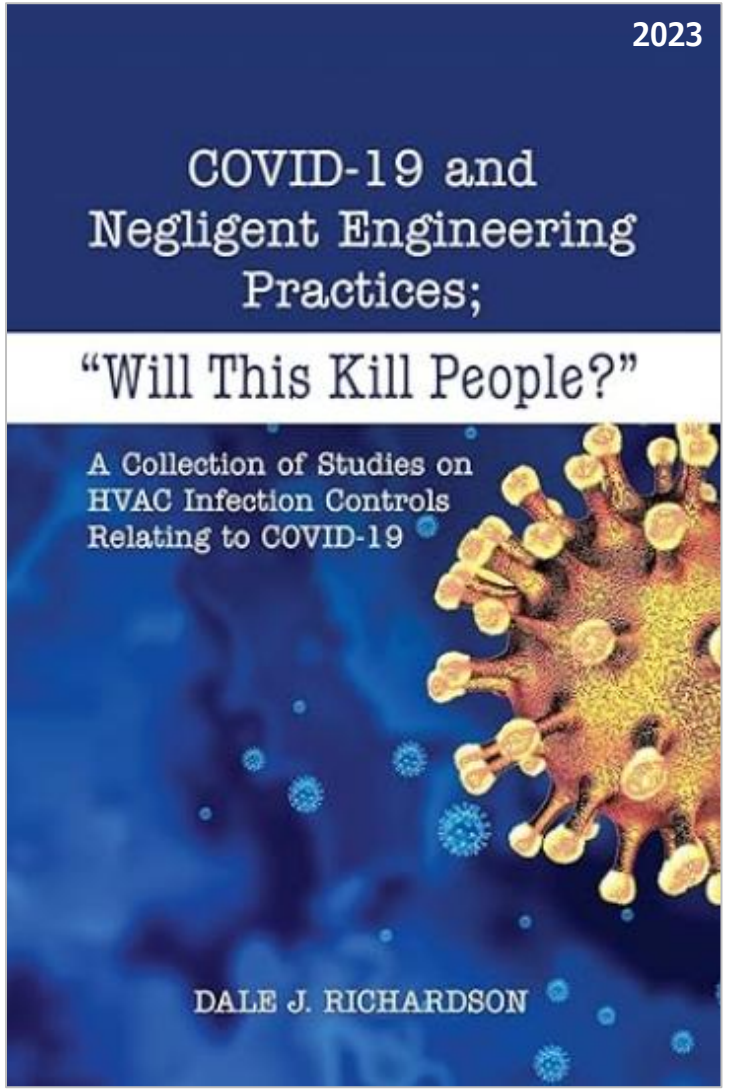


After various experiments, I found that an apparatus such as I now present answered both for measuring the volume of the air used and for shaking the air and lime-water together. It is simply a cylinder or cup of glass, with rounded bottom, and a smaller open cylinder, with a neck resembling that of a bottle at one end. The smaller cylinder is made to slip into the larger through a collar of rubber tubing, so that it forms an air-tight piston. When the inner cylinder is drawn out, air enters through its mouth. The amount of air drawn in can be measured by means of the graduations on the side of the larger tube, the bottom of the inner tube serving as an index.

A 1 per cent. solution of a saturated solution of lime-water was found most serviceable for the tests, and may be made as follows: about 95 c.c.'s of water, to which several drops of the phenolphthalein solution have been added as an indicator, are neutralized by the addition, drop by drop, of lime-water with shaking. As long as the pink color caused by the lime-water







https://www.amazon.com/COVID-19-Negligent-Engineering-Practices-People/
https://www.amazon.co.jp/COVID19-PANDEMIC-PROPER-PROTOCOL-HEALTHY-ebook/dp/B0BDJT2ZGC
https://www.amazon.com/COVID-HVAC-RETROFIT-FACILITIES-GUIDELINES/dp

Heating, ventilation and air-conditioning systems in the context of COVID-19: first update

10 November 2020

Key messages

- It is now well-established that COVID-19 transmission commonly occurs in closed spaces;
- If well-maintained and adapted for use in the COVID-19 pandemic, heating, ventilation and air-conditioning (HVAC) systems may have a complementary role in decreasing potential airborne transmission of SARS-CoV-2;
- Four bundles of non-pharmaceutical interventions (NPIs) should be considered to reduce potential airborne transmission of SARS-CoV-2 in closed spaces: the control of COVID-19 sources in closed spaces; engineering controls in mechanically ventilated (by HVAC systems) and naturally ventilated closed spaces; administrative controls; and personal protective behaviour.

Scope of this document

This document provides guidance on heating, ventilation and air-conditioning (HVAC) systems in closed spaces in the context of the COVID-19 pandemic.

Changes to the current update

The first update of the ECDC ventilation guidance document contains:

- key new findings that emphasise four bundles of NPIs to reduce the risk of SARS-CoV-2 transmission in closed spaces;
- updated references on the evidence of transmission in closed spaces;
- recommendations based on the new evidence and on national and international guidance; and
- an overview of national guidance ventilation documents in the context of COVID-19 based on an inquiry sent to ECDC's National Focal Points (NFPs) for Preparedness and Response and NFPs for Influenza and other respiratory diseases.

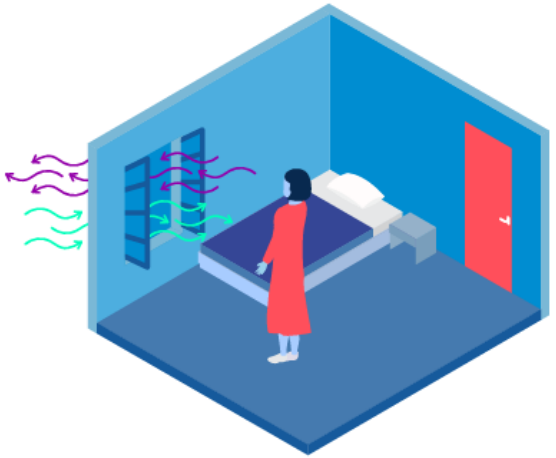
Target audience

Public health authorities in the European Union and European Economic Area (EU/EEA) and the United Kingdom (UK).

2021

World Health Organization

Roadmap to improve and ensure good indoor ventilation in the context of COVID-19



https://www.ecdc.europa.eu/en/publications-data/heating-ventilation-air-conditioning-systems-covid-19
https://www.who.int/publications/i/item/9789240021280

https://www.hgr-css.be/nl/advies/9599/ventilatie-en-overdracht-van-sars-cov-2-2020
https://www.hgr-css.be/nl/advies/9616/ventilatie-en-overdracht-van-sars-cov-2-2021

Ministerie van Volksgezondheid,
Welzijn en Sport

https://www.rijksoverheid.nl/documenten/publicaties/2021/05/01/feitenreconstructie-onderzoek-aanpak-coronacrisis-vws

Onderzoeksprogramma Pandemische Paraatheid en Ventilatie

- Rapportage Programmalijn I, juni 2024 - Samenvatting resultaten: Blootstelling tijdens operationele omstandigheden in de langdurige zorg, een inventarisatie in de praktijk
- Rapportage Programmalijn I, juni 2024 - Inventarisatie van de operationele omstandigheden locatie 1
- Rapportage Programmalijn I, juni 2024 - Inventarisatie van de operationele omstandigheden locatie 2
- Rapportage Programmalijn I, juni 2024 - Inventarisatie van de operationele omstandigheden locatie 3
- Rapportage Programmalijn I, juni 2024 - Inventarisatie van de operationele omstandigheden locatie 4
- Rapportage Programmalijn I, juni 2024 - Inventarisatie van de operationele omstandigheden locatie 5
- Rapportage Programmalijn I, juni 2024 - Inventarisatie van de operationele omstandigheden locatie 6
- Rapportage Programmalijn I, januari 2025 - Kwaliteitsindicatoren en theoretisch kader WIR-model
- Rapportage Programmalijn I, juli 2025 - Waarde, Interactie en Risico (WIR) model
- Rapportage Programmalijn II, januari 2023 - Analysis Computational Fluid Dynamics
- Rapportage Programmalijn II, September 2025 - CFD snelle methodes
- Rapportage Programmalijn II, September 2025 - CFD conventioneel
- Rapportage Programmalijn III - juli 2023 - Literatuuronderzoek
- Rapportage Programmalijn III, Resultaten experimenten in-situ, februari 2024
- Rapportage Programmalijn III, september 2025 - Handelingsperspectief gebruik
- Rapportage Programmalijn III, september 2025 - Rapportage Experimenteel onderzoek testfaciliteit
- Rapportage Programmalijn IV, maart 2024 - Afwegingskader resultaten 2023
- Rapportage Hogeschool Saxion programmalijn IV-1, mei 2024 – Technische en gebruiksinventarisatie ventilatiesystemen in gebouwen voor langdurige zorg
- Rapportage Hogeschool Saxion programmalijn IV-1, juli 2025 - Technische en gebruiksinventarisatie ventilatiesystemen in bestaande maatschappelijk urgente sportgebouwen
- Paper Programmalijn IV-1, juni 2025 - Inventarisatie ventilatievoorzieningen in 60 zorggebouwen
- Rapportage Programmalijn IV, juni 2025 - Begrippenkader maatschappelijk urgente sportvoorzieningen
- Rapportage Programmalijn IV, juli 2025 - Afwegingskader 2024
- Rapportage Programmalijn IV/V, juli 2025 - Advieskaart Pandemische Paraatheid in maatschappelijk urgente sportvoorzieningen
- Rapportage Programmalijn IV/V, juli 2025 - Werkvorm Besluitvorming over beleidsinstrumenten
- Rapportage Programmalijn IV/V, juli 2025 - Werkvorm Waardenverkenning en waardenafweging
- Rapportage Programmalijn IV/V, juli 2025 - Rekenhulp afwegingskader
- Rapportage Programmalijn IV/V, juli 2025 - Begrippenkader langdurige zorg
- Rapportage Programmalijn IV/V, september 2025 - Besluitvormingsperspectief Pandemische Paraatheid
- Rapportage Programmalijn V, december 2023 - Kosten en baten
- Rapportage Programmalijn V, oktober 2024 - Krachtenveld van drie maatschappelijk urgente sportvoorzieningen
- Rapportage Programmalijn V, december 2024 - MKBA ventilatie in langdurige zorg
- Rapportage Programmalijn V, januari 2025 - Besluitvorming en bedrijfsvoering in drie maatschappelijk urgente sportvoorzieningen over investeringen in ventilatie
- Rapportage Programmalijn V, februari 2025 - Besluitvormingskader voor pandemische paraatheid
- Rapportage EIB Programmalijn V, juni 2025 - MKBA Kleine fitnessruimten in een pandemische situatie
- Rapportage Programmalijn V, juli 2025 - Kosten- en batenfactoren zwembaden en medische fitness
- Rapportage Programmalijn VI, mei 2024 - Eigenschappen van uitgeademde aerosol deeltjes met SARS
- Rapportage Programmalijn VI, september 2025 - Stabiliteit van respiratoire virussen in aerosolen
- Rapportage Programmalijn VI, september 2025 - Evaluatie van collectiesystemen van virussen in aerosolen
- Rapportage Programmalijn VI, september 2025 - Ontwikkeling van een elektrodynamische balans levitator voor het bestuderen van aerosolen
- Rapportage RIVM, juni 2025 - Literatuurstudie Transmissieroutes
- Rapportage TU Eindhoven, september 2025- Handelingsperspectief systeemconfiguratie

https://p3venti.nl/science/rapportages