



**A NATION-WIDE
APPROACH TO
RESPOND TO THE
COVID-19 SPREAD
IN LEBANON**

COVID-19 PANDEMIC EPIDEMIOLOGY AND CLINICAL ASPECTS

Nesrine Rizk MD
Clinical Assistant Professor
Infectious Diseases
AUBMC



OUTLINE

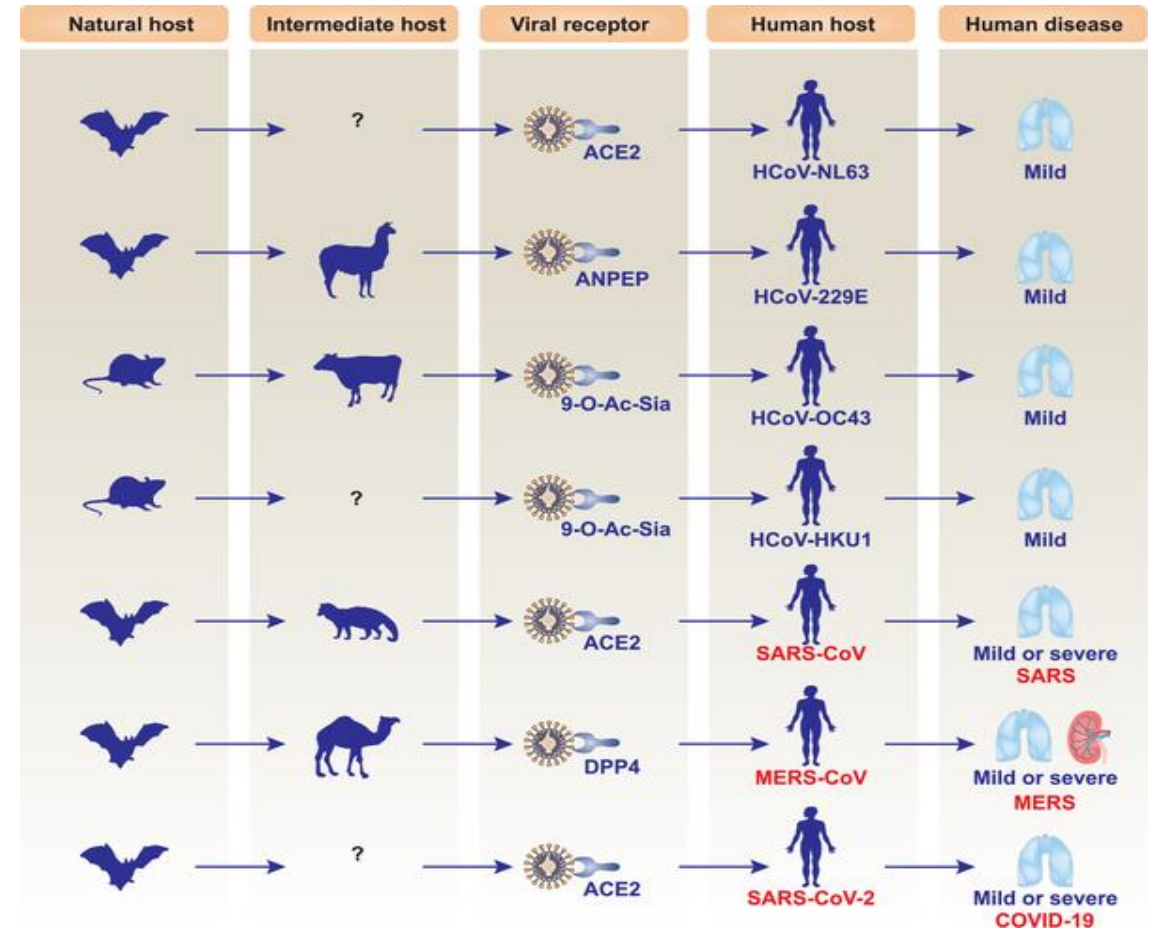
- 1. COVID-19 PANDEMIC**
quick overview
- 2. COVID-19: basics and transmission dynamics**
- 3. Clinical presentations**
- 4. Clinical outcomes**
Risk stratification



Coronaviruses are large, enveloped, positive-strand RNA viruses

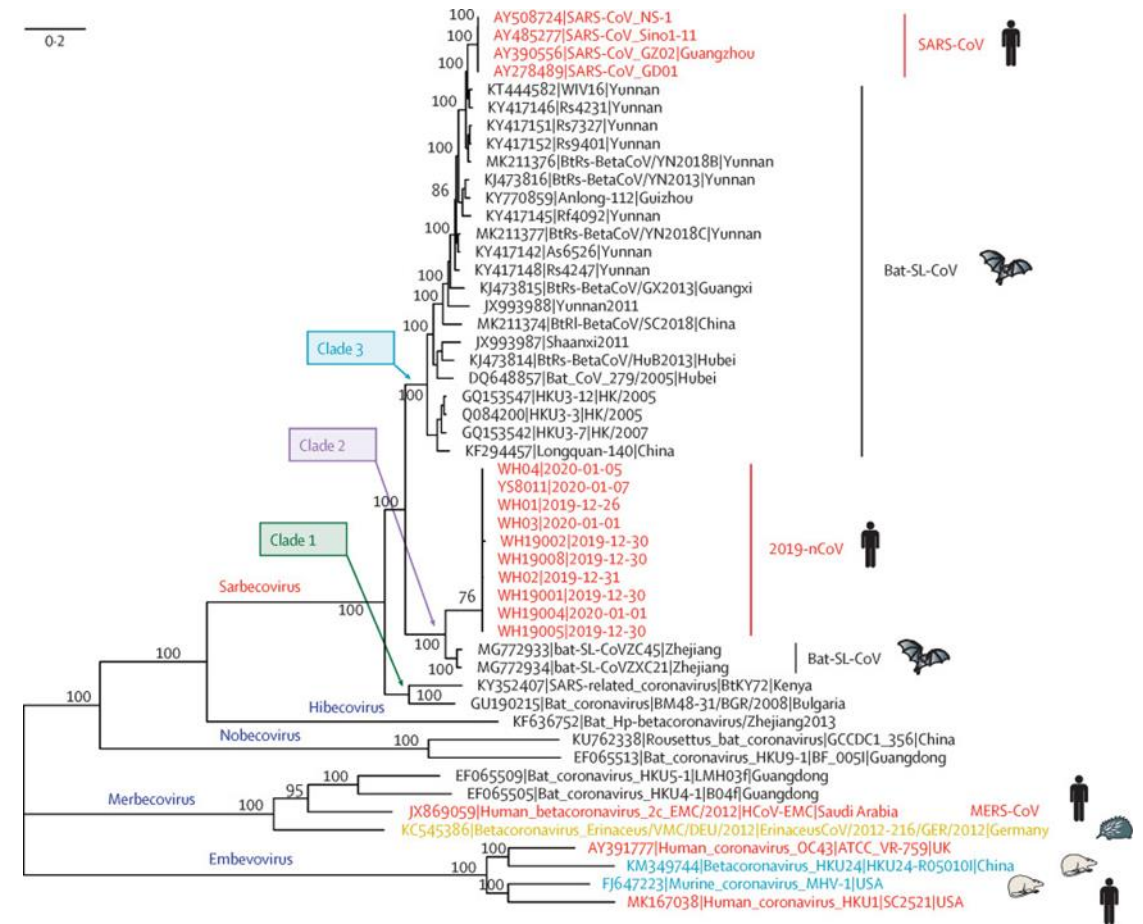
HOSTS AND CONSEQUENCES OF HUMAN CoV INFECTIONS

- Coronaviruses are divided into 4 genera: alpha, beta, delta, and gamma.
- **alpha and beta CoVs** are known to infect humans.
- Four HCoVs (**HCoV 229E, NL63, OC43, and HKU1**) are endemic globally and account for **10% to 30%** of upper respiratory tract infections in adults.



PHYLOGENY OF SARS-CoV2

- Previously **SARS** and **MERS** associated with novel coronaviruses and outbreaks
- Coronaviruses are ecologically diverse with the greatest variety seen in **bats**, suggesting that they are the reservoirs for many of these viruses.



THE EMERGENCE OF COVID-19

- Outbreak originated in Wuhan, China. May have be related to the Huanan Seafood Market
- First case of COVID-19 currently known: **17 November 2019**
- Rapid spread of the virus in Wuhan and the Hubei province
- **January 7 2020**: SARS-CoV-2 was identified by the Chinese Center for Disease Control and Prevention (CDC) from the throat swab sample of a patient
- The virus subsequently spread to all provinces of China and to more than 180 other countries in Asia, Europe, North America, South America, Africa, and Oceania
- **March 11 2020**: WHO declared COVID-19 a ***pandemic***



Chen N, *The Lancet*. 395 (10223): 507–513.

Zhou P, *Nature*. 579 (7798): 270–273

<https://www.who.int/blueprint/priority-diseases/key-action/novel-coronavirus/en>





Global Cases

58,666,247

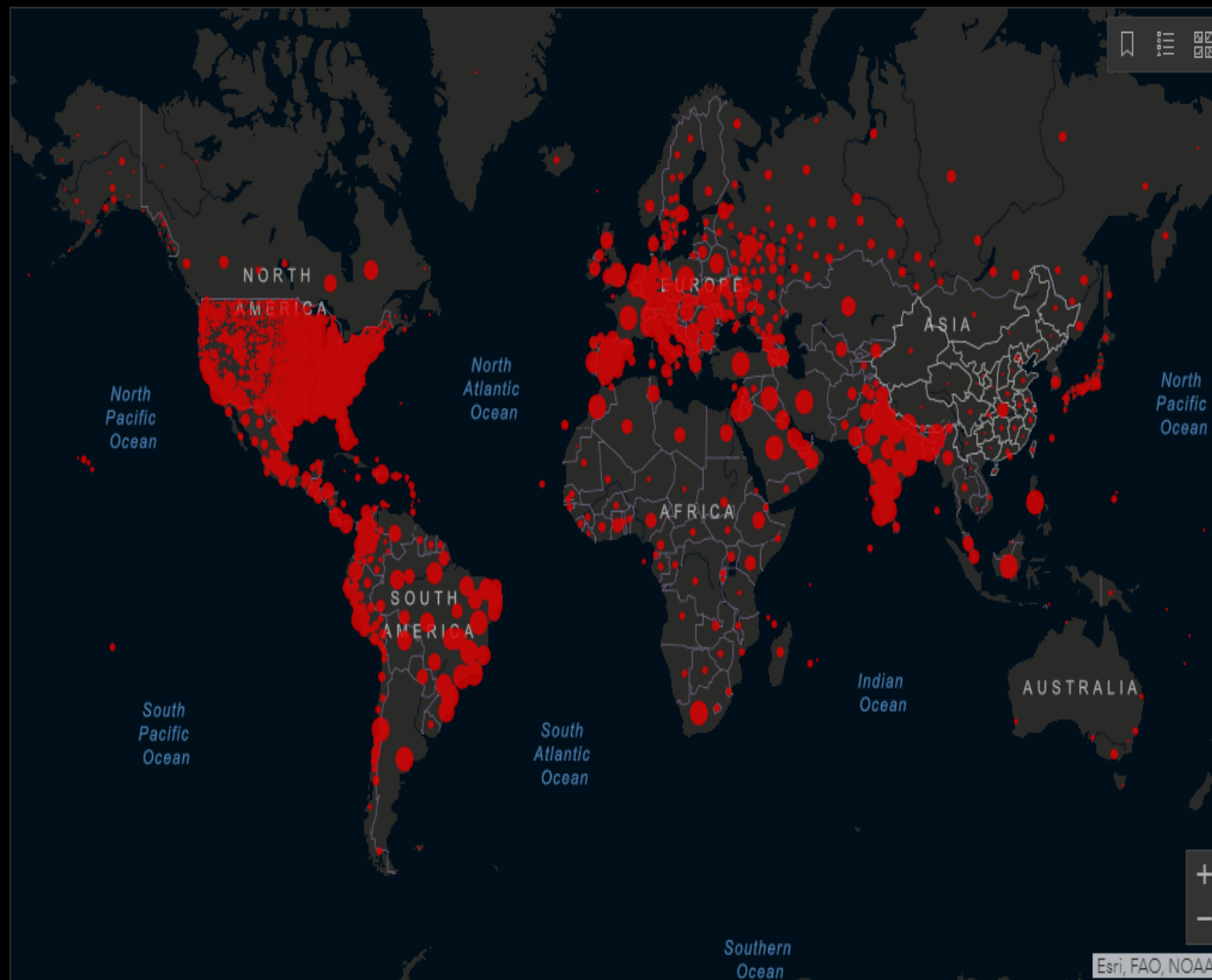
Cases by Country/Region/Sovereignty

- 12,247,486 US
- 9,139,865 India
- 6,071,401 Brazil
- 2,191,180 France
- 2,071,858 Russia
- 1,556,730 Spain
- 1,515,802 United Kingdom
- 1,408,868 Italy
- 1,370,366 Argentina
- 1,248,417 Colombia
- 1,041,875 Mexico
- 948,081 Peru
- 932,434 Germany
- 861,331 Poland
- 854,361 Iran

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Last Updated at (M/D/YYYY)

11/23/2020, 9:26 AM



Cumulative Cases Active Cases Incidence Rate Case-Fatality Ratio Testing Rate

191

countries/regions

Lancet Inf Dis Article: [Here](#). Mobile Version: [Here](#). Data sources: [Full list](#). Downloadable database: [Github](#), [Feature Layer](#).
 Lead by JHU CSSE. Technical Support: [Esri Living Atlas team](#) and [JHU APL](#). Financial Support: [JHU](#), [NSF](#), [Bloomberg Philanthropies](#) and [Stavros Niarchos Foundation](#). Resource support: [Slack](#), [Github](#) and [AWS](#). Click [here](#) to **donate** to the CSSE dashboard team, and other JHU COVID-19 Research Efforts. [FAQ](#). Read more in this [blog](#). [Contact US](#).

Global Deaths

1,388,272

256,783 deaths US

169,183 deaths Brazil

133,738 deaths India

101,676 deaths Mexico

55,120 deaths United Kingdom

49,823 deaths Italy

48,807 deaths France

Global Deaths

Global Recovered

US State Level

Deaths, Recovered

34,319 deaths, 83,307 recovered New York US

21,013 deaths, 913,796 recovered Texas US

18,727 deaths, recovered California US

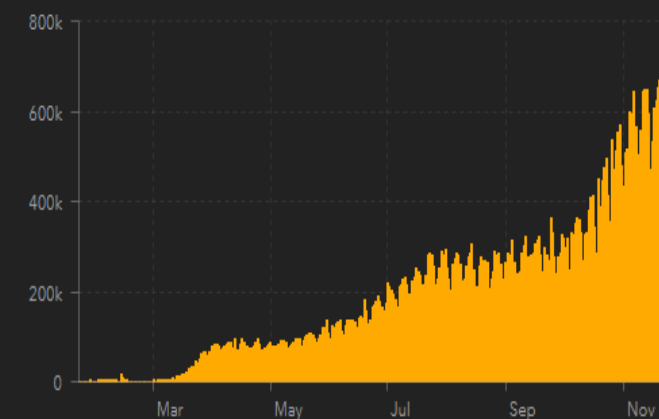
17,991 deaths, recovered Florida US

16,761 deaths, 41,303 recovered New Jersey US

12,050 deaths, recovered Illinois US

10,512 deaths, 145,682 recovered Massachusetts US

US Deaths, Recovered



Daily Cases

الخط الساخن:
01594459
01832700

ترصد عدوى الكوفيد 19 في لبنان

22 تشرين الثاني 2020

الجمهورية اللبنانية
وزارة الصحة العامة



من توصيات وزارة الصحة العامة: مرضى الكوفيد 19

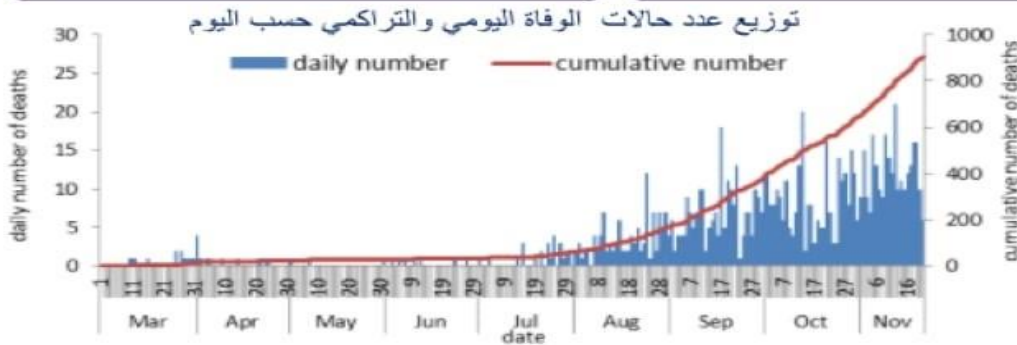
متى تنتهي فترة العزل لمرضى الكوفيد-19 دون الحاجة إلى إعادة الاختبار:

- للمرضى الذين يعانون من الأعراض: 10 أيام بعد ظهور العوارض، بالإضافة إلى 3 أيام إضافية على الأقل بدون عوارض (بما في ذلك بدون حمى وبدون أعراض تنفسية)
- للحالات بدون عوارض: 10 أيام بعد الاختبار الإيجابي لـ SARS-CoV-2

	التراكمي منذ 21 شباط	خلال 24 ساعة المنصرمة
عدد الحالات المثبتة في لبنان	116435	1193
عدد الحالات المثبتة المحلية	113763	1190
عدد الحالات المثبتة الوافدة	2672	3
عدد حالات الوفاة	900	6
عدد حالات القطاع الصحي	1668	3
عدد الاتصالات المجابة للخط الساخن «كوفيد» 01594459	93123	519

خلال 14 يوم المنصرمة	
نسبة الفحوصات المحلية لكل 100000	2763
إيجابية الفحوصات لكل مئة فحص	15%
عدد الحالات النشطة	22199
نسبة الحدوث المحلية لكل 100000	417

خلال 24 ساعة المنصرمة					
عدد الحالات المكررة	77	عدد الفحوصات المخبرية	8796	حالة استشفاء	866
عدد حالات الشفاء	67667	عدد الفحوصات المحلية	7963	حالة في العناية المركزة	337
		عدد الفحوصات في المطار	833	حالة مع تنفس اصطناعي	138
		عدد الفحوصات للمعابر البرية	-		

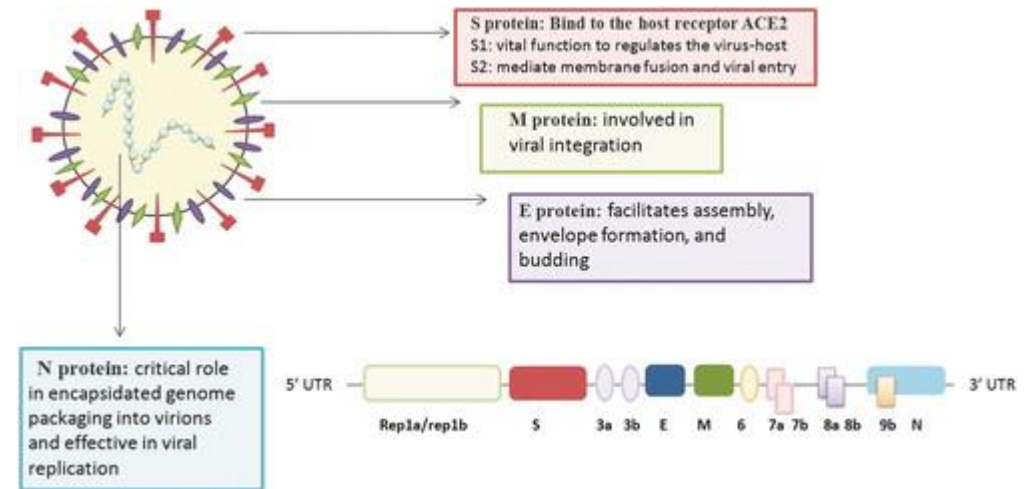


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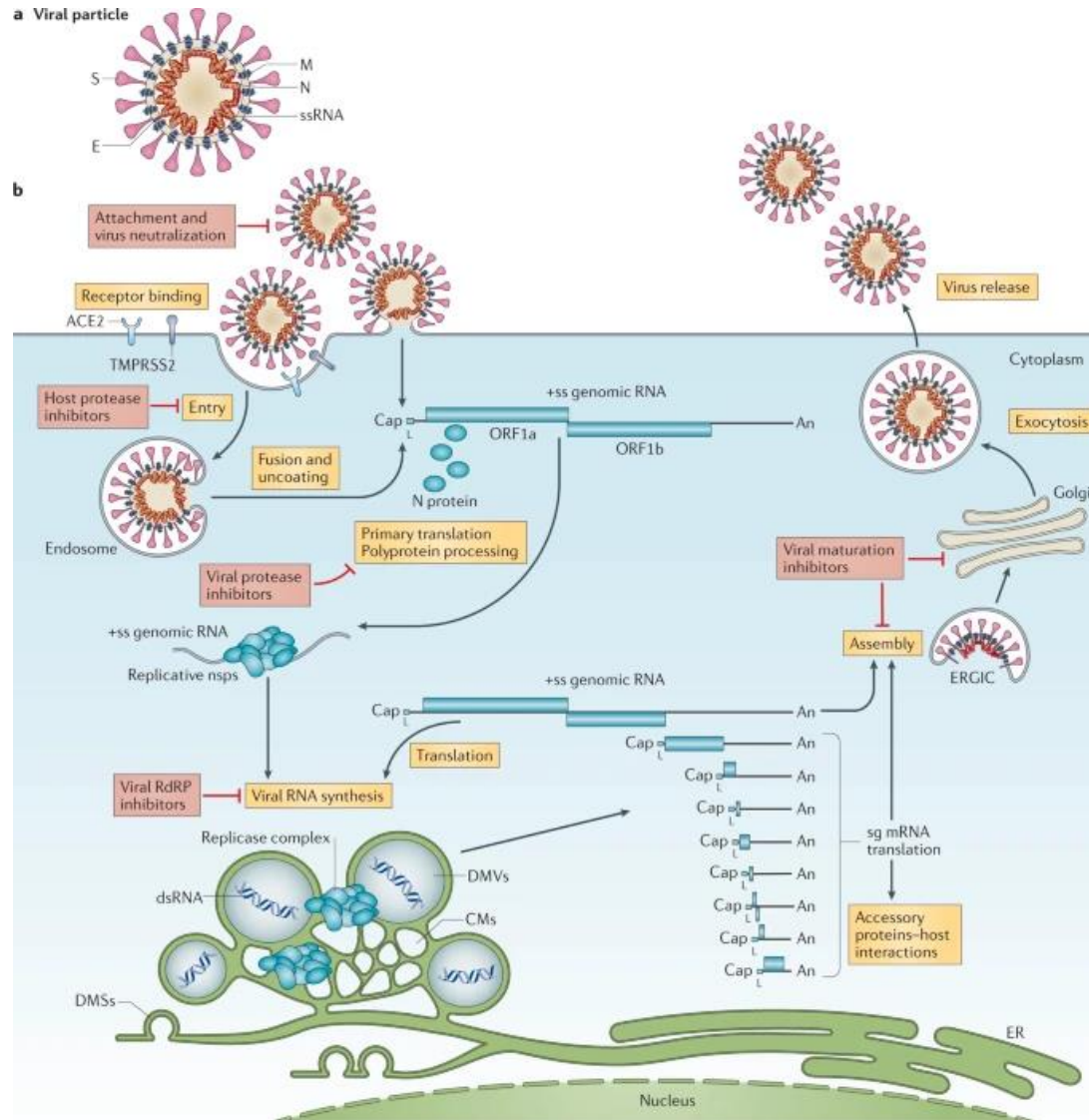


The VIRUS: SARS-CoV-2

- SARS-CoV-2
 - + sense single-stranded RNA (+ssRNA) virus
- Coronavirus name comes from the crown like shape: 'Coronum' means Crown in Latin
- 50–200 nanometres in diameter
- 4 structural proteins:
 - the S (spike), E (envelope), M (membrane), and N (nucleocapsid) protein



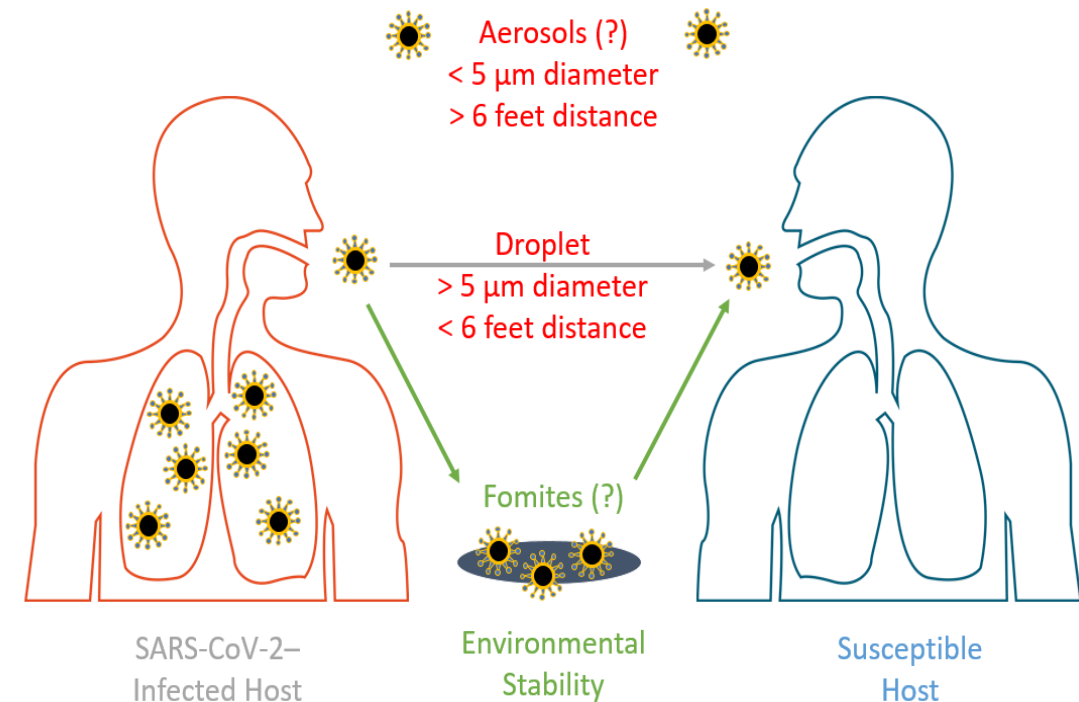
CORONAVIRUS BIOLOGY AND REPLICATION



Key steps inhibited by compounds that are currently being validated and which represent attractive antiviral targets are highlighted in red.

TRANSMISSION OF SARS-CoV2

- Primary mean of transmission: direct person-to-person
 - Droplet spread/respiratory
 - Environmental contamination
 - ?aerosol transmission
- Detection in non-respiratory specimens
 - ?role in transmission



Galbadage. Front Public Health. 2020;8:163.

Slide credit: clinicaloptions.com

McMichael TM, Clark S, Pogojans S, et al. MMWR Morb Mortal Wkly Rep. 2020;69(12):339-342.

Guo ZD, Wang ZY, Zhang SF, et al. Emerg Infect Dis. 2020;26(7):10.3201/eid2607.200885.

Wang W, Xu Y, Gao R, et al. JAMA. 2020;323(18):1843-1844.

He, X., Lau, E.H.Y., Wu, P. et al. Nat Med 26, 672-675 (2020).

Cheng H, Jian S, Liu D, et al. JAMA Intern Med. Published online May 01, 2020. doi:10.1001/jamainternmed.2020.2020

Virological assessment of hospitalized patients with COVID-2019

<https://doi.org/10.1038/s41586-020-2196-x>

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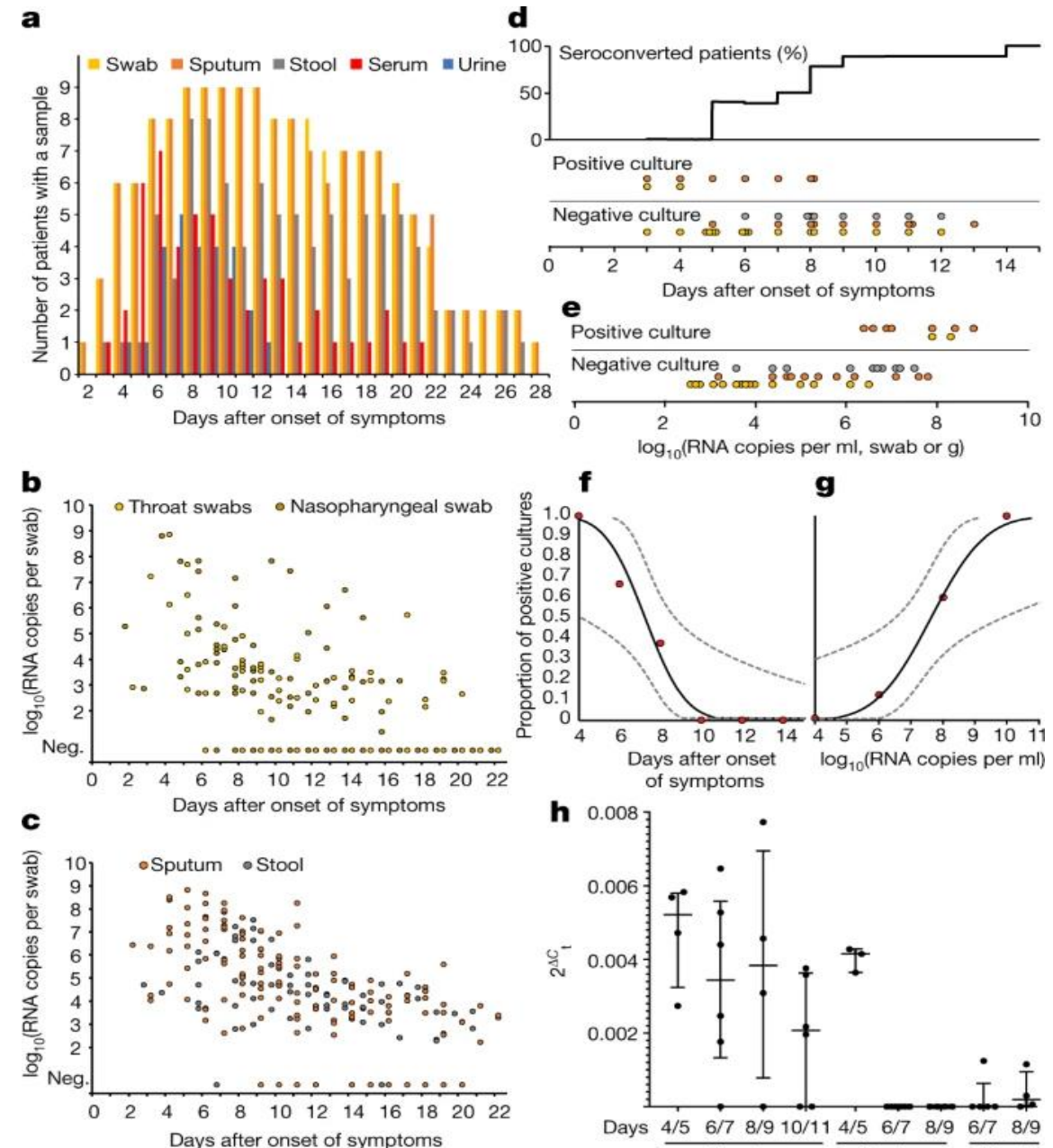
Roman Wölfel^{1,6}, Victor M. Corman^{2,6}, Wolfgang Guggemos^{3,6}, Michael Seilmaier³, Sabine Zange¹, Marcel A. Müller², Daniela Niemeyer², Terry C. Jones^{2,4}, Patrick Vollmar¹, Camilla Rothe⁵, Michael Hoelscher², Tobias Bleicker², Sebastian Brünink², Julia Schneider², Rosina Ehmann¹, Katrin Zwirgmaier¹, Christian Drosten^{2,7,8,9} & Clemens Wendtner^{3,7,8,9}

Viral shedding and period of infectivity

- **Prior to symptoms (around 3-4 days)**
- **Ends around 7 days of symptom onset**

- detailed virological analysis of 9 cases of COVID-19
- proof of active virus replication in tissues of the upper respiratory tract
- **Pharyngeal virus shedding was very high during the first week of symptoms, with a peak on day 4.**
- **Infectious virus was readily isolated from samples derived from the throat or lung, but not from stool samples—in spite of high concentrations of virus RNA.**
- Blood and urine samples never yielded virus.
- **The shedding of viral RNA from sputum outlasted the end of symptoms.**
- Seroconversion occurred after 7 days in 50% of patients (and by day 14 in all patients), but was not followed by a rapid decline in viral load.

COVID-19 can present as a mild illness of the upper respiratory tract. The confirmation of active virus replication in the upper respiratory tract has implications for the containment of COVID-19.

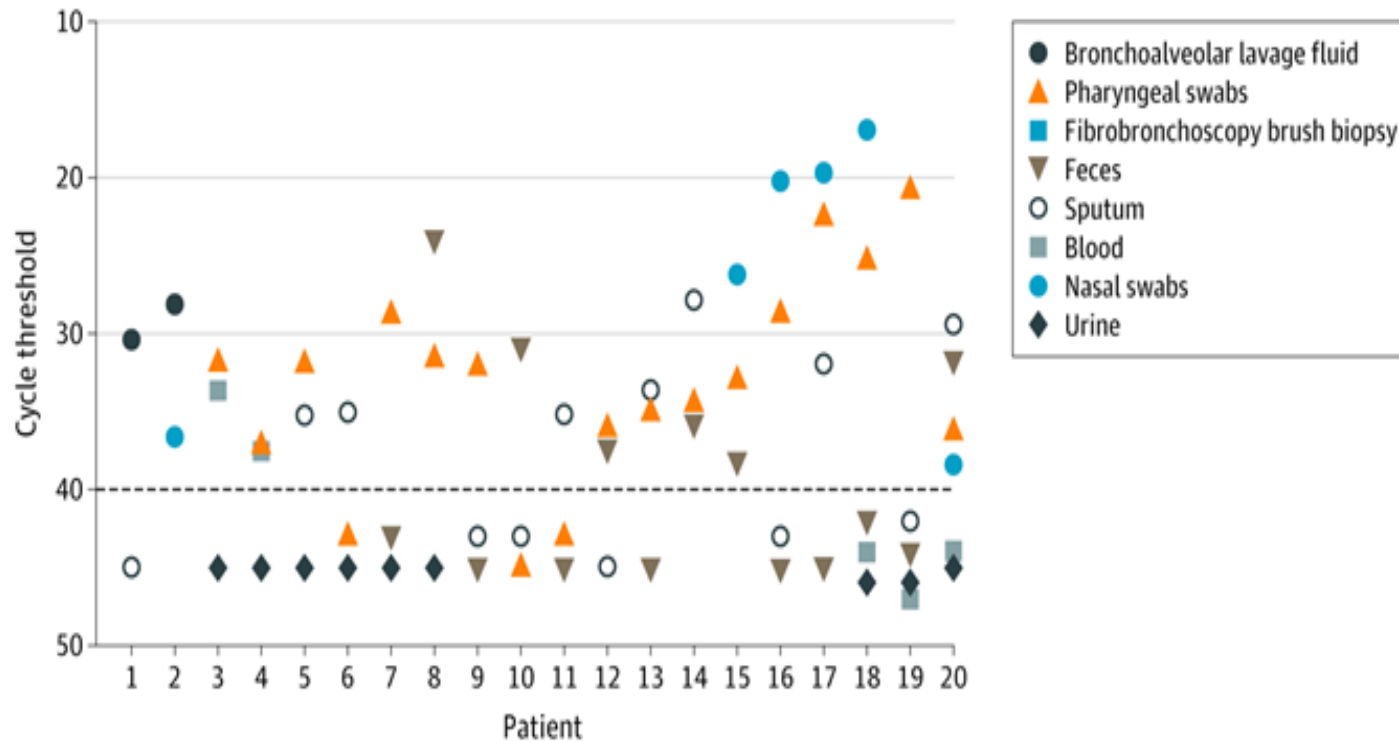


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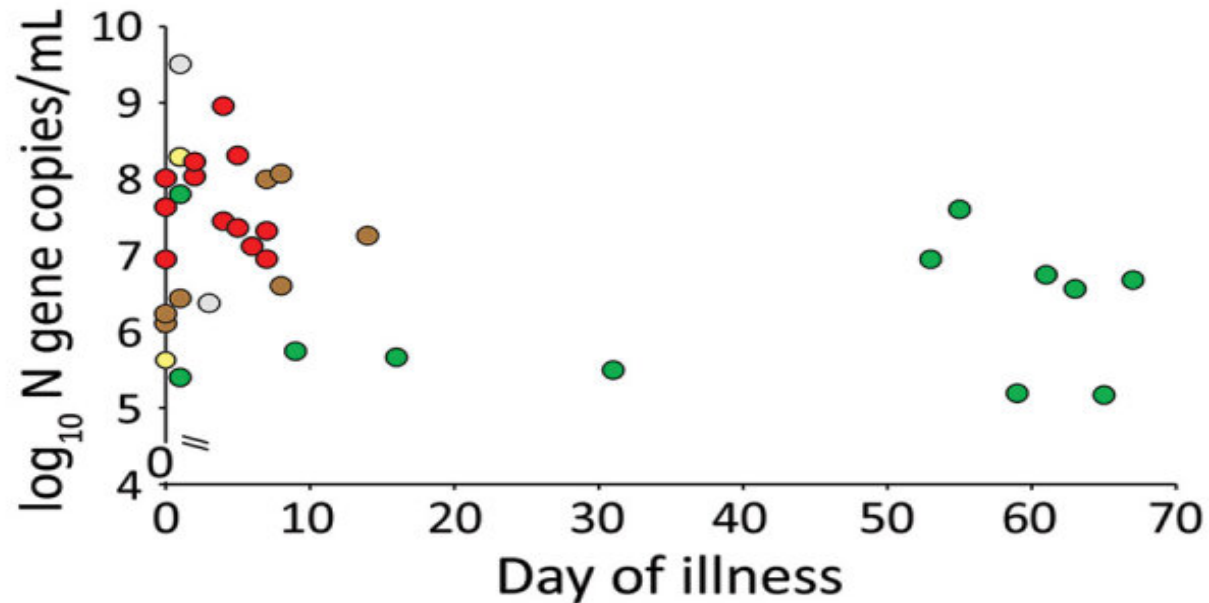


SARS-CoV-2 DETECTION BY RT-PCR ACROSS DIFFERENT CLINICAL SPECIMENS

Among 1070 specimens from 20 COVID-19 patients in China, highest SARS-CoV-2 positivity rates observed with BAL fluid (93%), sputum (72%), nasal swab (63%)



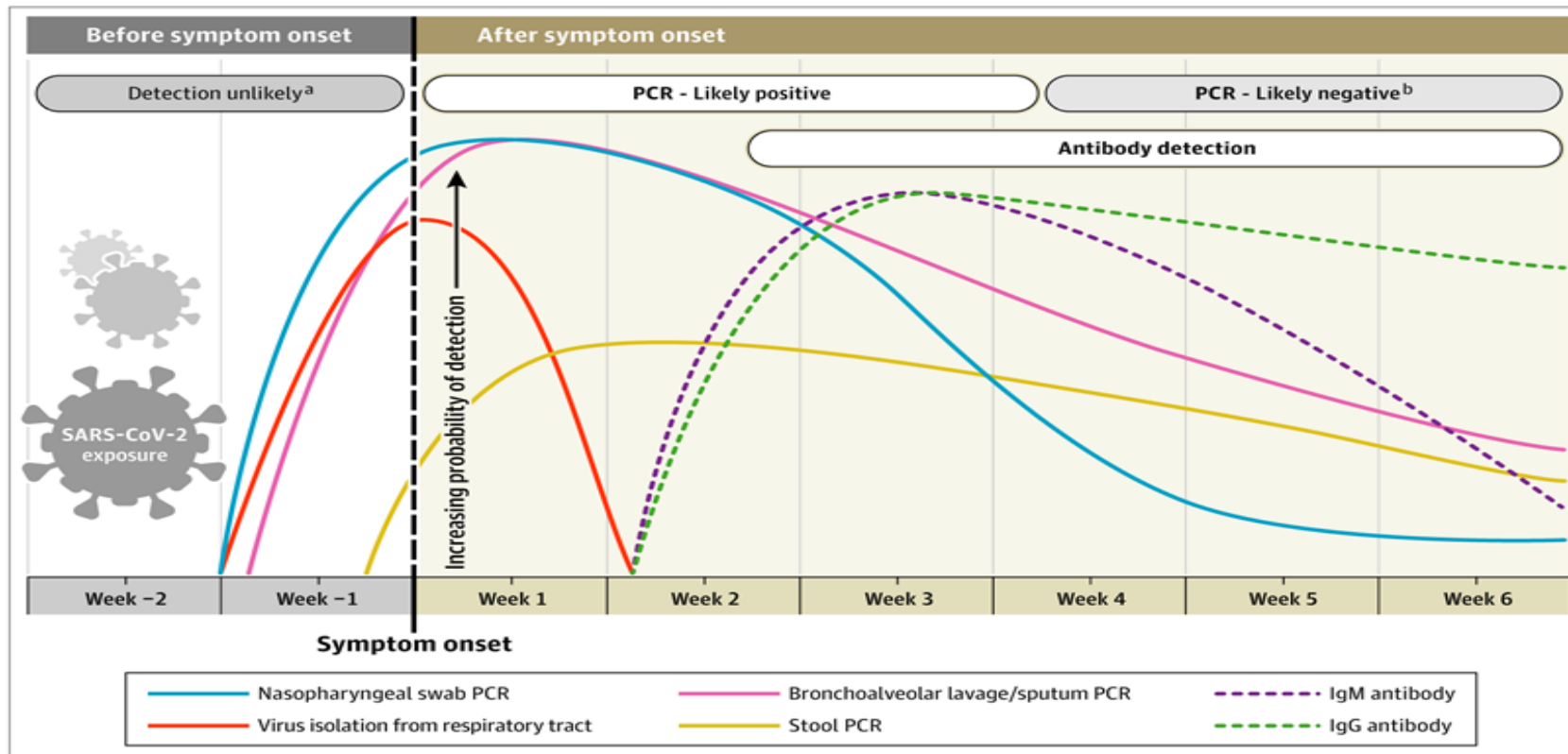
Virus rarely cultured in respiratory samples > 9 days after symptom onset, especially in patients with mild disease



Severe acute respiratory syndrome coronavirus 2 viral RNA load, virus culture, and subgenomic virus RNA (sgRNA) in relation to days after onset of illness for patients with mild coronavirus disease, Hong Kong. Red indicates culture and sgRNA positive, green indicates culture and sgRNA negative, yellow indicates culture positive and sgRNA negative, brown indicates culture negative and sgRNA positive, and gray indicates culture positive and no sgRNA data (because of insufficient specimen).

TEMPORAL CONSIDERATIONS FOR DIAGNOSIS

Estimated Variation Over Time in Diagnostic Tests for Detection of SARS-CoV-2 Infection Relative to Symptom Onset



Estimated time intervals and rates of viral detection are based on data from several published reports. Because of variability in values among studies, estimated time intervals should be considered approximations and the probability of detection of SARS-CoV-2 infection is presented qualitatively.

Epidemiology and transmission of COVID-19 in 391 cases and 1286 of their close contacts in Shenzhen, China: a retrospective cohort study

Qifang Bi*, Yongsheng Wu*, Shujiang Mei*, Chenfei Ye*, Xuan Zou, Zhen Zhang, Xiaojian Liu, Lan Wei, Shaun A Truelove, Tong Zhang, Wei Gao, Cong Cheng, Xiujuan Tang, Xiaoliang Wu, Yu Wu, Binbin Sun, Suli Huang, Yu Sun, Juncen Zhang, Ting Ma*, Justin Lessler*, Tiejian Feng*

391 cases of COVID-19

1286 of their close contacts

attack rate did not differ by age

- 7% of close contacts became infected
- 80% of these contacts showing any symptoms
- 3% of infections manifested severe disease at initial assessment
- **Household contacts and those travelling with a case** were at higher risk of infection (**OR= 6.27** for household contacts and **OR=7.06** for those travelling with a case)
- **household secondary attack rate was 11.2%**
- children as likely to be infected as adults (infection rate 7.4% in children <10 years vs population average of 6.6%).

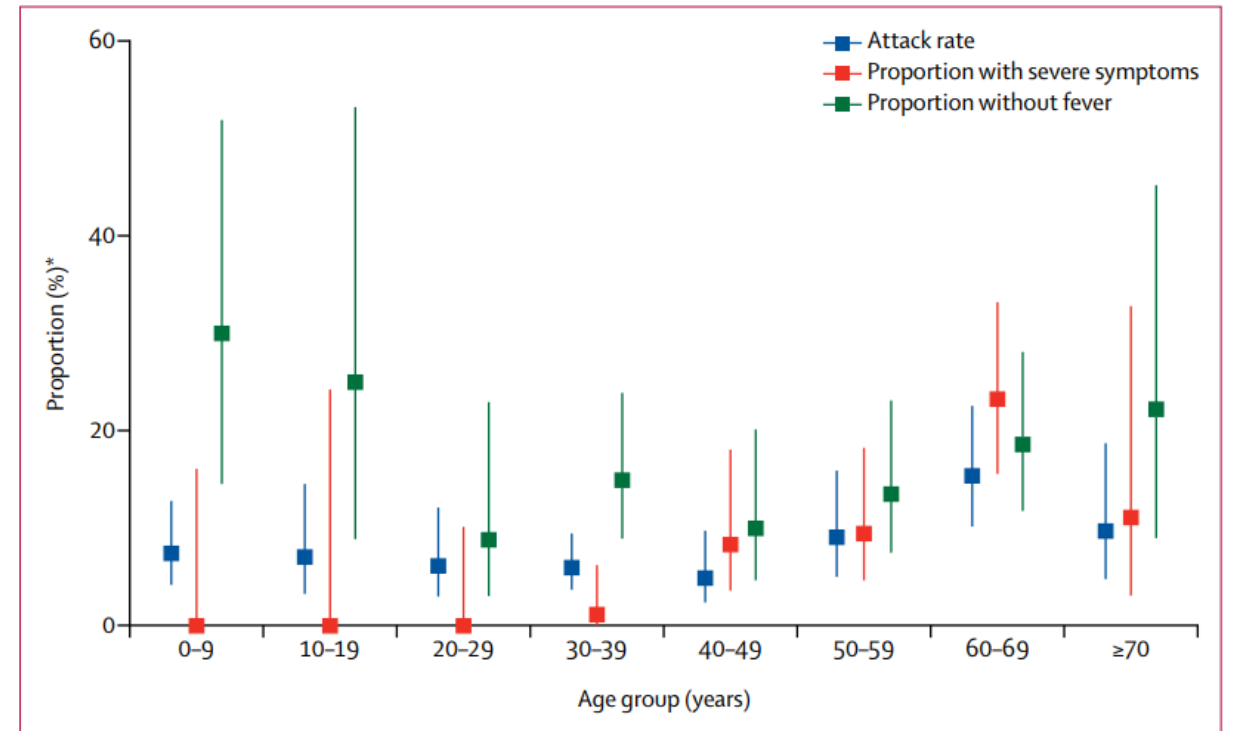


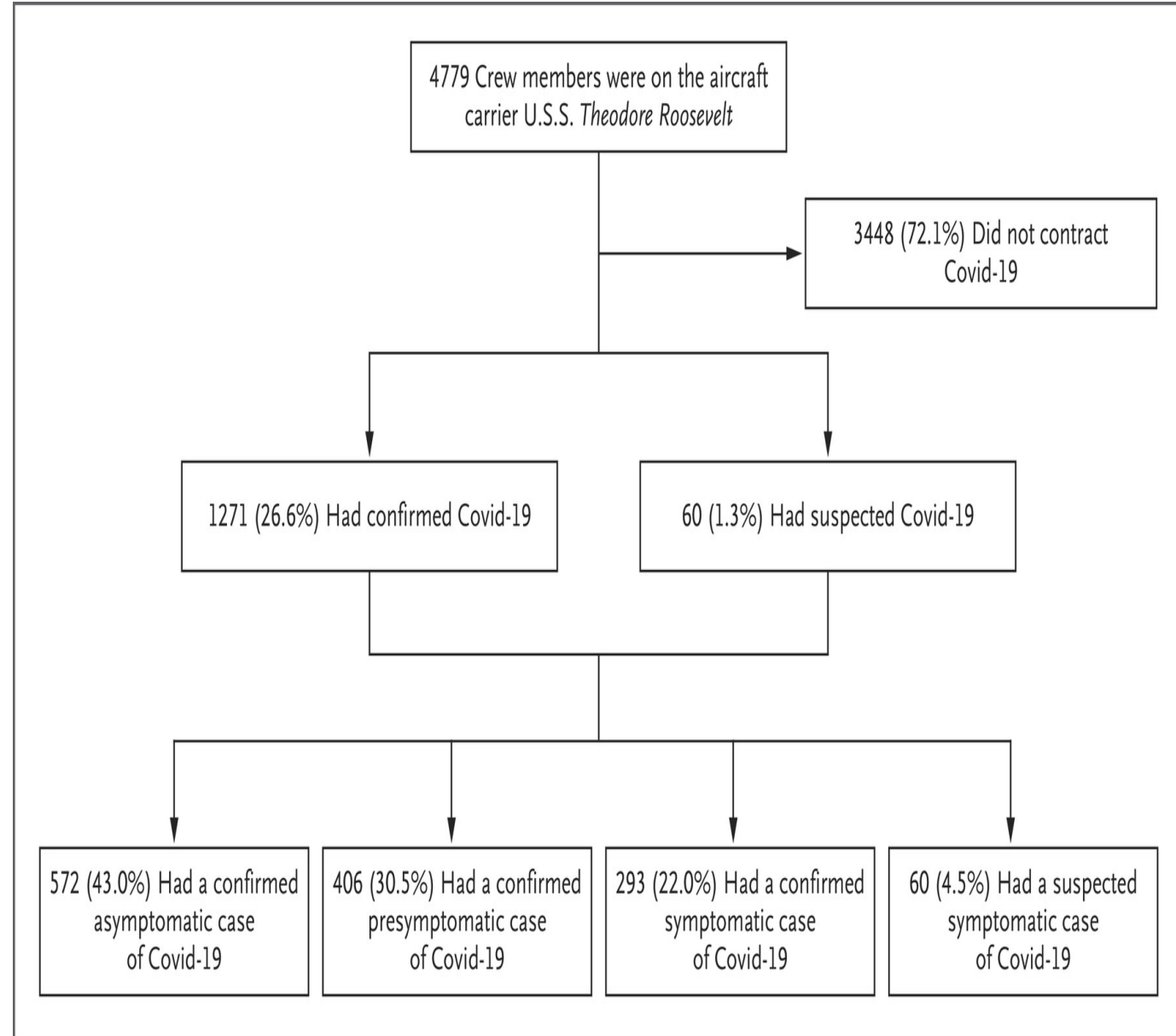
Figure 3: Attack rate among close contacts, baseline severity, and proportion of cases without fever at initial assessment by age group

*Proportion of close contacts for attack rate; proportion of all cases for those with severe symptoms or no fever at initial assessment.

ORIGINAL ARTICLE

An Outbreak of Covid-19 on an Aircraft Carrier

Matthew R. Kasper, Ph.D., Jesse R. Geibe, M.D., Christine L. Sears, M.D.,
Asha J. Riegodedios, M.S.P.H., Tina Luse, M.P.H., Annette M. Von Thun, M.D.,
Michael B. McGinnis, M.D., Niels Olson, M.D., Daniel Houskamp, M.D.,
Robert Fenequito, M.D., Timothy H. Burgess, M.D., Adam W. Armstrong, M.D.,
Gerald DeLong, Ph.D., Robert J. Hawkins, Ph.D., and Bruce L. Gillingham, M.D.





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CLINICAL COURSE of COVID-19

PRIMARY SYMPTOMS of COVID-19

Symptoms may appear 2-14 days after exposure to the virus

Congestion or runny nose, new loss of taste or smell

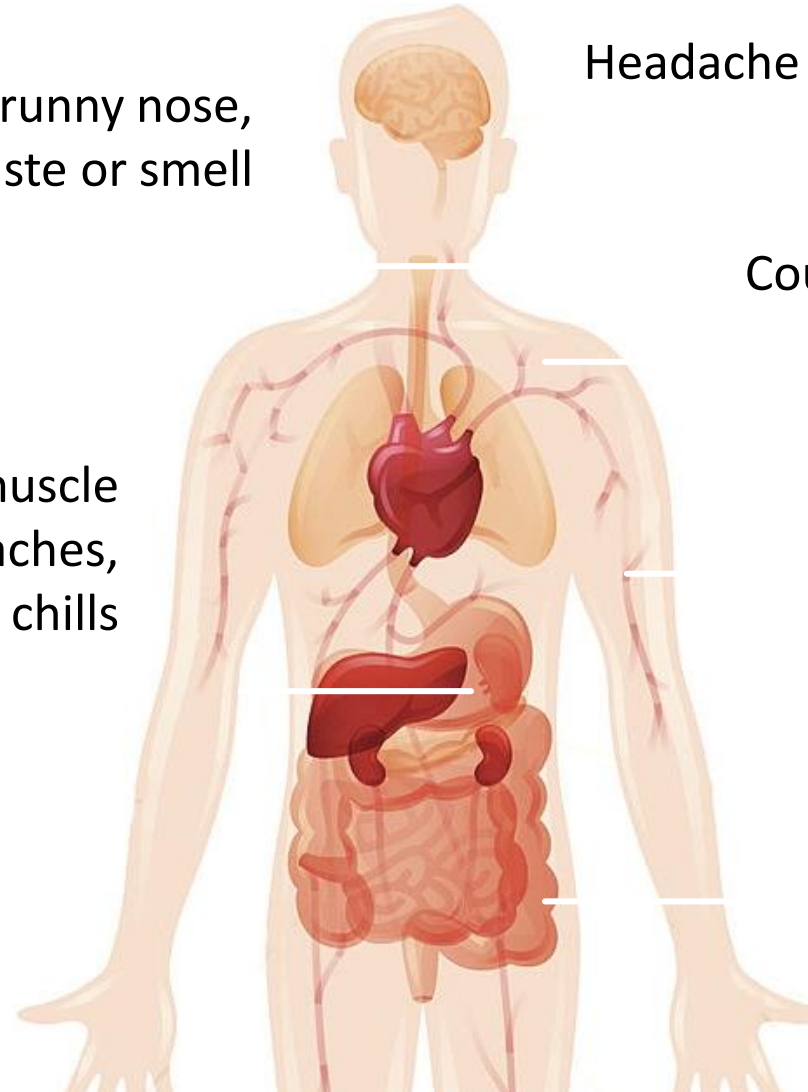
Headache

Cough, sore throat

Fatigue, muscle or body aches, fever or chills

Shortness of breath or difficulty breathing

Nausea or vomiting, diarrhea



CLASSIFICATION OF COVID-19 CASES

NIH Guidelines: Defining a COVID-19 Severity Spectrum

Stage	Characteristics
Asymptomatic or presymptomatic infection	<ul style="list-style-type: none">Positive test for SARS-CoV-2 but no symptoms
Mild illness	<ul style="list-style-type: none">Varied symptoms (eg, fever, cough, sore throat, malaise, headache, muscle pain) but no shortness of breath, dyspnea, abnormal imaging
Moderate illness	<ul style="list-style-type: none">SpO₂ ≥ 94% and lower respiratory disease evidenced by clinical assessment or imaging
Severe illness	<ul style="list-style-type: none">SpO₂ < 94%, PaO₂/FiO₂ < 300, respiratory rate > 30 breaths/min, or lung infiltrates > 50%
Critical illness	<ul style="list-style-type: none">Respiratory failure, septic shock, and/or multiorgan dysfunction

ASYMPTOMATIC INFECTIONS

- Asymptomatic infections have been well documented but not systematically and prospectively studied
- Up to 30-40% in some cohort studies
- DIAMOND PRINCESS
 - all passengers and staff were screened for SARS-CoV-2
 - approximately 19 % of passengers tested positive
 - 58% of the 712 confirmed COVID-19 cases were asymptomatic at the time of diagnosis
 - In studies of subsets of those asymptomatic individuals, who were hospitalized and monitored, approximately 77 - 89 % remained asymptomatic over time
- NURSING HOME
 - 27 of the 48 residents (56%) who had a positive screening test were asymptomatic at the time of diagnosis, but 24 of them ultimately developed symptoms over the next seven days
- ***pregnant women in NYC***
 - **210 asymptomatic women were screened: 14 %** had a positive SARS-CoV-2 PCR and no symptoms
 - 33 women +SARS-CoV-2 PCR: 88 % were asymptomatic on presentation

SARS-CoV-2 Transmission among Marine Recruits during Quarantine

A.G. Letizia, I. Ramos, A. Obla, C. Goforth, D.L. Weir, Y. Ge, M.M. Bamman, J. Dutta, E. Ellis, L. Estrella, M.-C. George, A.S. Gonzalez-Reiche, W.D. Graham, A. van de Guchte, R. Gutierrez, F. Jones, A. Kalomoiri, R. Lizewski, S. Lizewski, J. Marayag, N. Marjanovic, E.V. Millar, V.D. Nair, G. Nudelman, E. Nunez, B.L. Pike, C. Porter, J. Regeimbal, S. Rirak, E. Santa Ana, R.S.G. Sealfon, R. Sebra, M.P. Simons, A. Soares-Schanoski, V. Sugiharto, M. Termini, S. Vangeti, C. Williams, O.G. Troyanskaya, H. van Bakel, and S.C. Sealfon

ABSTRACT

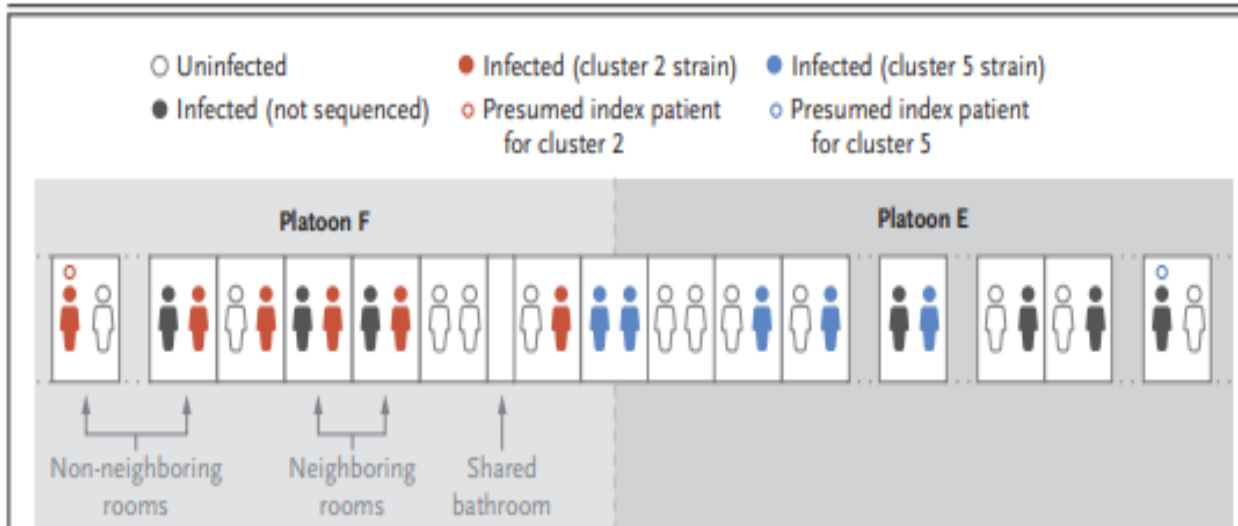


Figure 2. Local Transmission of SARS-CoV-2 during Quarantine.

Participants who were associated with the two largest transmission clusters (clusters 2 and 5) were identified by means of sequencing and were either roommates or members of the same platoons, which indicates that double-occupancy rooming and shared platoon membership were important contributors to transmission. Other infected members of these platoons whose samples were not sequenced may have been infected with the same cluster strains. One recruit in each platoon was found to be infected at the beginning of quarantine and represents the potential source of each cluster strain.

A total of 1848 recruits volunteered to participate in the study; within 2 days after arrival on campus 16 (0.9%) tested positive for SARS-CoV-2, 15 of whom were asymptomatic.

An additional 35 participants (1.9%) tested positive on day 7 or on day 14. Five of the 51 participants (9.8%) who tested positive at any time had symptoms in the week before a positive qPCR test.

Of the recruits who declined to participate in the study, 26 (1.7%) of the 1554 recruits with available qPCR results tested positive on day 14.

Analysis of 36 SARS-CoV-2 genomes obtained from 32 participants revealed six transmission clusters among 18 participants.

Epidemiologic analysis supported multiple local transmission events, including transmission between roommates and among recruits within the same platoon.

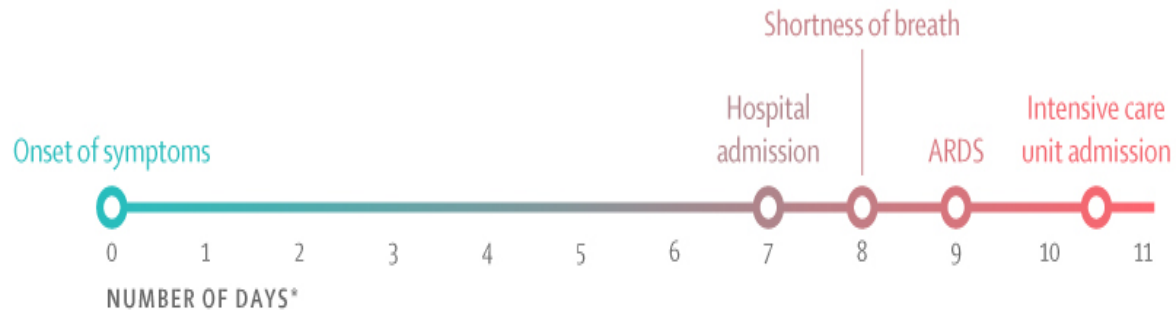
ASYMPTOMATIC INFECTIONS

PROSPECTIVE FOLLOW UP

- 50% of 24 patients with asymptomatic infection who all underwent CT chest
 - typical ground-glass opacities or patchy shadowing
 - 5 patients developed low-grade fever, with or without other typical symptoms, a few days after diagnosis.
- 67% of 55 patients with asymptomatic infection identified through contact tracing
 - CT evidence of pneumonia on admission
 - **two patients** developed hypoxia, and all recovered
- **Meta-analysis: 7 studies with 231 asymptomatic cases**
 - 63% asymptomatic with abnormal CT chest
 - 155/231 cases that were followed up for later symptom development
 - 90/155 remained asymptomatic
 - 65/155 developed symptoms during the study period (7-30 days of follow-up)

CLINICAL FEATURES OF COVID-19

Timeline of coronavirus onset



ARDS=Acute respiratory distress syndrome

*Median time from onset of symptoms, including fever (in 98% of patients), cough (75%), myalgia or fatigue (44%), and others.

THE LANCET

Common symptoms at onset of illness

- **fever 98%** of 41 patients
- **cough 76%**
- **myalgia or fatigue 44%**
- less common symptoms: sputum production, headache, hemoptysis and diarrhea.
- **Dyspnea** developed in **55%** of patients (median time from illness onset to dyspnea **8·0 days** [IQR 5·0–13·0]).
- 63% of 41 patients had lymphopenia.
- **All 41 patients had pneumonia with abnormal findings on chest CT.**

DISEASE COURSE AND PROGRESSION

Duration of symptoms

- **Fever**, median 4-12 days in survivors
- **Dyspnea**, median 13 days
- **Cough**, median 19 days in survivors. Still present in 45% of survivors on discharge and 72% of non-survivors on death

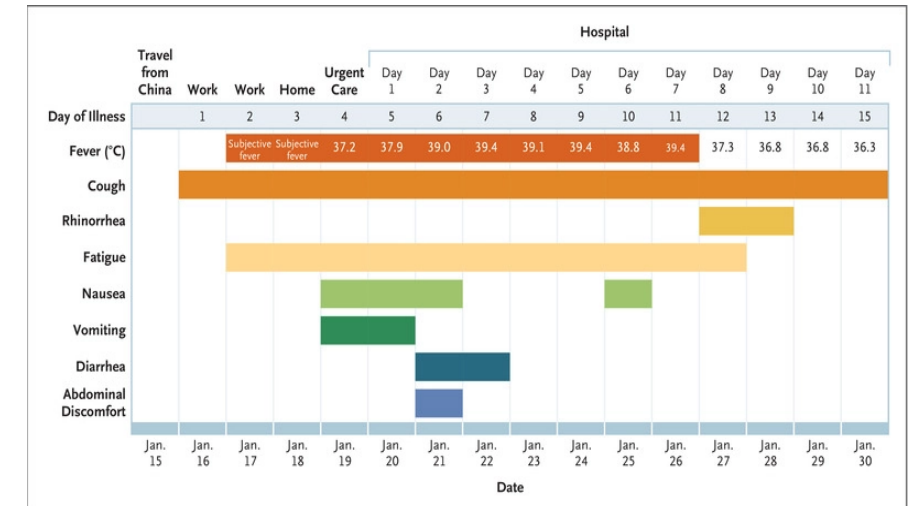
Timing of complications

- Sepsis, median 9 days
- ARDS, median 12 days
- **RESPIRATORY STATUS CAN DECOMPENSATE VERY RAPIDLY**

Duration between symptom onset and ventilation ranges from 3-12.5 days

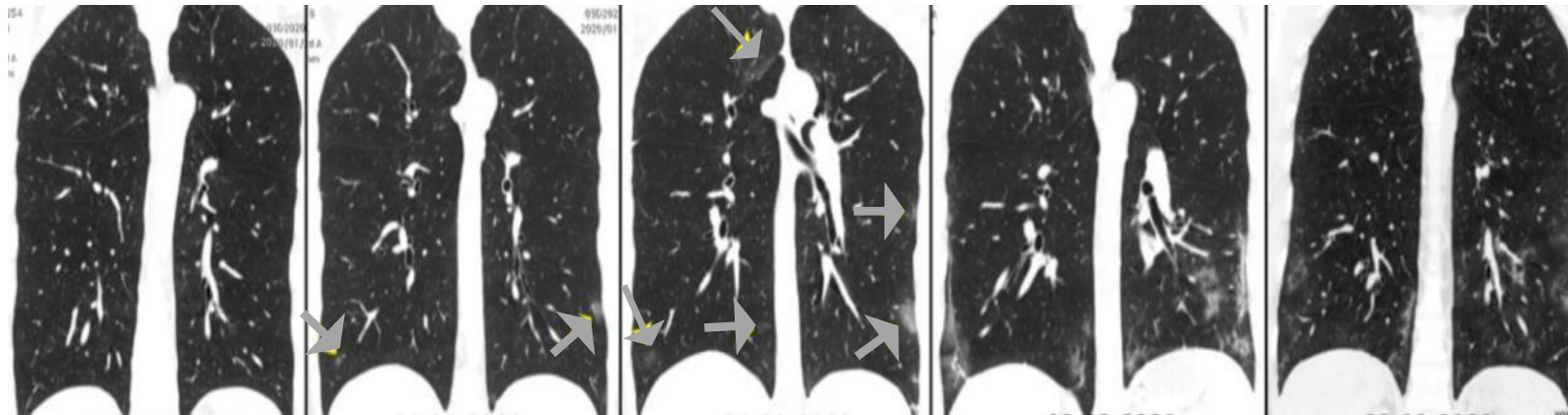
- Acute cardiac injury, median 15 days
- AKI, median 15 days
- Secondary infection, median 17 days

Time from initiation of invasive ventilation to VAP occurrence, median 8 days



Chest-CT ABNORMALITIES

- Most common hallmark features on chest CT images include bilateral peripheral ground-glass opacities and consolidations of the lungs with peak lung involvement between 6 days and 11 days post-symptom onset
- In a study in Wuhan, China, chest CT imaging demonstrated a sensitivity of 97% and specificity of 25% with RT-PCR as the reference (N = 1014) 60% to 93% of patients had initial positive lung CT consistent with COVID-19 *before* the initial positive RT-PCR result



1. Bernheim. Radiology. 2020;295:685.
2. Pan. Radiology. 2020;295:715.
3. 4. Wang. Radiology. 2020;296:E55.
- Ai. Radiology. 2020;296:E32.



Slide credit: clinicaloptions.com



CLINICAL COURSE: worldwide

Clinical presentation

- Variable, but most common are **non-specific flu-like** symptoms.
- Most have more than one sign/symptom on admission

Symptoms:

- Fever 44-94%
- Cough 68-83%
- Anosmia and/or ageusia ~70%
- Upper respiratory symptoms 5-61%
- Shortness of breath 11-40%
- Fatigue 23-38%
- Muscle aches 11-15%
- Headache 8-14%
- Confusion 9%
- GI symptoms (nausea, vomiting, diarrhea) 3-17%

Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study

Nanshan Chen*, Min Zhou*, Xuan Dong*, Jieming Qu*, Fengyun Gong, Yang Han, Yang Qiu, Jingli Wang, Ying Liu, Yuan Wei, Jia'an Xia, Ting Yu, Xinxin Zhang, Li Zhang

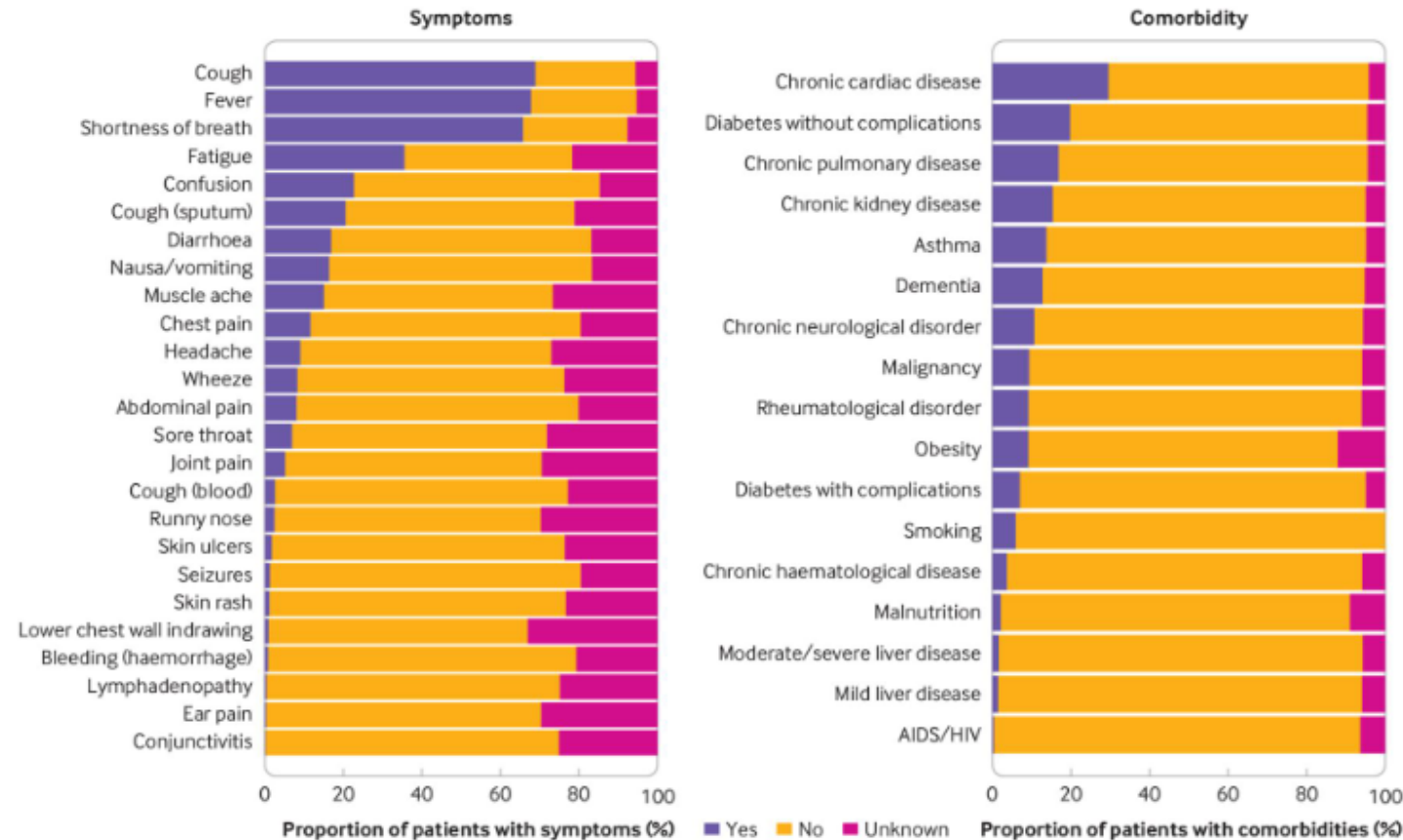
The Early Natural History of SARS-CoV-2 Infection: Clinical Observations From an Urban, Ambulatory COVID-19 Clinic

Pieter A. Cohen, MD; Lara E. Hall, MD; Janice N. John, MHS, MHCDS; and Alison B. Rapoport, MD

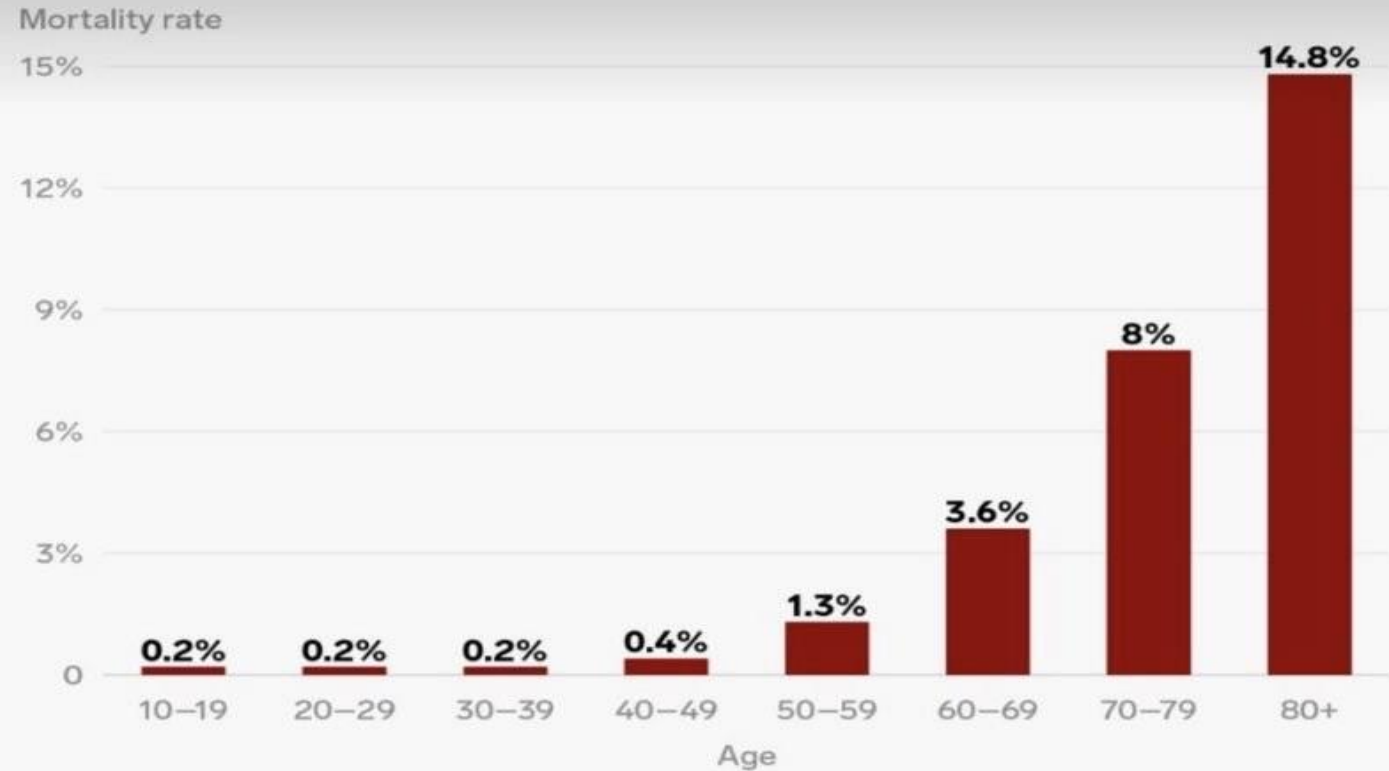
JAMA | Original Investigation

Epidemiologic Features and Clinical Course of Patients Infected With SARS-CoV-2 in Singapore

Features of 20 133 UK patients in hospital with covid-19 using the ISARIC WHO Clinical Characterization Protocol: prospective observational cohort study



COVID-19 mortality rate by age



Source: Chinese Center for Disease Control and Prevention

BUSINESS INSIDER

MORTALITY AND PRE-EXISTING CONDITIONS: CHINA

PRE-EXISTING CONDITION	DEATH RATE*
Cardiovascular disease	10.5%
Diabetes	7.3%
Chronic respiratory disease	6.3%
Hypertension	6.0%
Cancer	5.6%
<i>no pre-existing conditions</i>	0.9%

*Death Rate = (number of deaths / number of cases) = probability of dying if infected by the virus (%).



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Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area

Safiya Richardson, MD, MPH; Jamie S. Hirsch, MD, MA, MSB; Mangala Narasimhan, DO; James M. Crawford, MD, PhD; Thomas McGinn, MD, MPH; Karina W. Davidson, PhD, MASc; and the Northwell COVID-19 Research Consortium

- Case series of patients with COVID-19 admitted to 12 hospitals in **New York City**
- March 1, 2020, and April 4, 2020
- **5700 patients** (median age: 63 years ; 39.7% female).

most common comorbidities:

- hypertension (56.6%)
- obesity (41.7%)
- diabetes (33.8%)

Symptoms on presentation:

- 30.7% fever
- 17.3% RR greater than 24/min
- 27.8% supplemental O2

Outcomes were assessed for **2634 patients** (discharged or death) at the study end point

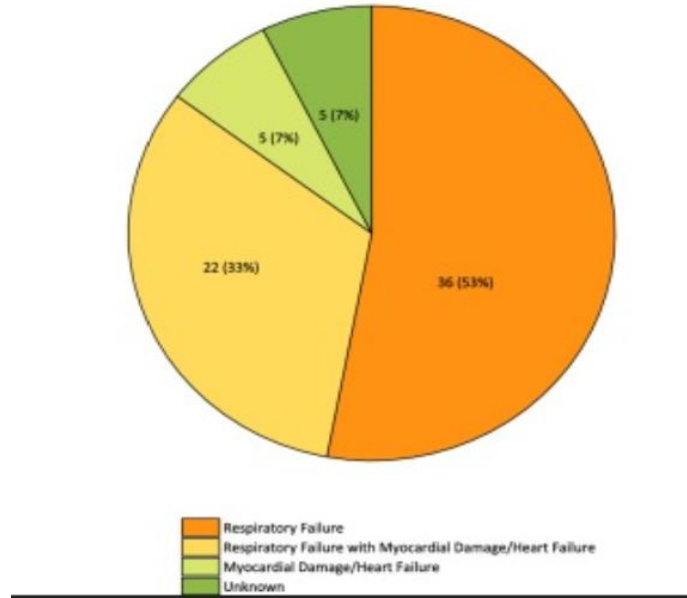
- **14.2% ICU** (median age: 68 years and 33.5% female)
 - 12.2% invasive mechanical ventilation
 - 3.2%: kidney replacement therapy
 - **21% died**
- A total of 45 patients (2.2%) were readmitted during the study period.
 - The median time to readmission was 3 days

Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China

[Qiurong Ruan](#),^{#1,2} [Kun Yang](#),^{#3} [Wenxia Wang](#),⁴ [Lingyu Jiang](#),⁵ and [Jianxin Song](#)⁴

Cause of death

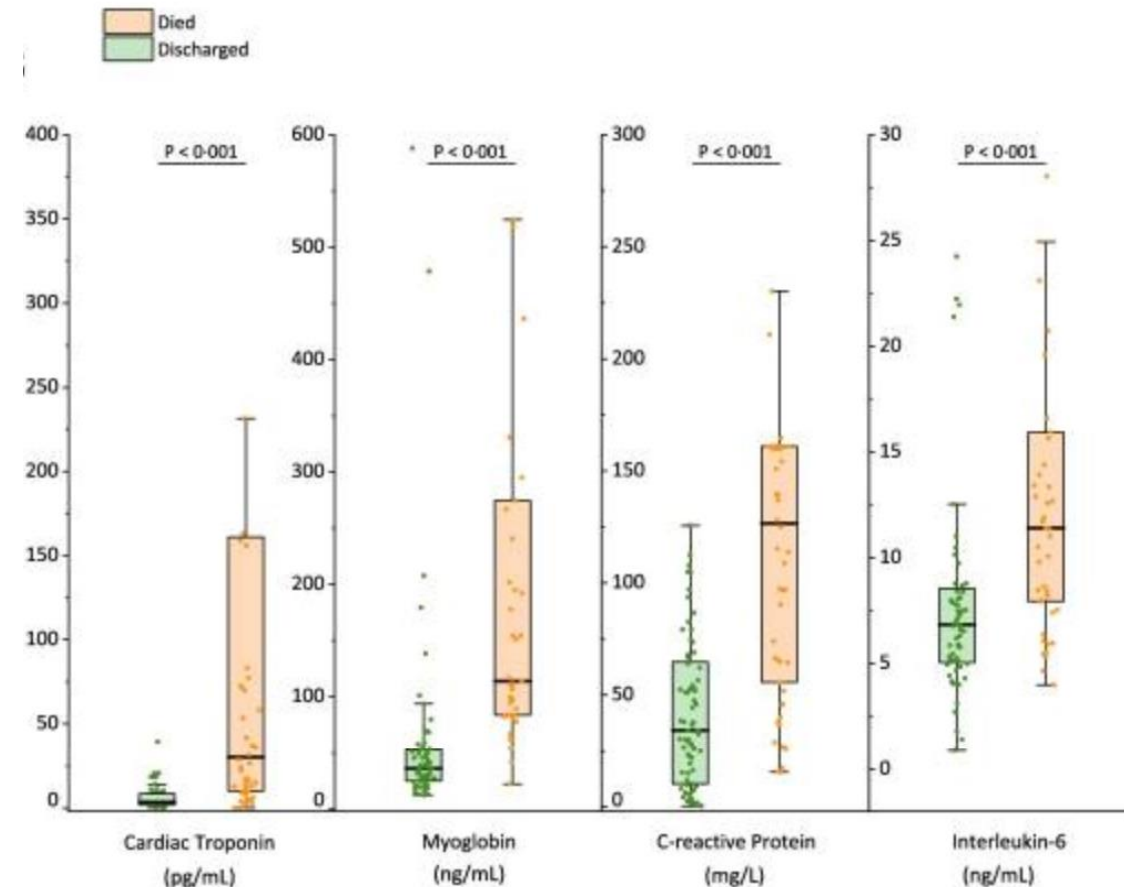
- Respiratory failure 53%
- Circulatory failure (myocardial damage) 7%
- Mixed respiratory and circulatory failure 33%
- Unknown cause 7%



Laboratory results

significant differences between the two groups

CRP/IL6/Troponin/myoglobin



OVERALL DISEASE DISTRIBUTION

- Among individuals with symptomatic coronavirus disease 2019 (COVID-19)
 - Mild to moderate (mild symptoms up to mild pneumonia): 81%
 - Severe (dyspnea, hypoxia, or more than 50% lung involvement on imaging): 14%
 - Critical (respiratory failure, shock, or multiorgan system dysfunction): 5%
- Infection fatality rates are population and age dependent, with very low rates for children and young adults but mortality rates >25% for individuals over age 90.

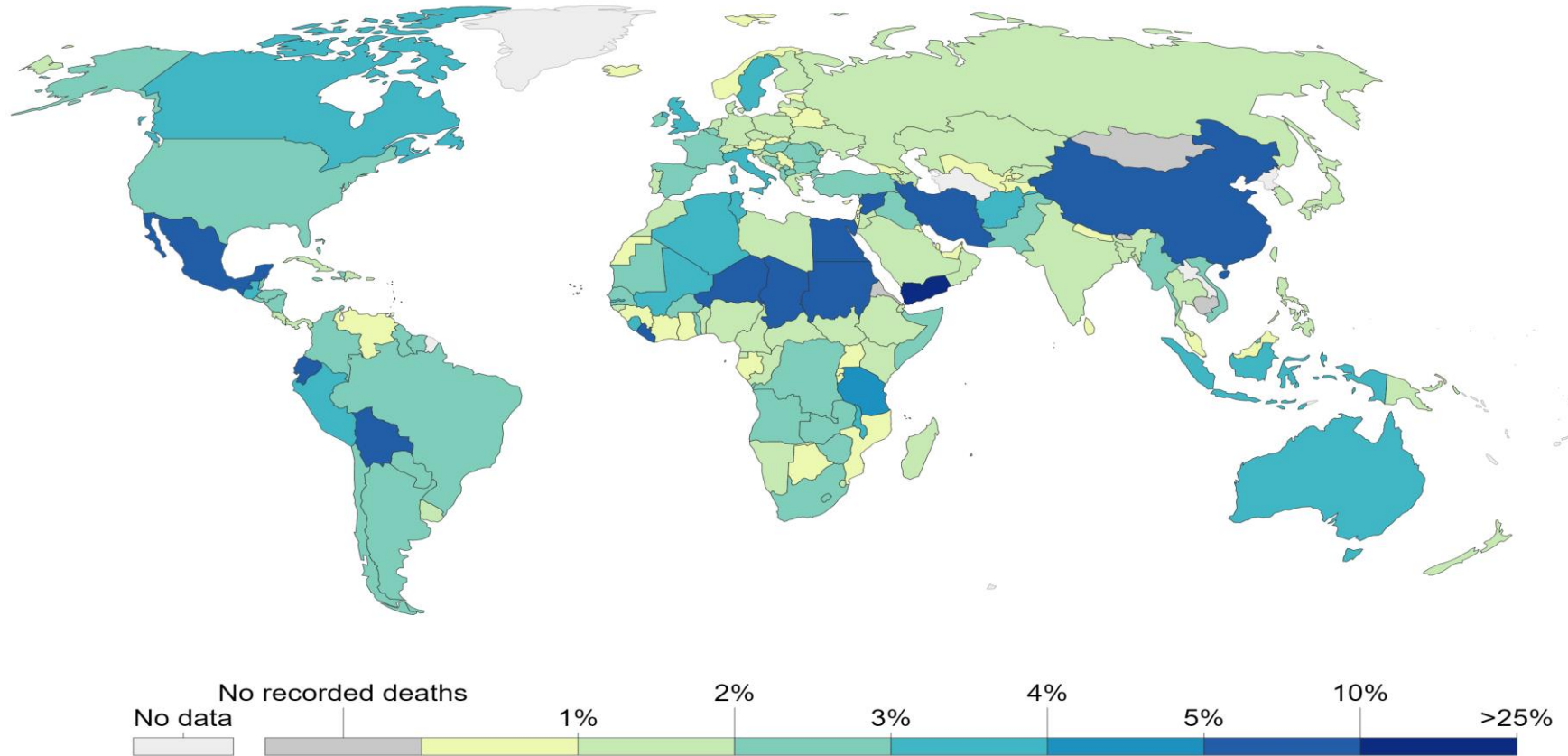
<https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html>

WHO. Estimating mortality from COVID-19: Scientific brief, 4 August 2020. <https://www.who.int/publications/i/item/WHO-2019-nCoV-Sci-Brief-Mortality-2020>.



Case fatality rate of the ongoing COVID-19 pandemic, Nov 23, 2020

The Case Fatality Rate (CFR) is the ratio between confirmed deaths and confirmed cases. During an outbreak of a pandemic the CFR is a poor measure of the mortality risk of the disease. We explain this in detail at OurWorldInData.org/Coronavirus



Source: European CDC – Situation Update Worldwide – Last updated 22 November, 10:06 (London time)

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ROLE OF THE INFLAMMATORY RESPONSE

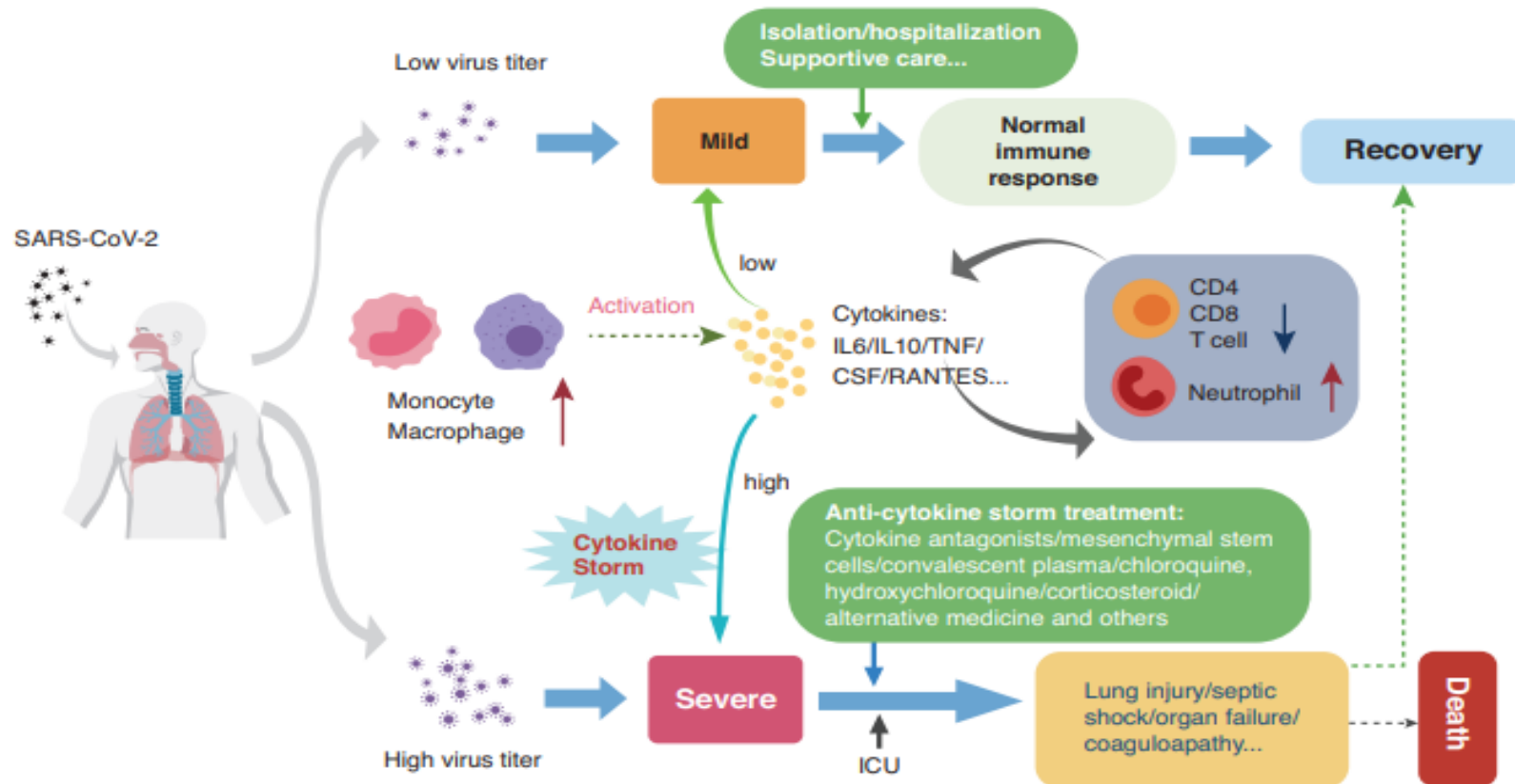
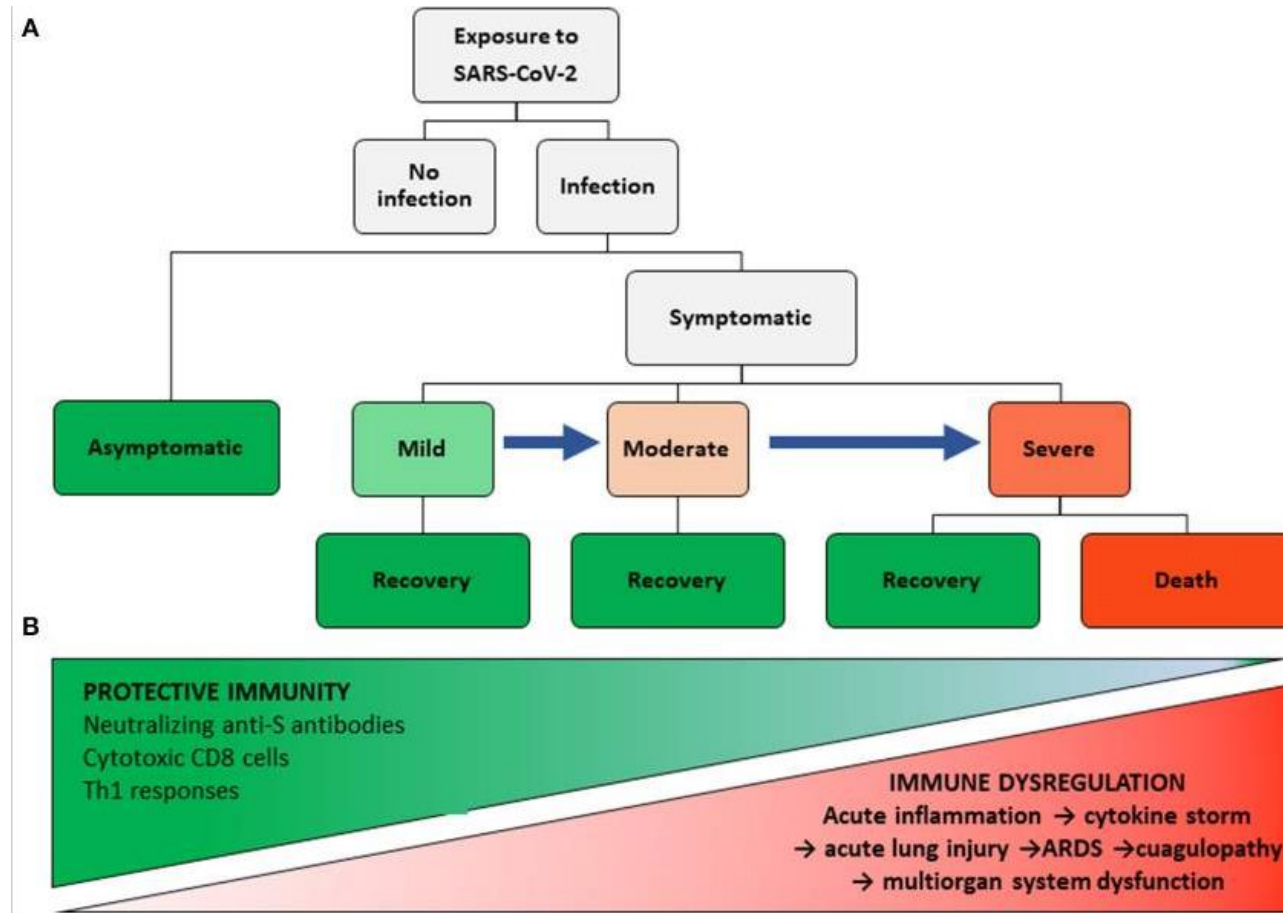


FIGURE 1 Major blood leukocyte, cytokine changes, and therapy strategies in mild vs. severe SARS-CoV-2 infection. Conceptual model of the interplay between immune activation and clinical pathology from patients with mild vs. severe infection, as well as current therapeutic strategies and possible outcome. Figure is made with BioRender (<https://app.biorender.com/>)

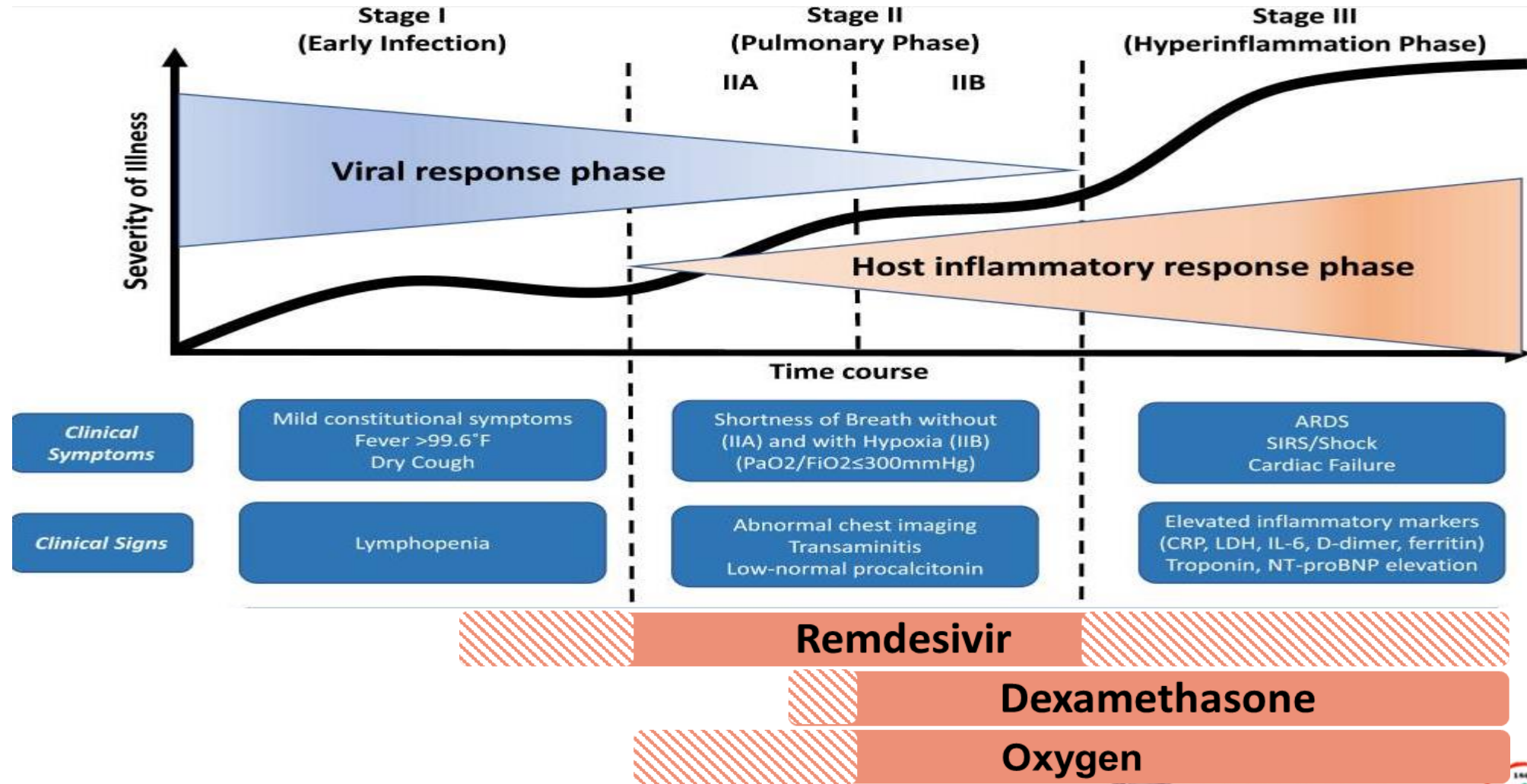
COVID-19 CLINICAL AND IMMUNOLOGICAL SPECTRA



(A) Clinical stages of COVID-19.

(B) Protective immunity and inflammatory spectra.

PATHOPHYSIOLOGY AND STAGES OF ILLNESS





THANK YOU