

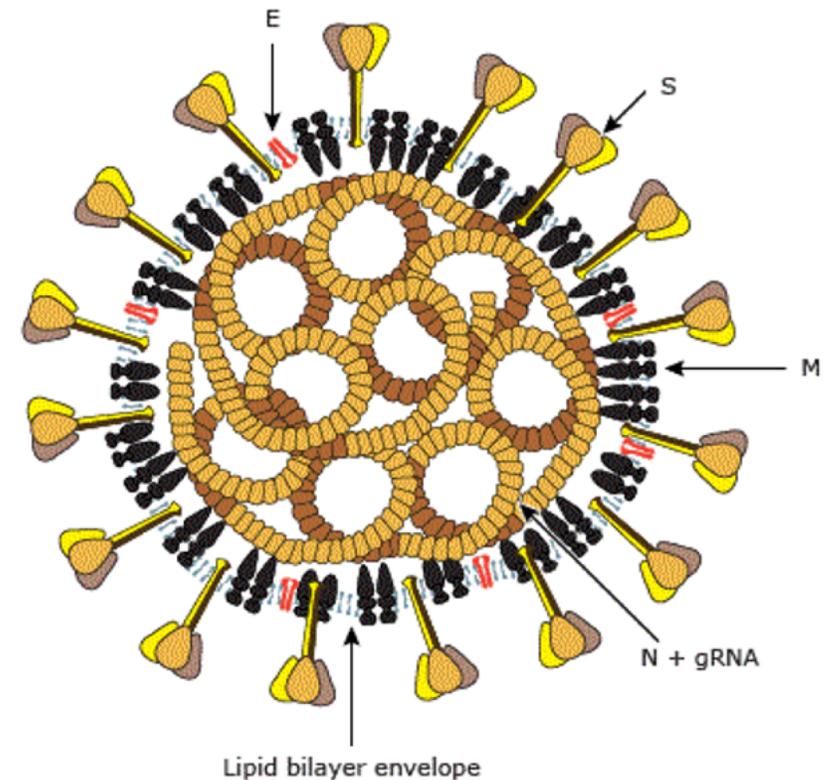
Update on the current state of COVID-19

Max O'Donnell MD, MPH

Florence Irving Associate Professor of Medicine
Division of Pulmonary, Allergy, and Critical Care Medicine, &
Department of Epidemiology
Columbia University Medical Center
NY, NY

Overview

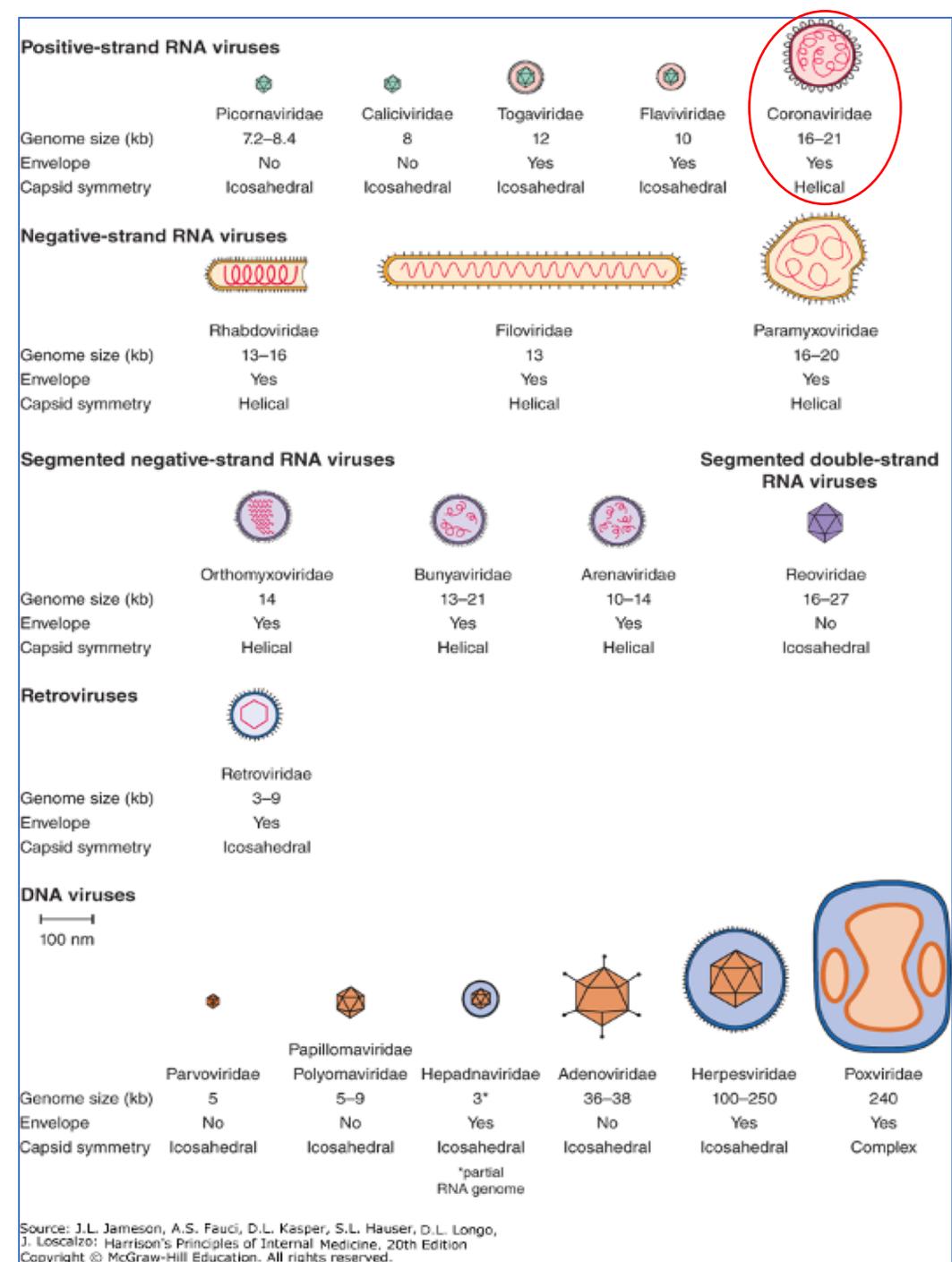
- Global & national epidemiology SARS-CoV-2
 - Review virology SARS CoV-2
 - Covid-19 Epidemiology
- Clinical epidemiology Covid-19
- ‘No new thing under the sun’?



S: spike protein; M: membrane protein; E: envelope protein; N: nucleocapsid protein.

Coronaviruses

- Family of enveloped positive-stranded RNA viruses
 - Most affect bats, but also widespread among birds and mammals
 - α and β effect mammals; γ , and δ mainly birds
- Possess four main structural proteins: S, M, N, & E
- Viruses transmitted via contact with secretions or droplets containing shedding virus
- Prior to 2019, there were six coronaviruses known to affect humans
 - HCoV-229E, HCoV-NL63, HCoV-HKU1, HCoV-OC43, **SARS-CoV**, and **MERS-CoV**

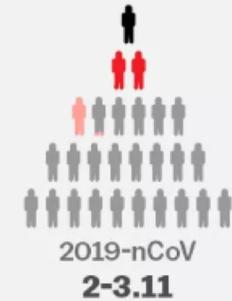


SARS-CoV-2

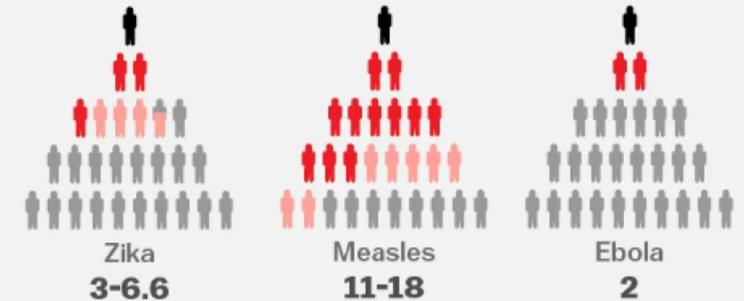
- Beta-coronavirus, incubation period 2-14 days
- Entry of SARS-CoV-2 is mediated by receptor binding domain (RBD) in the S protein and the angiotensin converting enzyme 2 (ACE2) receptor on host cell.
- Activation of S protein is related to TMPRSS2
- Contact, droplet, aerosol transmission confirmed relative contribution uncertain. MTCT, fecal-oral transmission possible.
- $R_0=2.68$ (range 2-4 depending on host susceptibility and epidemiologic scenarios e.g. nosocomial) for SARS-CoV-2

How contagious is a disease?

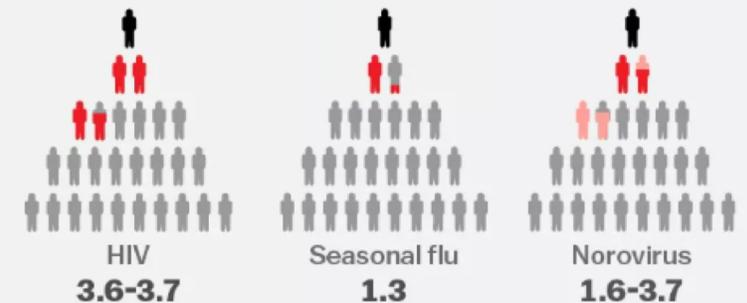
Scientists use "R naught," or R_0 , to estimate how many other people one sick person is likely to infect



*This estimate is preliminary and likely to change



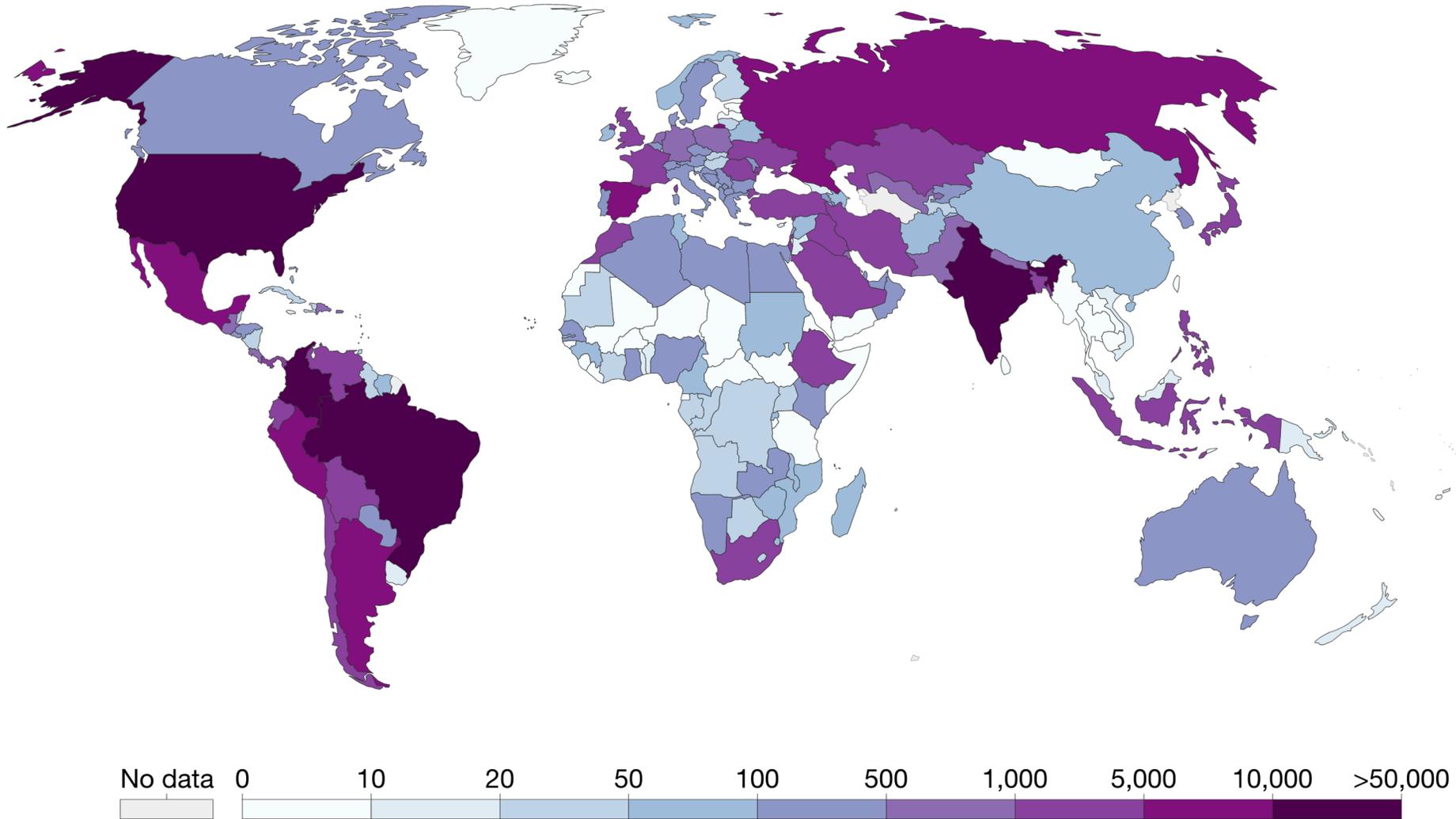
*An early estimate based on the Colombia outbreak in 2015



*An estimate based on Réunion Island in 2006

Daily new confirmed COVID-19 cases, Aug 18, 2020

Shown is the rolling 7-day average. The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

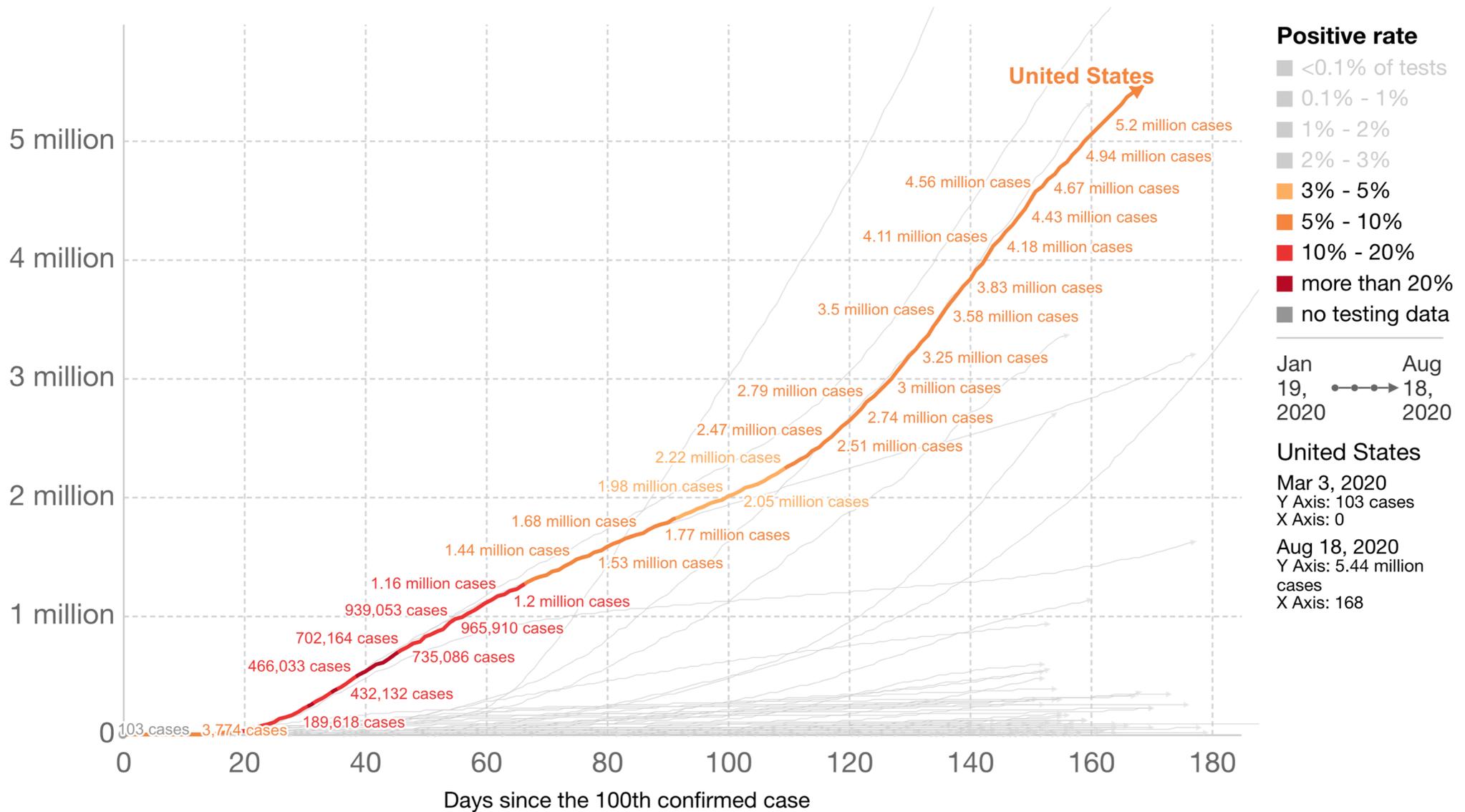


Source: European CDC – Situation Update Worldwide – Last updated 18 August, 15:40 (London time), Official data collated by Our World in Data

CC BY

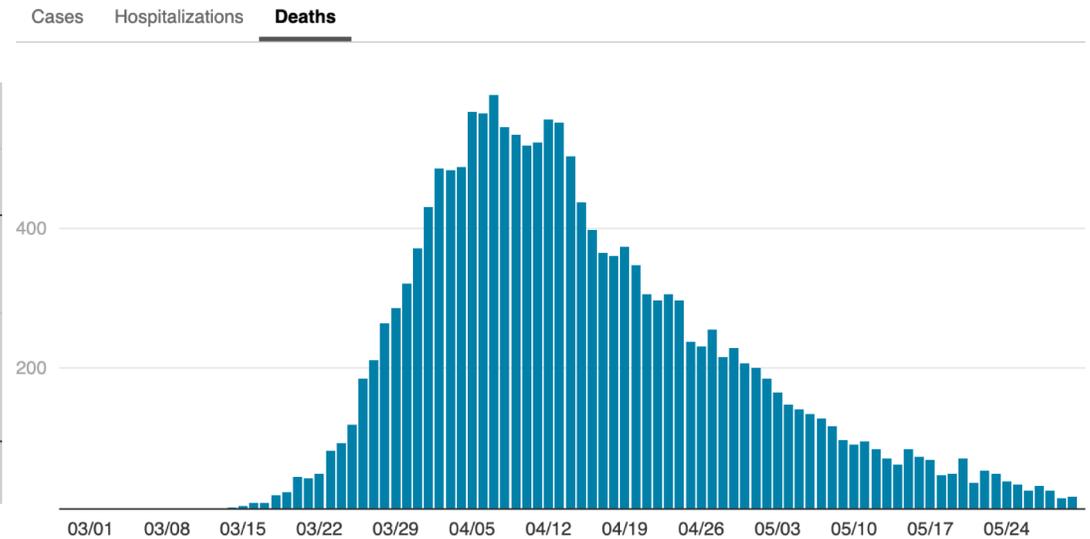
Cumulative confirmed COVID-19 cases

The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.



COVID-19, NYC

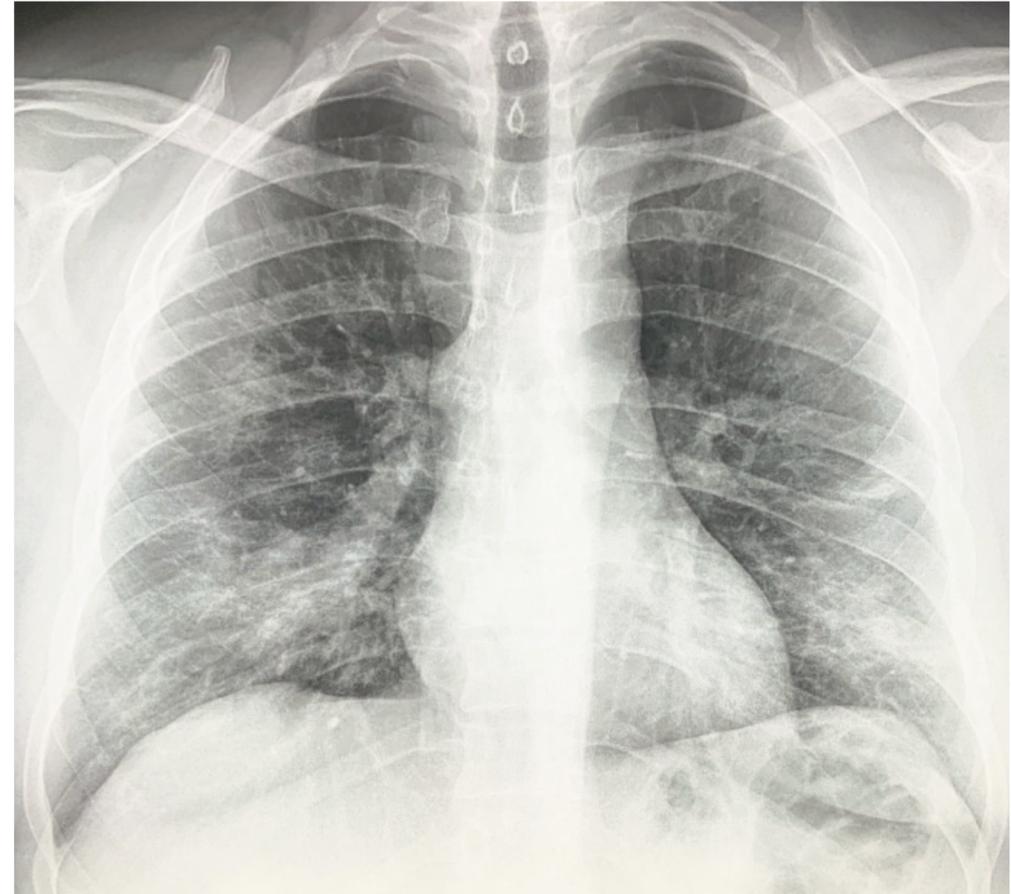
Cases	200,830
Hospitalizations	52,333
Confirmed deaths* Deaths following a positive COVID-19 laboratory test	16,882
Probable deaths Cause of death reported as "COVID-19" or equivalent, but no positive laboratory test	4,725
Updated:	June 1, at 1 p.m.



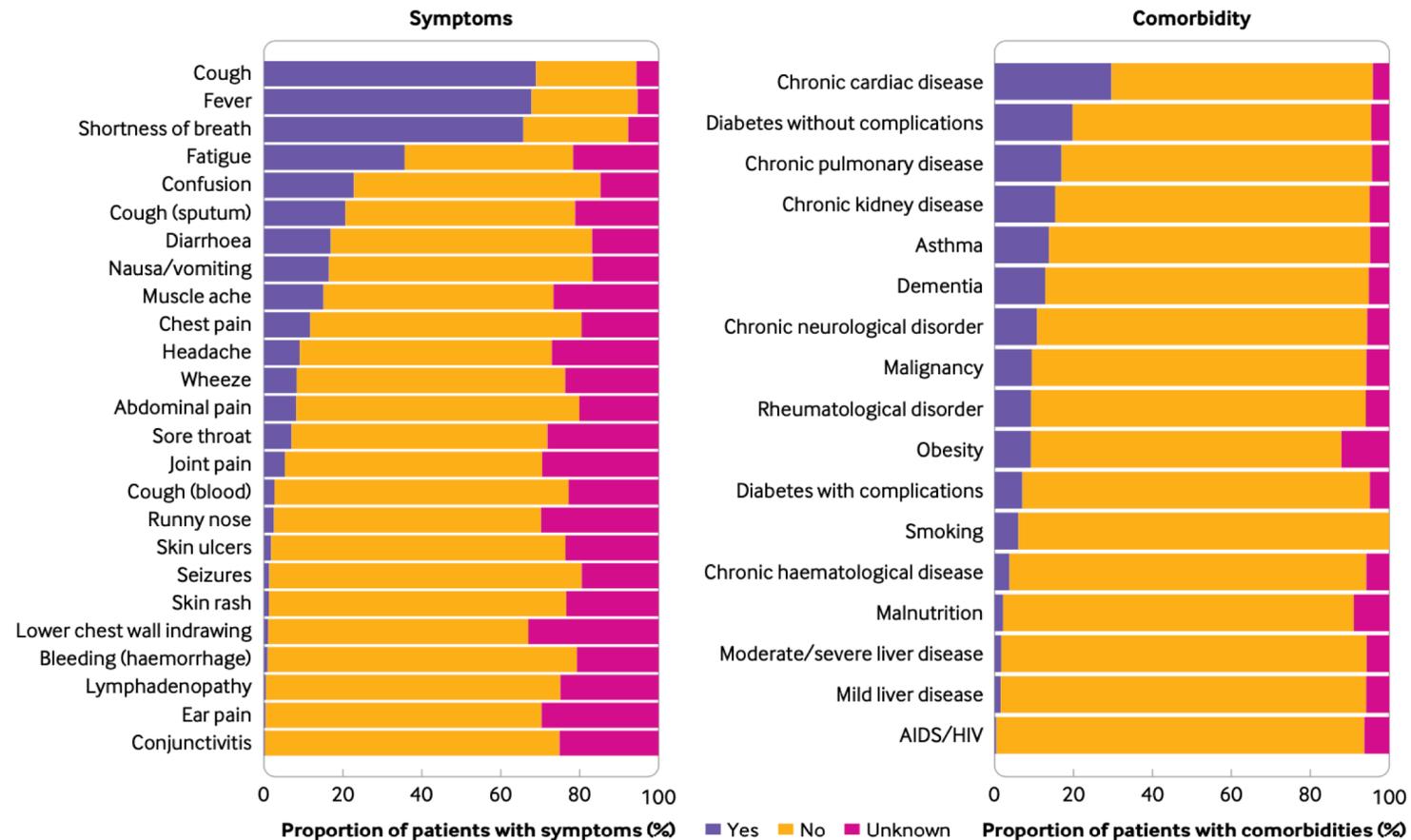
Source: NYC DOH, June 1, 2020

Overview

- Global & national epidemiology SARS-CoV-2
- **Clinical epidemiology Covid-19**
- ‘No new thing under the sun’?



Clinical characteristics of patients admitted to hospital with COVID-19 infection



Epidemiology, clinical course, and outcomes of critically ill adults with COVID-19 in New York City: a prospective cohort study

Matthew J Cummings, Matthew R Baldwin, Darryl Abrams, Samuel D Jacobson, Benjamin J Meyer, Elizabeth M Balough, Justin G Aaron, Jan Claassen, LeRoy E Rabbani, Jonathan Hastie, Beth R Hochman, John Salazar-Schicchi, Natalie H Yip, Daniel Brodie, Max R O'Donnell

- Adult patients (age ≥ 18 years) presenting to Milstein and Allen Hospitals between March 2nd and April 1st, 2020
 - Laboratory-confirmed COVID-19
 - Critically ill with acute hypoxemic respiratory failure
 - Mechanical ventilation (invasive or non-invasive)
 - High-level supplemental oxygen via high-flow nasal cannula or non-rebreathing face mask (15L/min)
- Patients identified prospectively through daily review of hospital admission logs in EMR

Patients and Demographics

- 1,150 patients hospitalized with laboratory-confirmed COVID-19 during the study period
 - 257 (22%) critically ill with acute hypoxemic respiratory failure
 - Inpatient observation for median of 19 days (IQR 9-30)

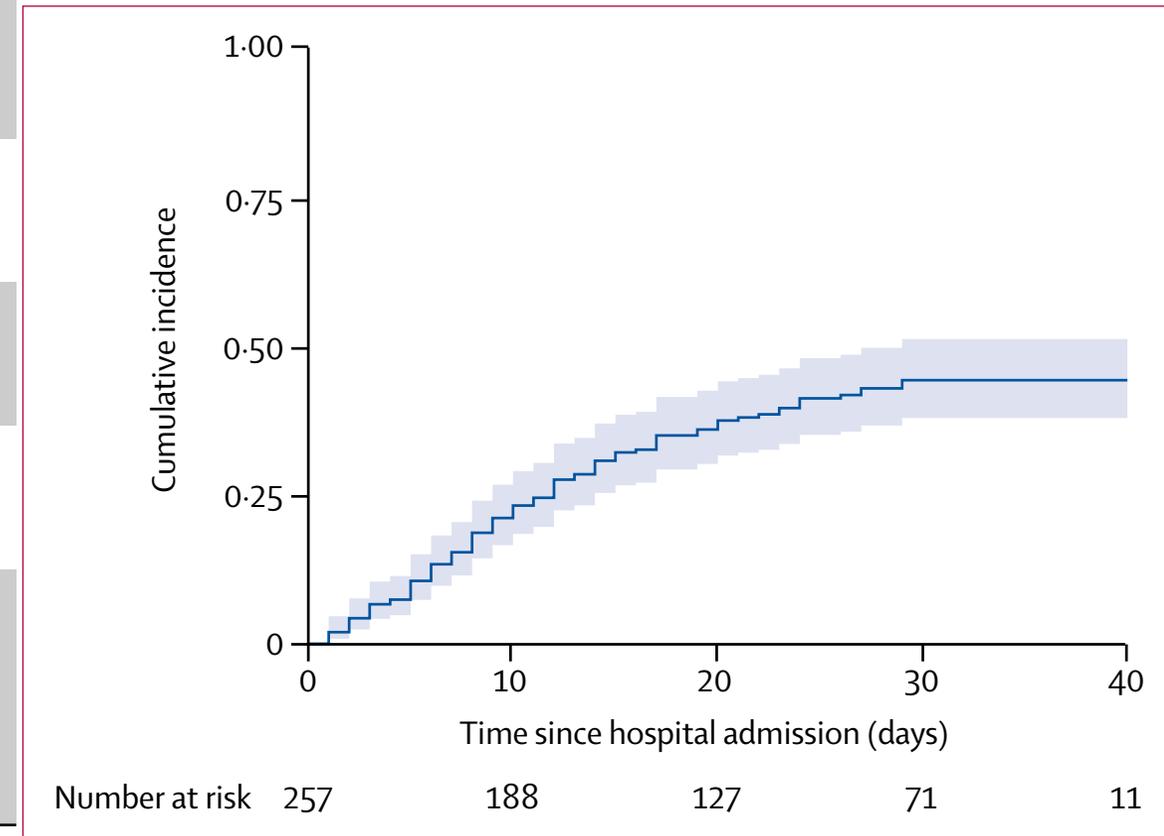
Patient characteristic	Study population, n=257
Male sex, n (%)	171/257 (66%)
Age, years, median (IQR)	62 (51-72)
Race or ethnic group, n (%)	
Hispanic or Latino	159/257 (62%)
Black or African American	49/257 (19%)
White	32/257 (12%)
Asian	8/257 (3%)
Other	9/257 (4%)
Employed as healthcare worker, n (%)	13/257 (5%)

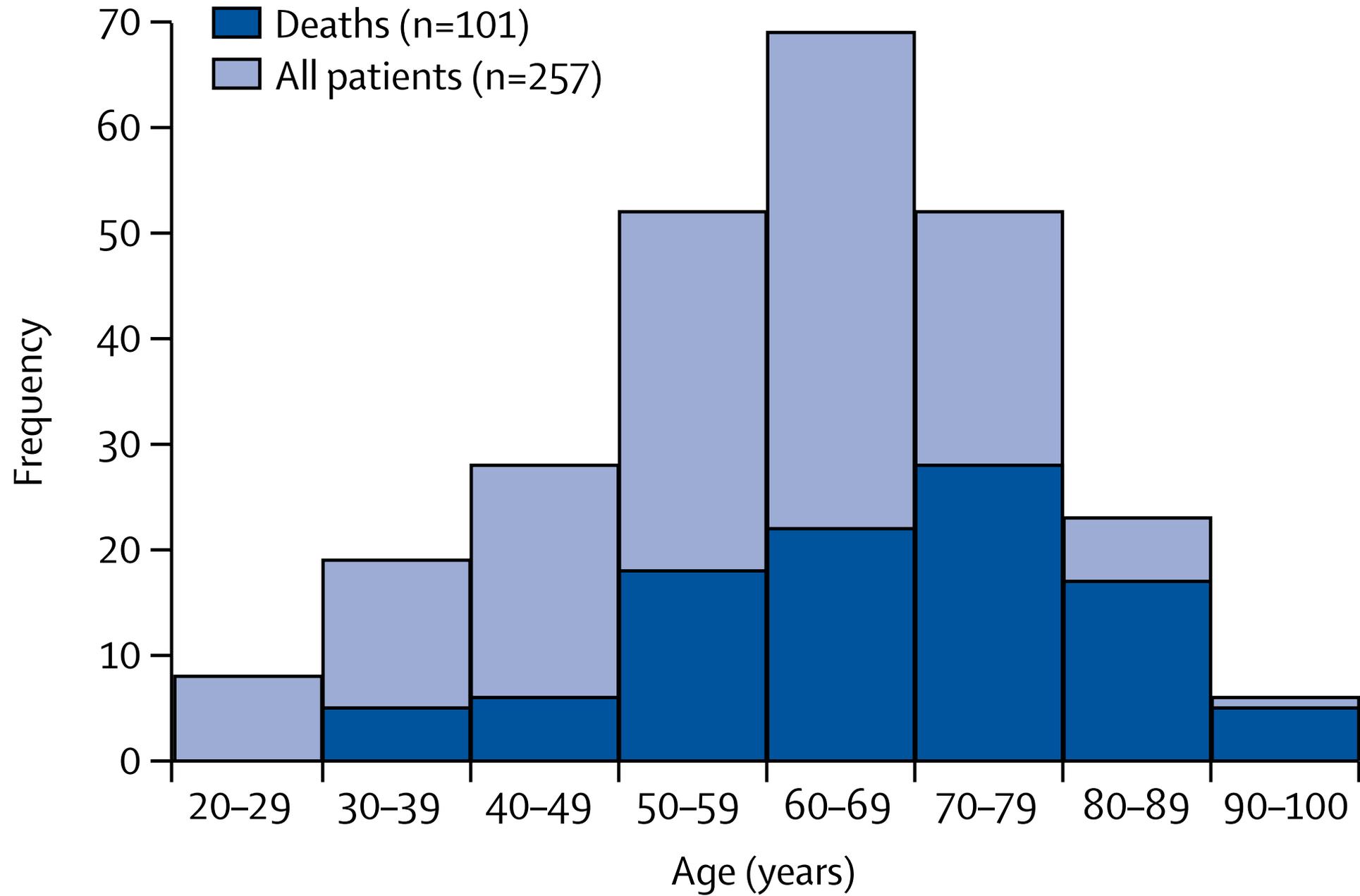
Co-morbidities

Patient Characteristic	Study Population (n=257)
Body mass index, kg/m², mean (\pmSD)	30.8 (\pm 7.7)
Body mass index \geq 30, n (%)	119/257 (46%)
Body mass index \geq 35, n (%)	68/257 (26%)
Body mass index \geq 40, n (%)	33/257 (13%)
Co-existing disorder, n (%)	
Hypertension	162/257 (63%)
Diabetes mellitus	92/257 (36%)
Chronic cardiac disease	49/257 (19%)
Chronic kidney disease	37/257 (14%)
Current or former smoker	33/257 (13%)
Chronic obstructive pulmonary or interstitial lung disease	24/257 (9%)
Chronic neurological disease or dementia	24/257 (9%)
Asthma	21/257 (8%)
Active solid or hematologic malignancy or dysplasia	18/257 (7%)
Solid organ transplant recipient	10/257 (4%)
Human immunodeficiency virus infection	8/257 (3%)
Liver cirrhosis	5/257 (2%)
Number of co-existing disorders, median (IQR)	2 (1-3)

28 Day Outcomes

Outcomes	Study population, n=257 n (%)
Died in-hospital	101/257 (39; 34-45)
Duration of hospitalization prior to death, days, median (IQR)	9 (5-15)
Hospitalized	94/257 (37; 31-43)
Transferred to another hospital	4/257 (2; 0-4)
Discharged alive	58/257 (23; 18-28)
Required supplemental oxygen at discharge	12/58 (21; 12-33)





Risk Factors for in-hospital mortality

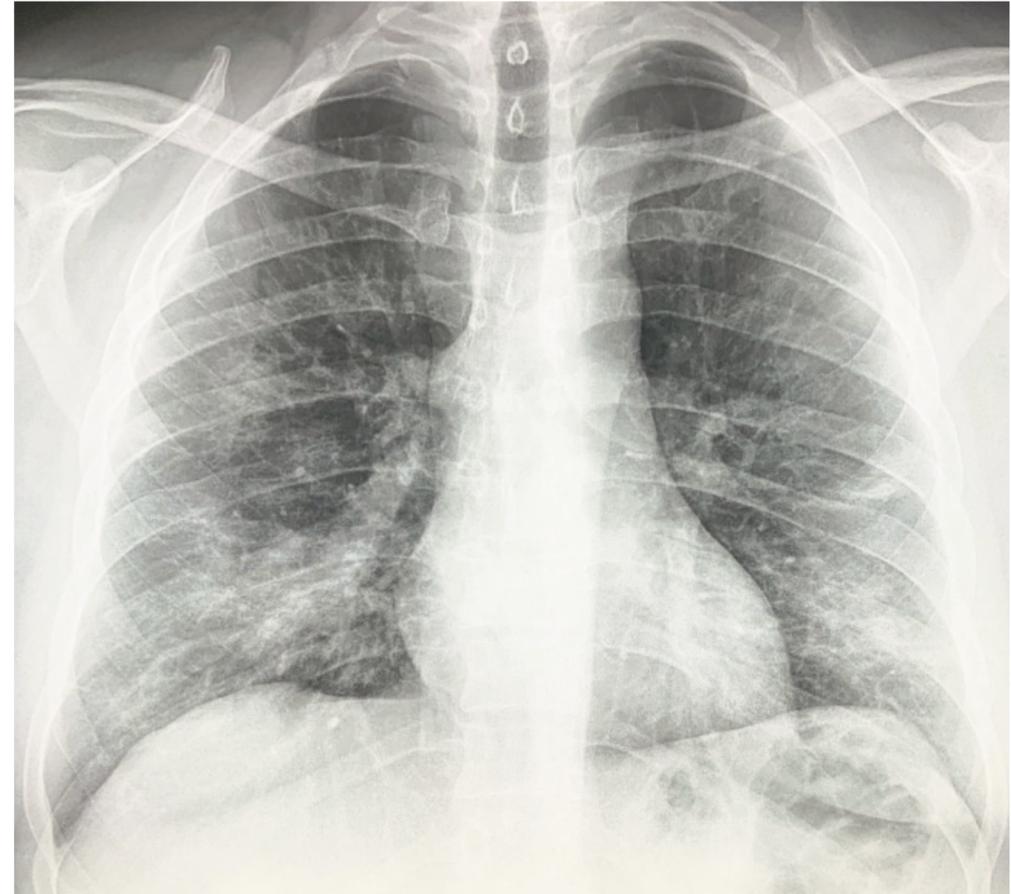
Variable	Univariable HR (95% CI)	Multivariable HR (95% CI)
Age, per ten-year increase	1.49 (1.29-1.73)	1.31 (1.09-1.57)
Male sex	0.85 (0.57-1.27)	1.13 (0.71-1.81)
Symptom duration prior to hospital presentation, per day	0.98 (0.93-1.02)	1.01 (0.96-1.05)
Hypertension	2.24 (1.40-3.59)	1.58 (0.89-2.81)
Chronic cardiac disease	2.21 (1.44-3.39)	1.76 (1.08-2.86)
Chronic obstructive pulmonary and/or interstitial lung disease	3.15 (1.84-5.39)	2.94 (1.48-5.84)
Chronic kidney disease	1.50 (0.92-2.45)	---
Diabetes mellitus	1.65 (1.11-2.44)	1.31 (0.81-2.10)
Body-mass-index ≥ 40	0.76 (0.40-1.47)	---
Interleukin-6, per-decile increase	1.12 (1.04-1.21)	1.11 (1.02-1.20)
D-dimer, per-decile increase	1.18 (1.10-1.27)	1.10 (1.01-1.19)

Long term follow up

- As of July 2nd, 2020, all patients >90-days of observation,
 - Final in-hospital outcome was known for 250 of 257 (97%) patients.
 - 113 (44%) patients had died (including 96 of 203 [47%] patients who received invasive mechanical ventilation)
 - 133 patients (52%) were discharged alive
 - 4 (1%) were transferred to another hospital
 - 7 (3%) remained hospitalized

Overview

- Global & national epidemiology SARS-CoV-2
- Clinical epidemiology Covid-19
- 'No new thing under the sun'?



What are the unique clinical aspects of Covid-19?

Clinical epidemiology

- Cytokine storm?
- Does NP viral load correlate with treatment response?
- Co-morbid risk factors?
- Macro- and micro-thrombotic state?
- Multiorgan involvement?
- Unique ARDS sub-phenotypes?

Clinical therapeutics

- Responsive to IL-6 inhibition?
- Role of antivirals for therapy?
- Steroid responsive?
- Convalescent plasma?
- Empiric anticoagulation?
- Strategies to avoid renal failure?
Neuroprotective?
- Non-ARDSnet ventilatory strategies?
When to intubate?