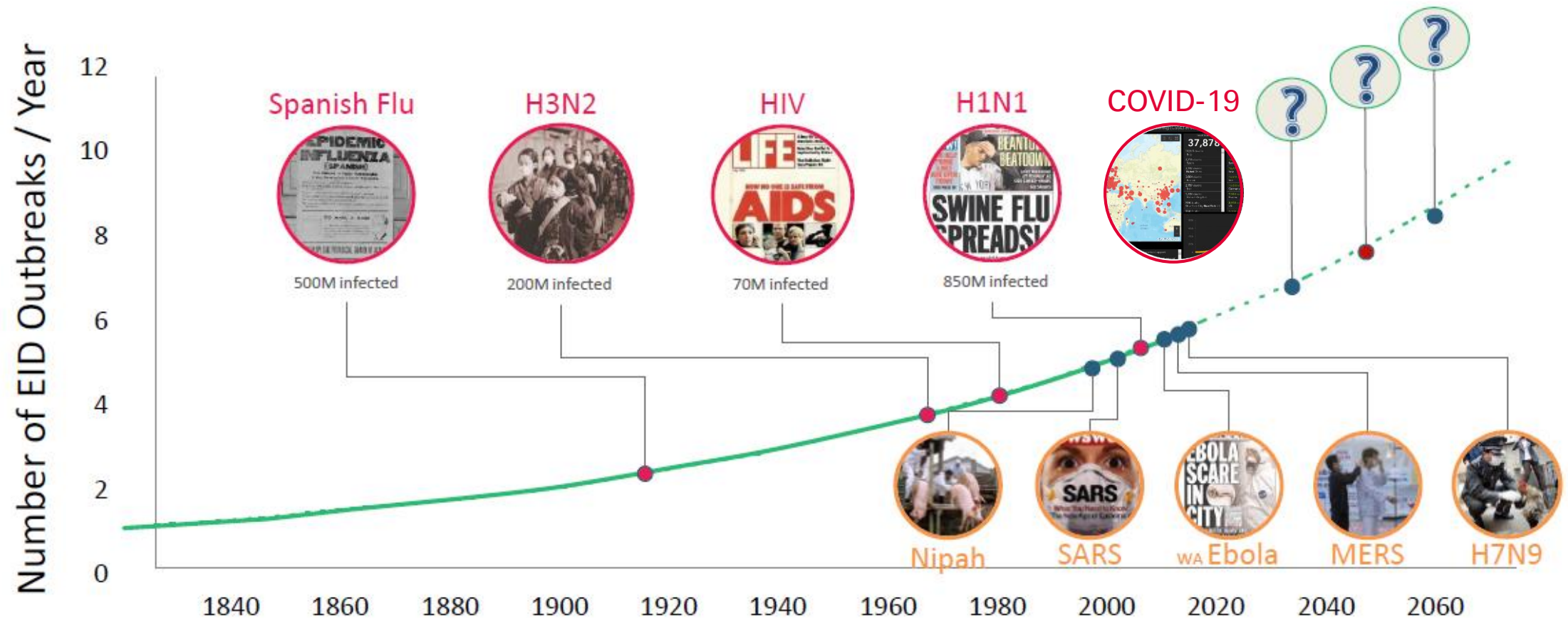# COVID-19

Medical consequences and our hope for medical innovation

Dr. Christoph Nabholz
Head Life & Behaviour R&D
Swiss Re

Emerging infectious diseases are a growing threat

Allan et al. Nature Communications 2017

COVID-19 epidemiology

01

Total Confirmed
5,267,452

Confirmed Cases by Province/State/Dependency

359,926 confirmed
New York US

153,140 confirmed
New Jersey US

105,444 confirmed
Illinois US

90,889 confirmed
Massachusetts US

90,778 confirmed
California US

86,825 confirmed
Lombardia Italy

76,871 confirmed
Sao Paulo Brazil

70,784 confirmed
Pennsylvania US

68,135 confirmed
Hubei China

67,425 confirmed

Admin0   Admin1   Admin2

Last Updated at (M/D/YYYY)
5/23/2020 7:32:43 p.m.

NORTH AMERICA
North Pacific Ocean
EUROPE
ASIA
North Atlantic Ocean
AFRICA
SOUTH AMERICA
South Pacific Ocean
South Atlantic Ocean
Indian Ocean
AUSTRALI

Esri, FAO, NOAA

Cumulative Confirmed Cases

Global Deaths
339,949

96,479 deaths
US

36,757 deaths
United Kingdom

32,735 deaths
Italy

28,628 deaths
Spain

28,218 deaths
France

21,048 deaths
Brazil

9,237 deaths

Global Deaths

US State Level
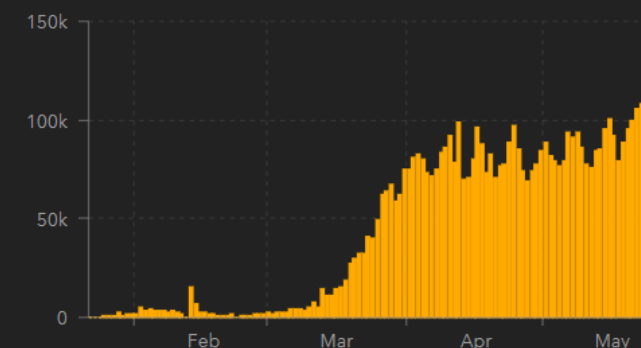Deaths, Recovered

28,905 deaths, 63,292 recovered
New York US

11,082 deaths, 24,491 recovered
New Jersey US

6,228 deaths, recovered
Massachusetts US

5,158 deaths, 28,234 recovered
Michigan US

5,100 deaths, 37,767 recovered
Pennsylvania US

US Deaths, Recov...

150k
100k
50k
0
Feb   Mar   Apr   May

Confirmed   Logarithmic   Daily Cases

Lancet Inf Dis Article: Here. Mobile Version: Here.
Lead by JHU CSSE. Technical Support: Esri Living Atlas team and JHU APL. Financial Support: JHU and NSF. FAQ. Read more in this blog. Contact US.

188
countries/regions

https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6

# Comparison of COVID-19 with other coronaviruses MERS and SARS

Demographics	COVID-19	MERS-CoV	SARS-CoV
Date	Dec 2019	Jun 2012	Nov 2002
Location of first detection	Wuhan, China	Jeddah, Saudi Arabia	Guangdong, China
Age, years (range)	51*/62** (1-102)	56 (14-94)	39.9 (1-91)
Confirmed cases	5'276'452 [†]	2'494	8'096
Case Fatality Rate	339'949 [†] (6%)	858 (37%)	744 (10%)
Health-care worker infected	3.8%* / 10.4%**	9.8%	23.1%

† Data as of 23 May 2020 − Johns Hopkins CSSE (case fatality of clinically confirmed cases only)
* Hubei Province 20 Feb 2020; ** Italy 1 May 2020
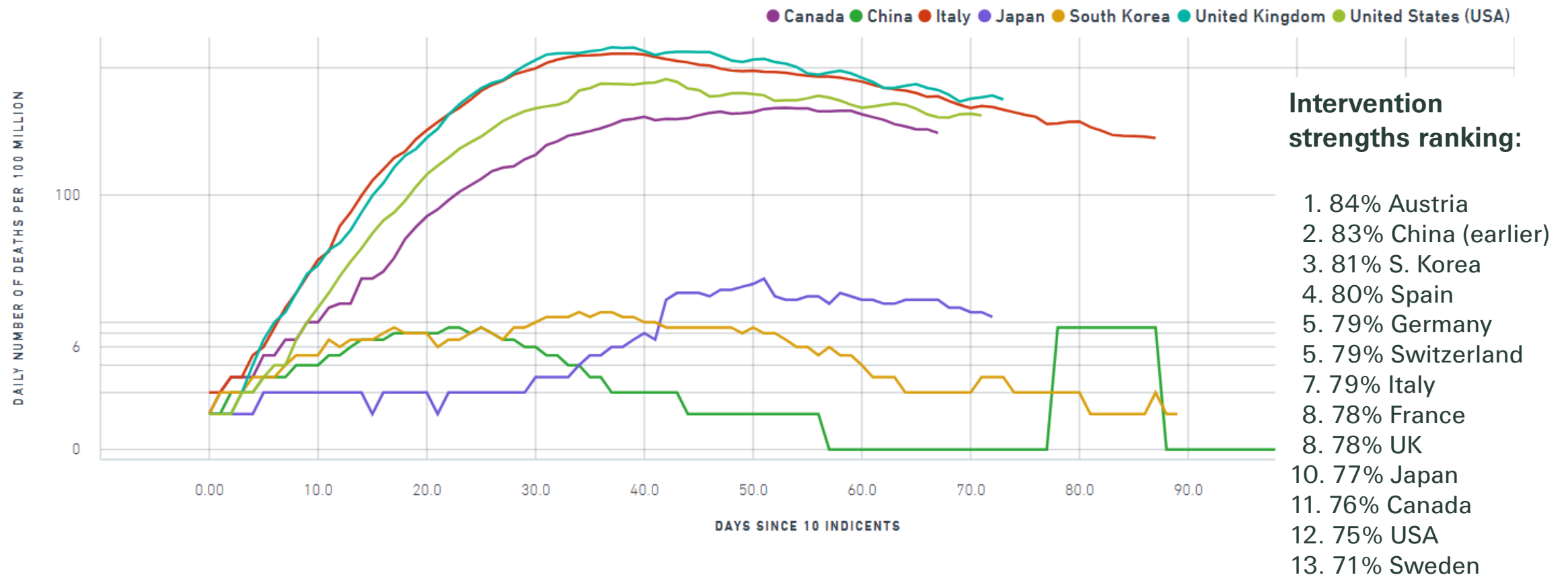
Swiss Re
Institute

Differences between Asia and the Western world: slower containment led to faster death toll

COVID-19 reported deaths over time
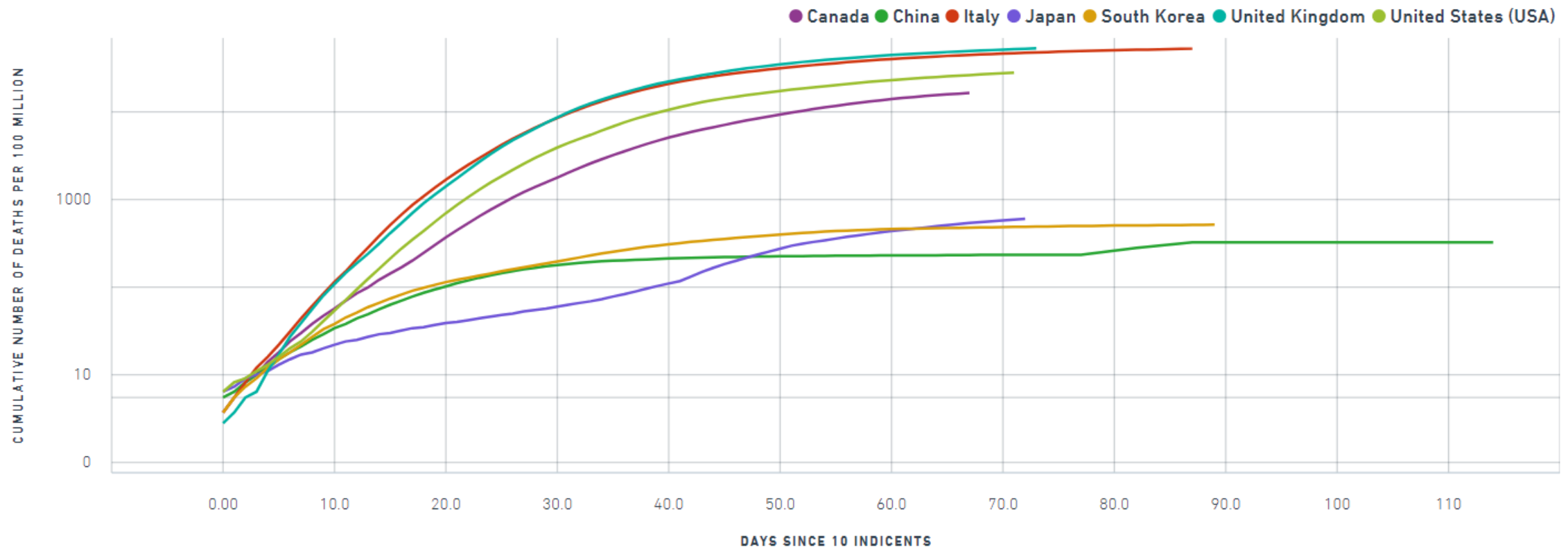
Countries have taken variable social distancing measures of different strengths

COVID-19 reported deaths over time

● Canada ● China ● Italy ● Japan ● South Korea ● United Kingdom ● United States (USA)

DAILY NUMBER OF DEATHS PER 100 MILLION

DAYS SINCE 10 INDICENTS

Intervention strengths ranking:

1. 84% Austria
2. 83% China (earlier)
3. 81% S. Korea
4. 80% Spain
5. 79% Germany
5. 79% Switzerland
7. 79% Italy
8. 78% France
8. 78% UK
10. 77% Japan
11. 76% Canada
12. 75% USA
13. 71% Sweden

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Institute

Social distancing measures in New York as measured by mobility data

Source: IHME https://covid19.healthdata.org/united-states-of-america/new-york
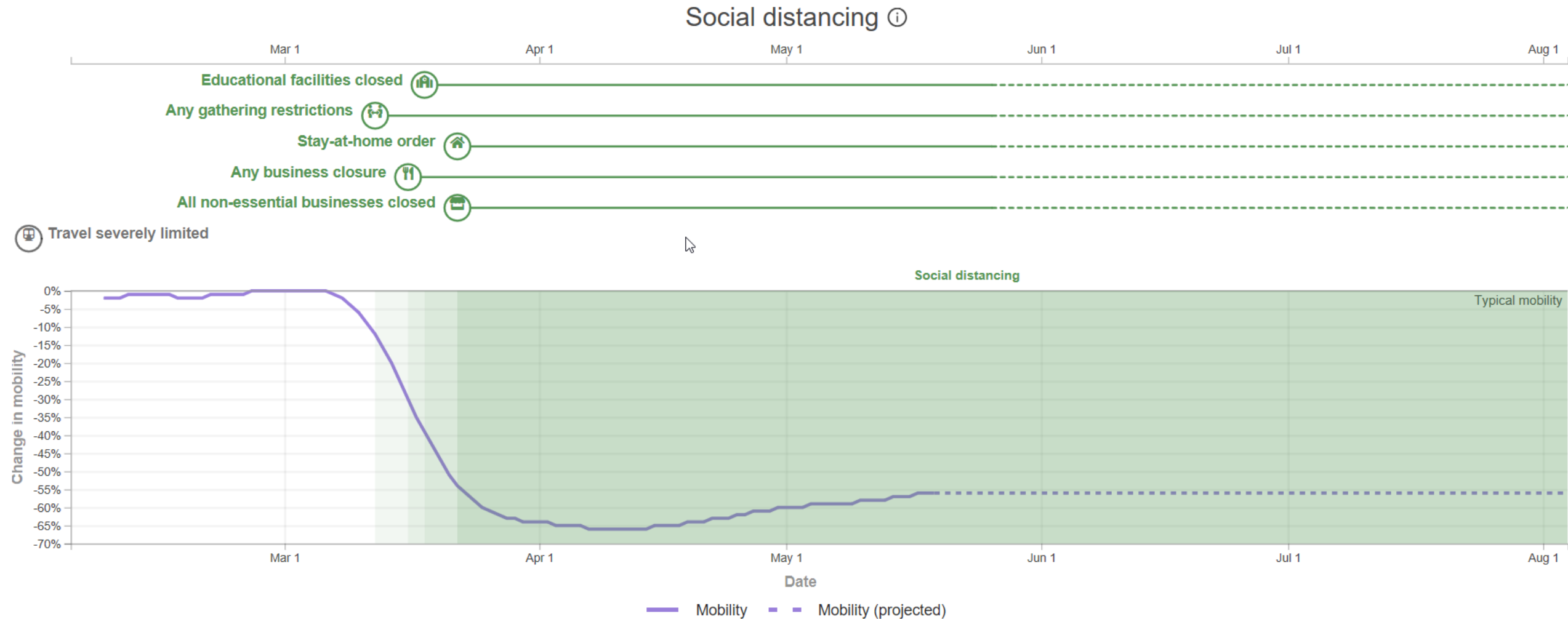
Daily infections confirmed vs estimated in New York

Source: IHME https://covid19.healthdata.org/united-states-of-america/new-york

Daily deaths in New York

Daily deaths ⓘ
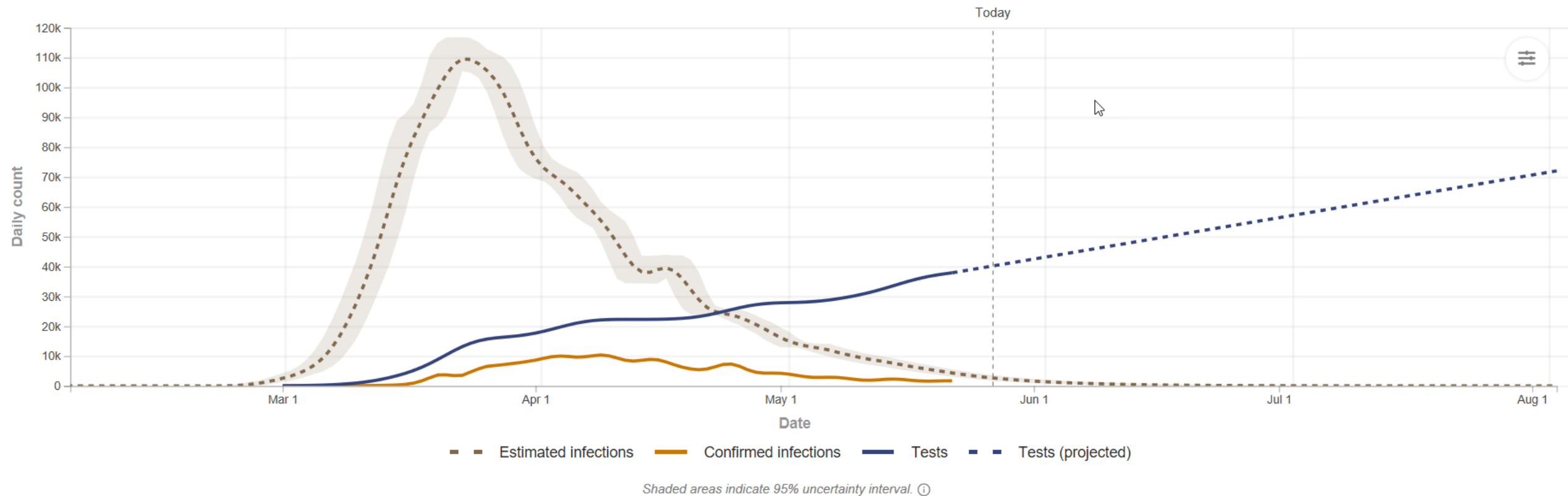
Source: IHME https://covid19.healthdata.org/united-states-of-america/new-york
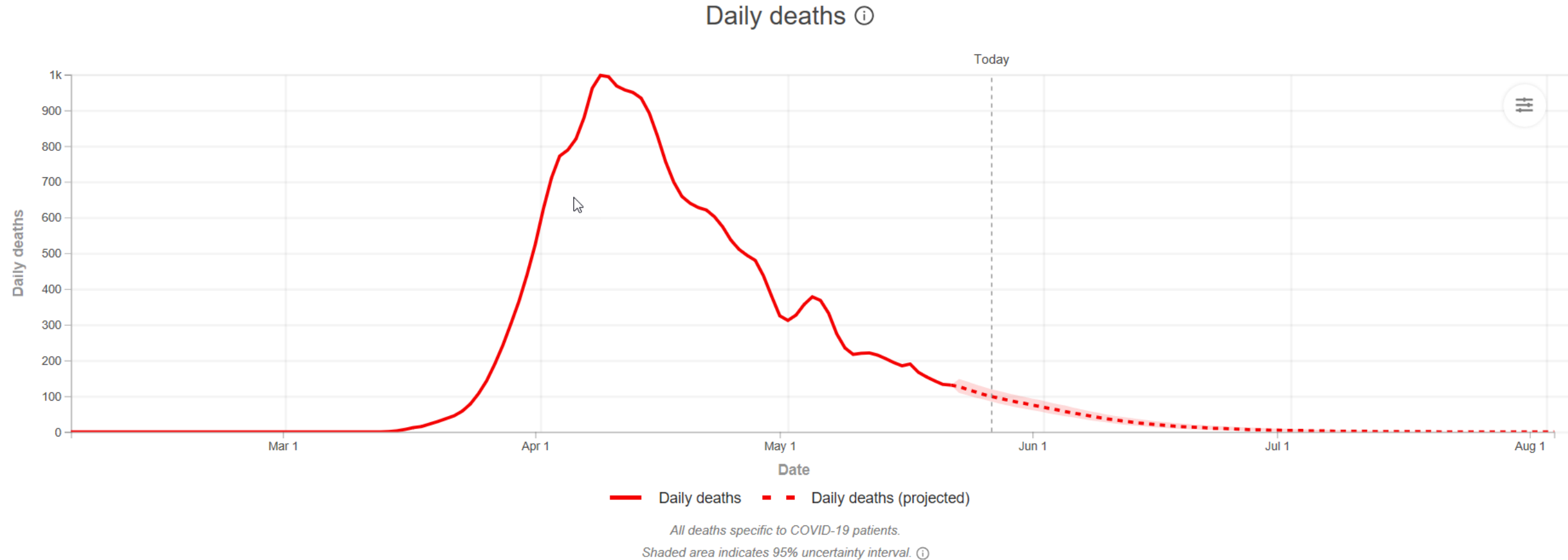
COVID-19 reported cases in the USA

Reported Cases

- ⬤ 0 to 1,000
- ⬤ 1,001 to 5,000
- ⬤ 5,001 to 10,000
- ⬤ 10,001 to 20,000
- ⬤ 20,001 to 40,000
- ⬤ 40,001 or more
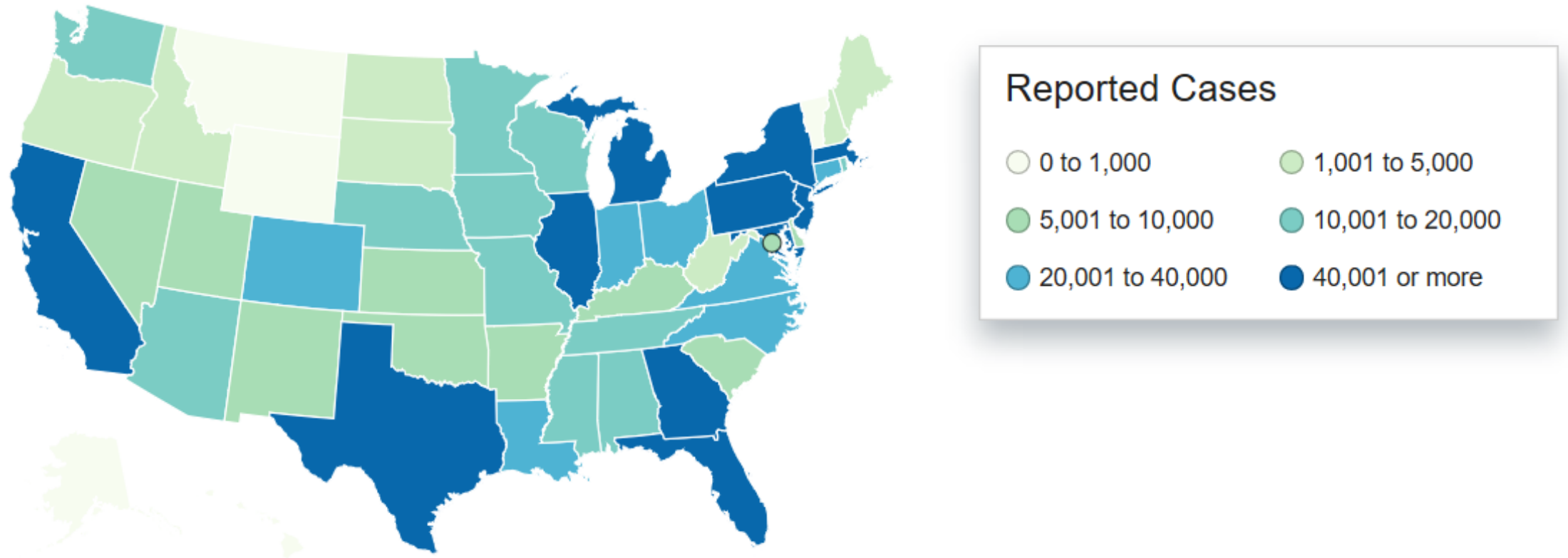
Source: CDC GOV; 21 May 2020
https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html

Spike in US % of deaths due to Pneumonia, Influenza or COVID-19

Source: CDC GOV; Weekly COVID-19 report; 21 May 2020
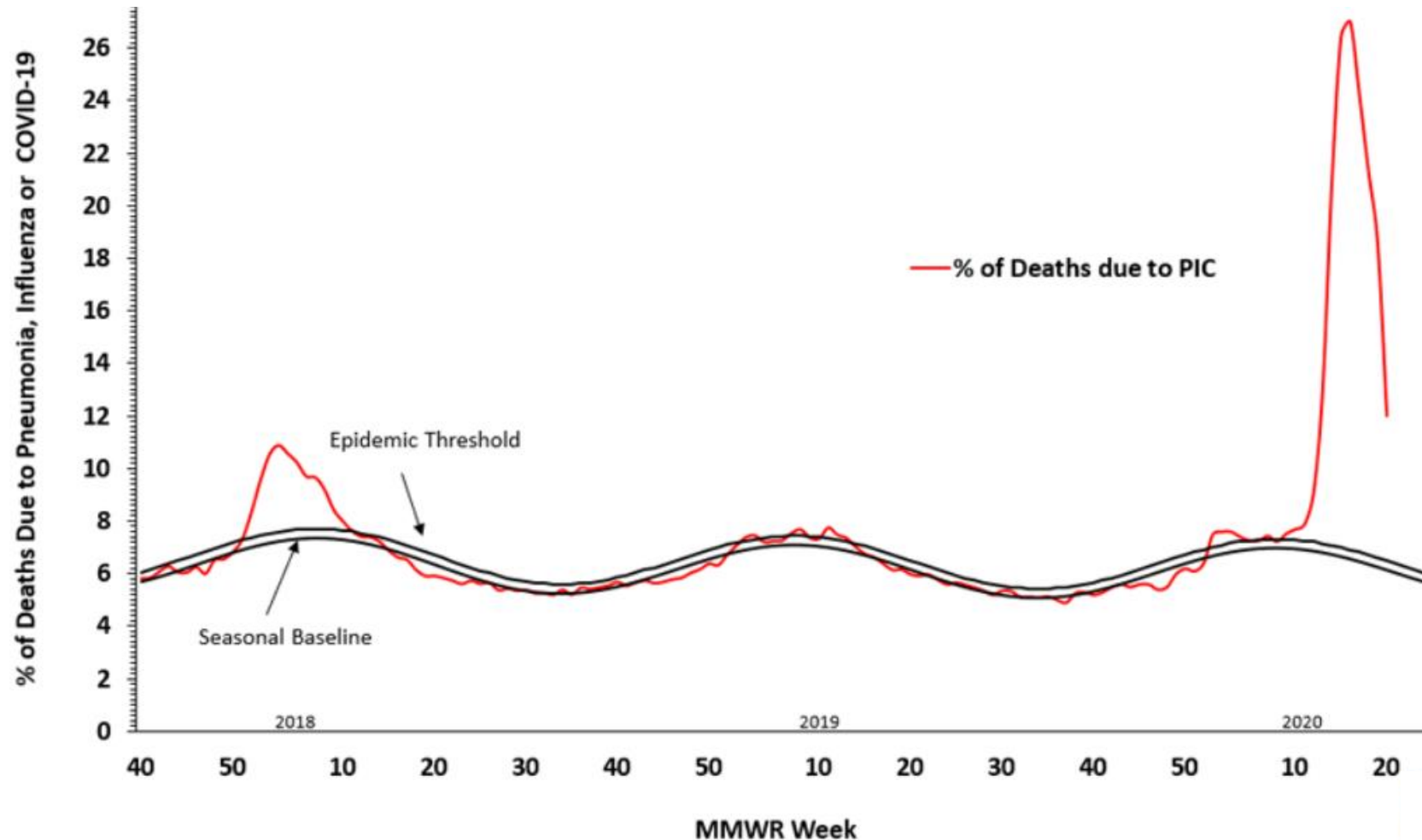
Official COVID-19 death reporting as a % of total excess deaths

Excess mortality since region/country's first 50 covid deaths
Updated on April 28th 08:47 UTC

| REGION / COUNTRY	TIME PERIOD	COVID-19 DEATHS	TOTAL EXCESS DEATHS	COVID-19 AS % OF TOTAL
England and Wales	Mar 14th-Apr 17th	19,088	27,035	71%
Spain	Mar 11th-Apr 14th	18,021	26,844	67%
France	Mar 10th-Apr 13th	14,937	17,398	86%
Lombardy	Mar 1st-Apr 4th	6,132	12,802	48%
New York City	Mar 15th-Apr 11th	10,263	10,994	93%
Netherlands	Mar 16th-Apr 19th	3,664	7,569	48%
Belgium	Mar 16th-Apr 12th	4,519	4,877	93%
Istanbul	Mar 22nd-Apr 25th	1,343	3,067	44%
Sweden	Mar 18th-Apr 14th	1,509	1,677	90%
Jakarta	Mar 1st-Mar 31st	84	1,543	5%
Austria	Mar 23rd-Apr 5th	188	330	57%

[Tracking covid-19 excess deaths across countries](#)

This shows the official COVID-19 deaths as a % of total excess deaths.

The closer to 100% the better the COVID-19 reporting.
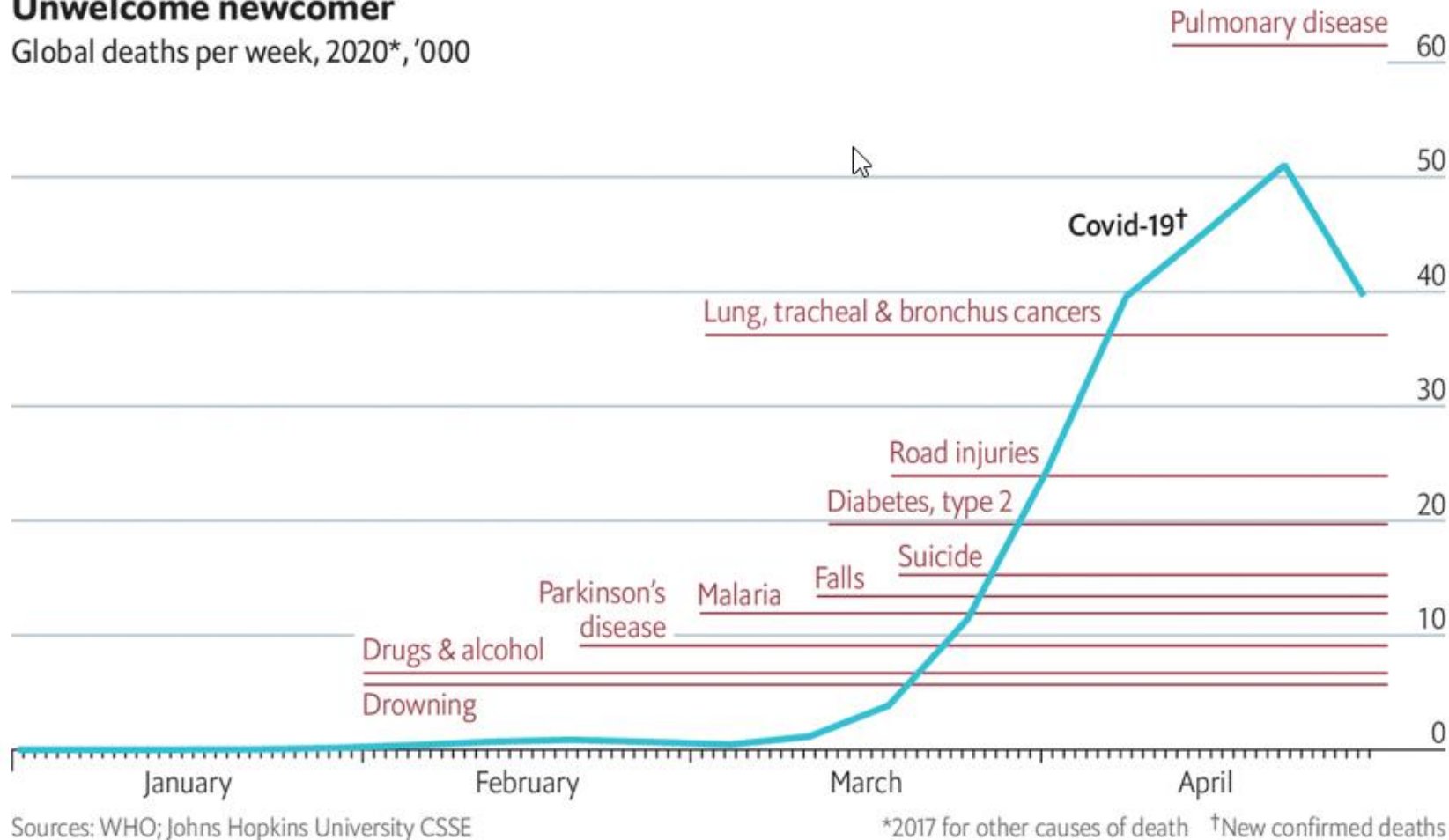
Source: The Economist

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COVID-19 contributes to extra mortality experience in England and Wales

Source: Office of National Statistics (ONS); 11 May 2020
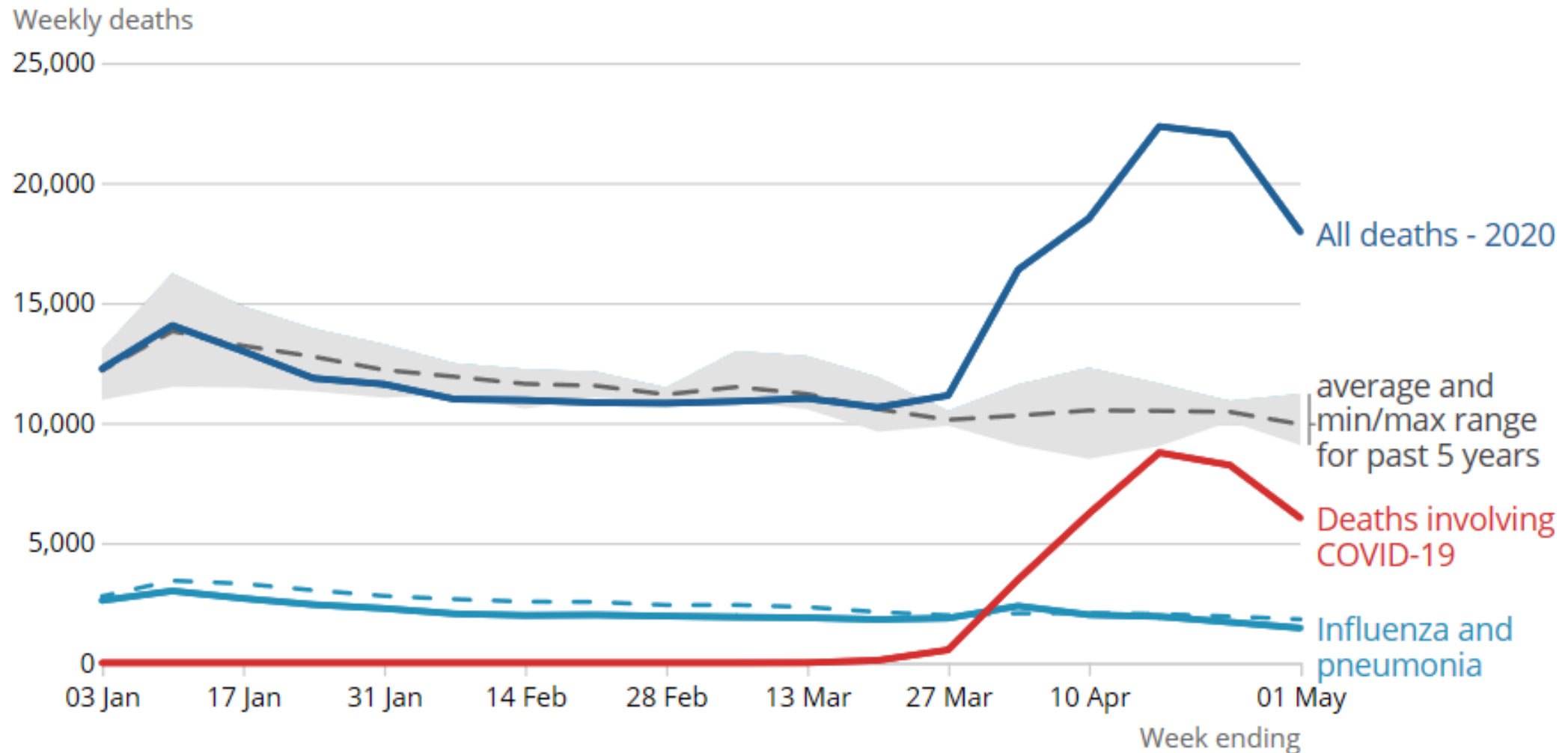
Covid-19 has become one of the biggest causes of death

Unwelcome newcomer
Global deaths per week, 2020*, '000

Pulmonary disease — 60

Covid-19†

Lung, tracheal & bronchus cancers — 40

Road injuries

Diabetes, type 2 — 20

Suicide

Falls

Parkinson's disease   Malaria

Drugs & alcohol — 10

Drowning

January   February   March   April

Sources: WHO; Johns Hopkins University CSSE   *2017 for other causes of death   †New confirmed deaths
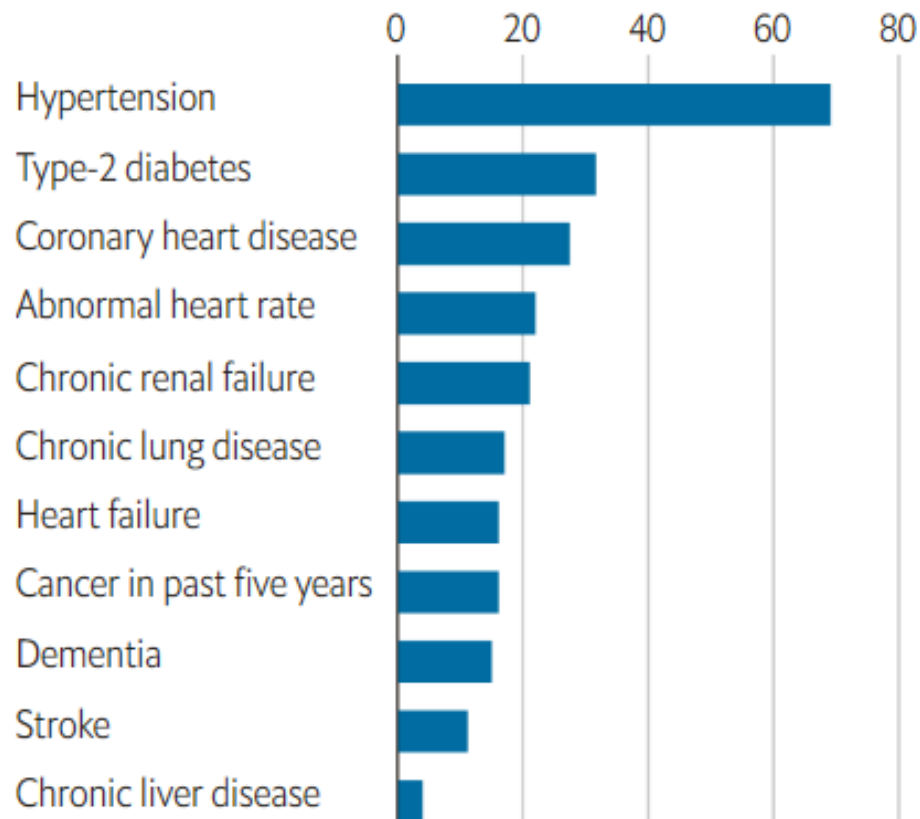
[This year its global toll exceeds that of breast cancer or malaria](#)

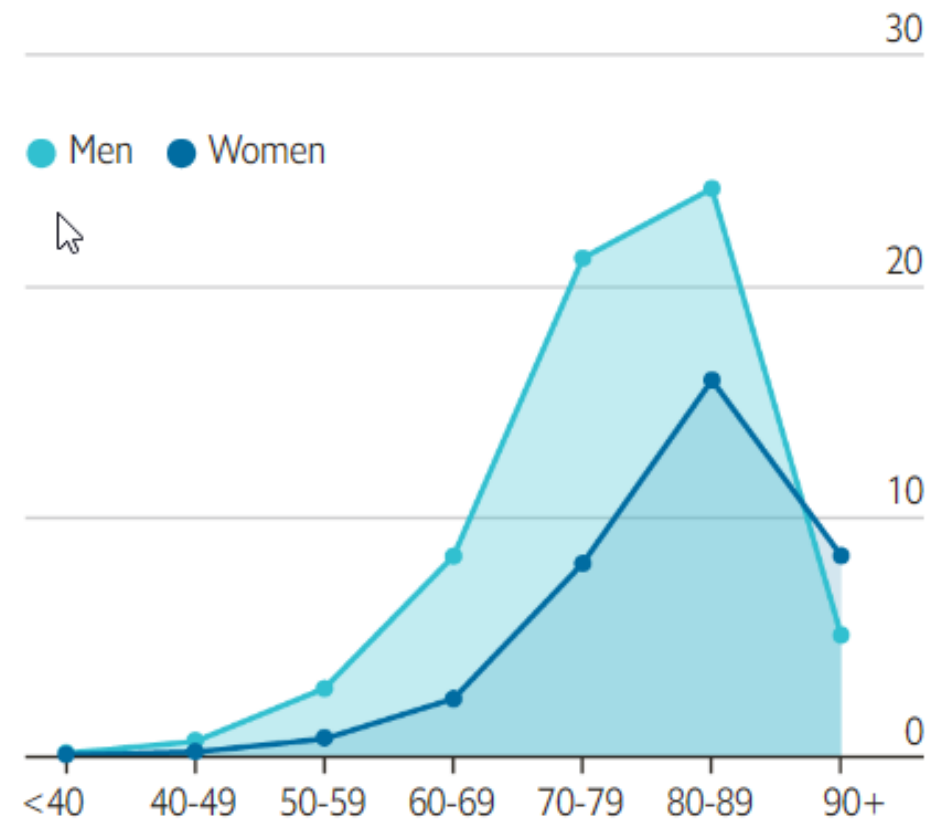Mortality by cause of death will see COVID-19 amongst the top 10 causes of death.

Source: The Economist

Swiss Re
Institute

Mortality experience in Italy driven by male, 60+ and co-morbidity

Italy, share of covid-19 deaths with selected long-term conditions, %

Hypertension
Type-2 diabetes
Coronary heart disease
Abnormal heart rate
Chronic renal failure
Chronic lung disease
Heart failure
Cancer in past five years
Dementia
Stroke
Chronic liver disease

Italy, share of covid-19 deaths by age and sex, %

Men   Women

<40 40-49 50-59 60-69 70-79 80-89 90+

Source: The Economist
Would most covid-19 victims have died soon, without the virus?

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Institute

5683 COVID-19 related hospital death in linked e-health records of 17 million adult NHS patients shows an age, gender and socio economic mortality impact

Age	Deaths HR Fully adj.	95% CI
18-39	0.07	(0.05-0.10)
40-49	0.31	(0.25-0.39)
50-59	1.0	1.0 ref
60-69	2.09	(1.84-2.38)
70-79	4.77	(4.23-5.38)
80+	12.64	(11.19-14.28)

Sex	Deaths HR Fully adj.	95% CI
Female	1.0	1.0
Male	1.99	(1.88-2.10)

Depravation	Deaths HR Fully adj.	95% CI
Least	1.0	1.0
Most	1.75	(1.60-1.91)

17 mio patient her: 5683 deaths were attributed to COVID-19

Death Hazard Ratio (HR) for hospitalized COVID-19 patients is elevated for a number of co-morbidities

Diseases	Deaths HR Fully adj.	95% CI
Diabetes uncontrol.	2.36	(2.18-2.56)
Cancer malig. <1y	3.52	(2.41-5.14)
Liver disease	1.61	(1.33-1.95)
Stroke / dementia	1.79	(1.67-1.93)
Kidney disease	1.72	(1.62-1.83)
Respiratory disease	1.78	(1.67-1.90)

BMI	Deaths HR Fully adj.	95% CI
Non	1.0	1.0 ref
Obese <35	1.27	(1.18-1.36)
Morbid <40	1.56	(1.41-1.73)

Smoking	Deaths HR Fully adj.	95% CI
Never	1.0	1.0 ref
Ex-smoker	1.25	(1.18-1.33)
Current	0.88	(0.79-0.99)

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Increase in mortality, in particular for older age, male, and co-morbid population, partially offset by healthier insureds and lower accidental and flu deaths
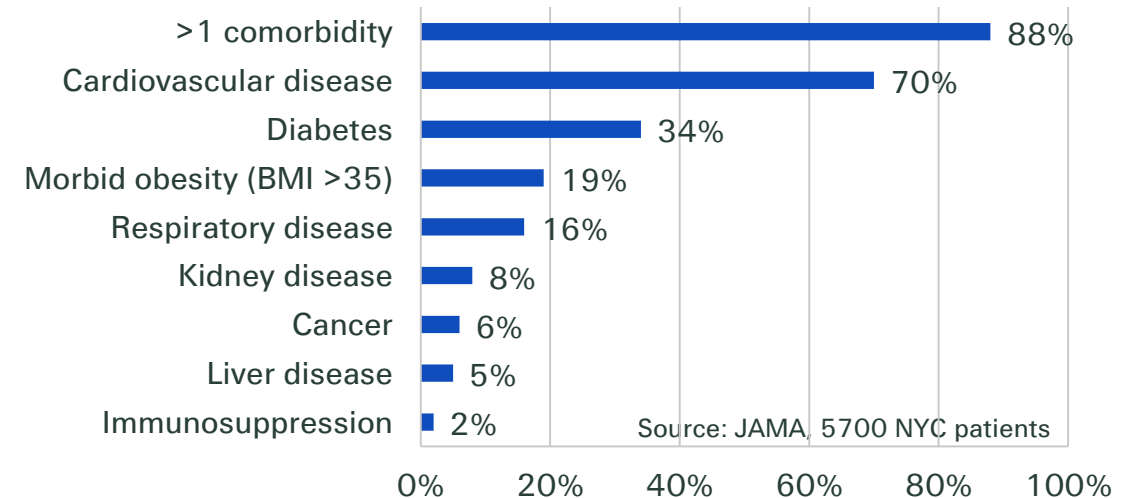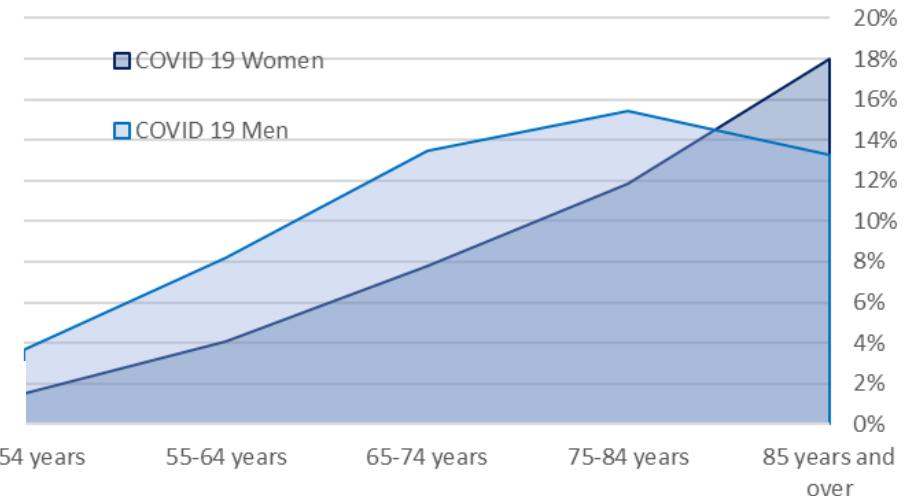
L&H Risk

- **Increase in mortality,** in particular for **older age**, **co-morbid** and **male** population. Partially offset by lower accidental and flu deaths, healthier insured population and different demographic portfolio

- **Longevity** will offer partial off-set to increased mortality claims

- **Unknown mid/long term** impact on **mortality** due to dependence on government intervention and healthcare system performance incl. vaccines and drugs

Males are more severely affected

Source: US CDC (updated May 6)

Legend: COVID 19 Women, COVID 19 Men

X-axis: 45-54 years, 55-64 years, 65-74 years, 75-84 years, 85 years and over

Comorbidity	Percentage
>1 comorbidity	88%
Cardiovascular disease	70%
Diabetes	34%
Morbid obesity (BMI >35)	19%
Respiratory disease	16%
Kidney disease	8%
Cancer	6%
Liver disease	5%
Immunosuppression	2%

Source: JAMA, 5700 NYC patients

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Clinical presentation and interventions
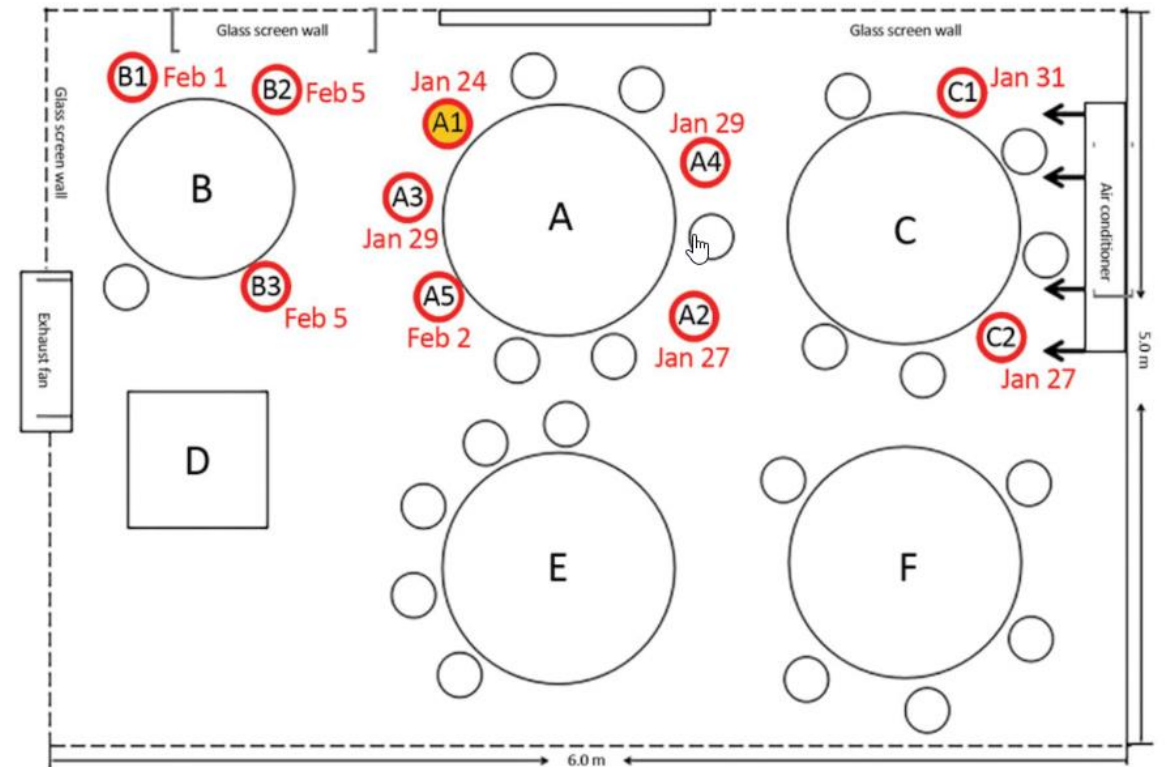
02

Swiss Re Institute

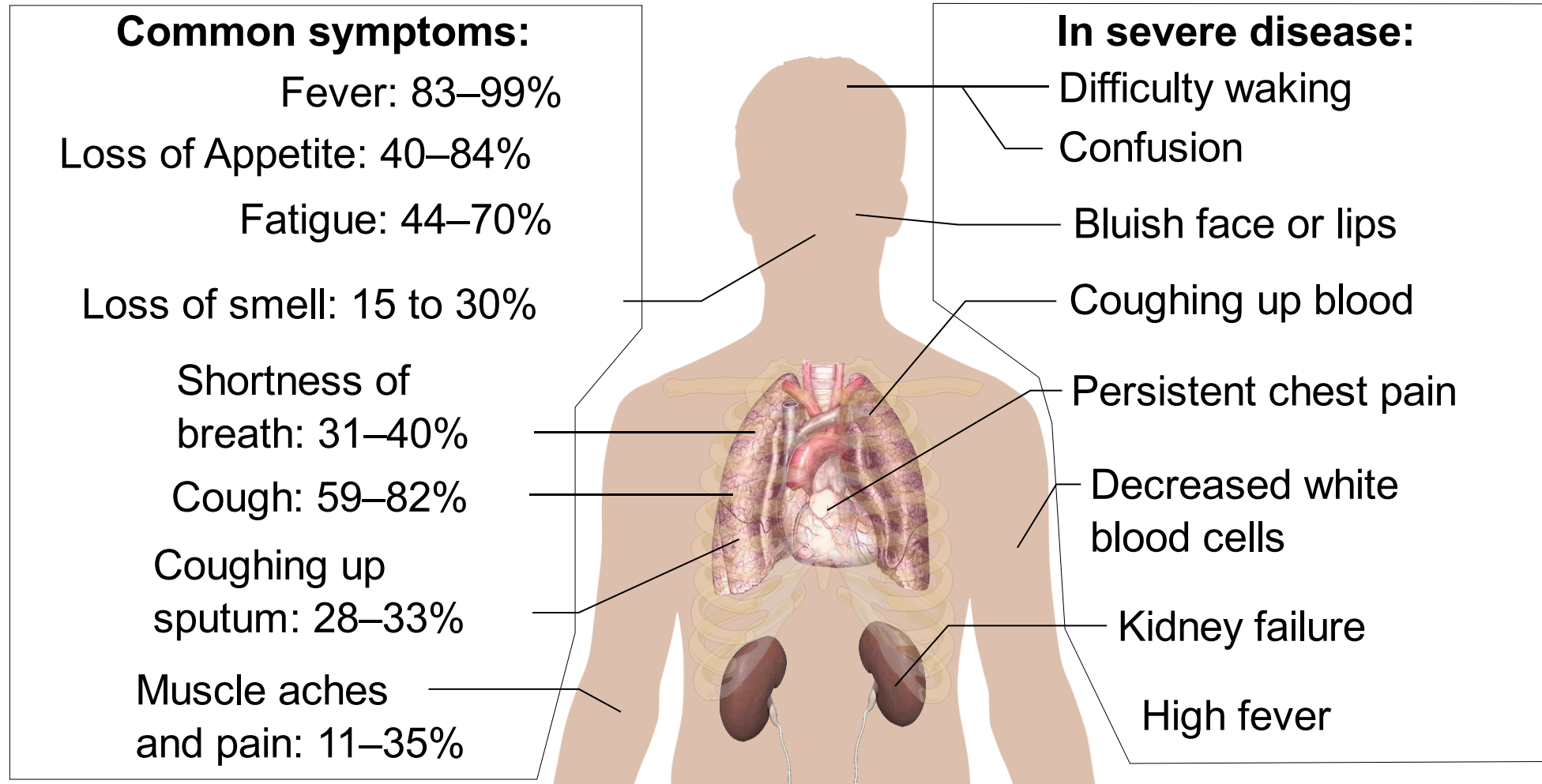# Large respiratory droplets identified as a transmission mode for COVID-19

- The virus is primarily spread between people during **close contact** most often **via small droplets** produced by coughing, sneezing, and talking.

- The droplets usually **fall to the ground** or onto surfaces rather than travelling through air over long distances.

- **Less commonly**, people may become infected by touching a contaminated surface and then touching their face.

- It is most contagious during the **first three days after the onset of symptoms**, although spread is possible before symptoms appear, and from people who do not show symptoms.
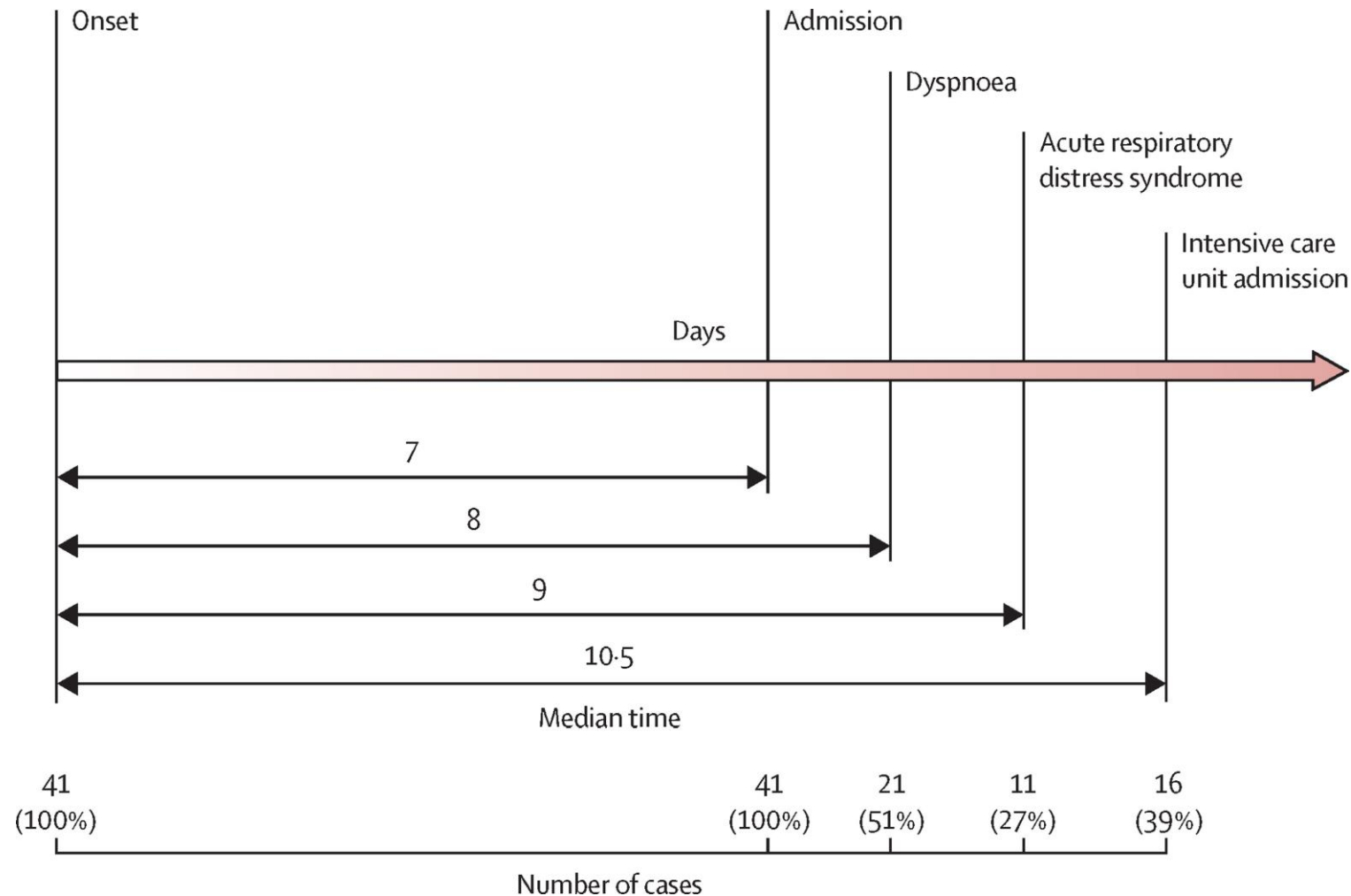
COVID-19 Superspreader Events

Source: Quillette, April 23

COVID-19: what are the symptoms?

Common symptoms:

Fever: 83–99%

Loss of Appetite: 40–84%

Fatigue: 44–70%

Loss of smell: 15 to 30%

Shortness of breath: 31–40%

Cough: 59–82%

Coughing up sputum: 28–33%

Muscle aches and pain: 11–35%

In severe disease:

Difficulty waking

Confusion

Bluish face or lips

Coughing up blood

Persistent chest pain

Decreased white blood cells

Kidney failure

High fever

Source: Wikipedia − COVID-19 pandemic

Timeline of initial COVID-19 cases after onset of illness

Reproductive number (R0)

2.2 (CI 95%: 1.4 - 3.9)

Incubation: 5-6 days

Infectivity:

Peaks 3 days after onset of symptoms

Over a period up to 14 days

**Hospitalized patients:**

14% intensive care unit
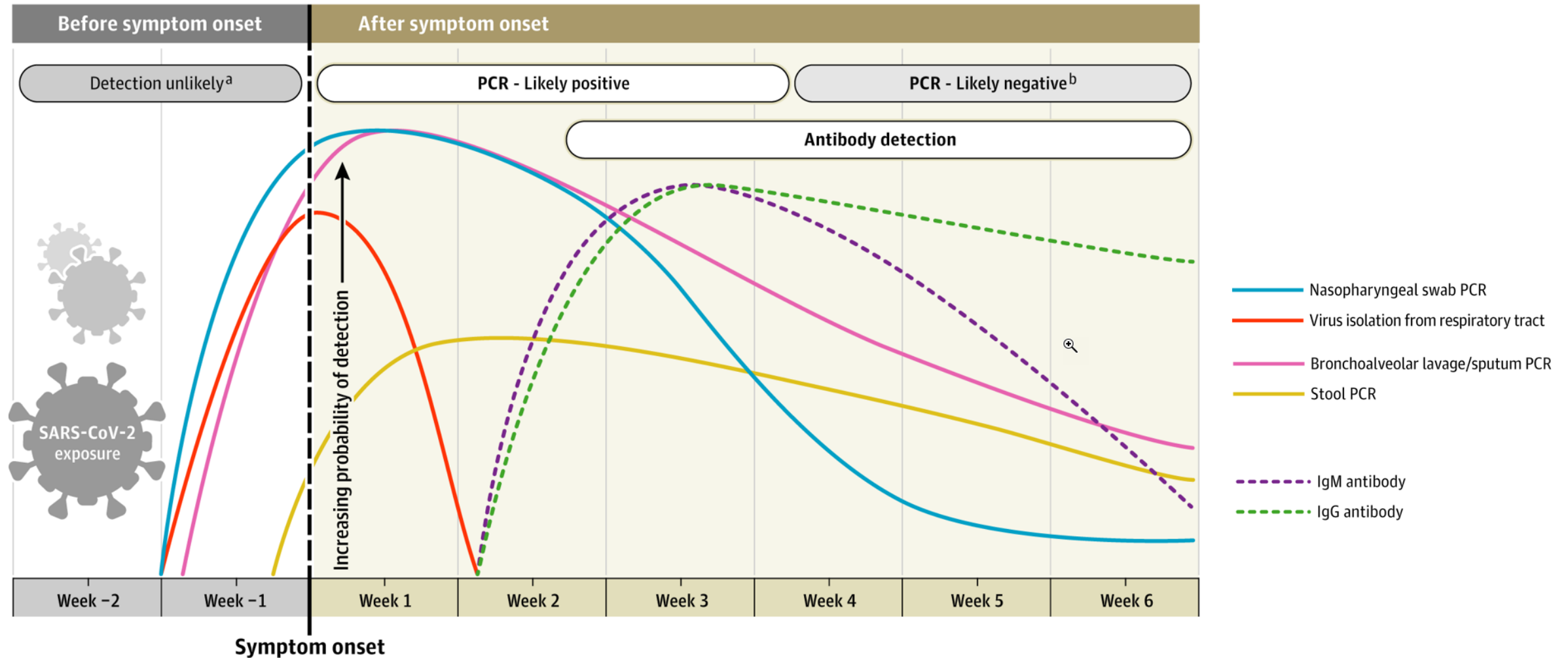
21% died

Asymptomatic patients:

Estimate of 40%

Source: Huang et al. Lancet, 24 Jan 2020 / Li et al. NEJM, Jan 29, 2020

Diagnostics are key in managing the spread of COVID-19

- COVID-19 diagnosis relies on measuring viral RNA by **polymerase chain reaction** (PCR)

- Computer tomography (CT) of the chest has been used where RT-PCR is not available

- **Immunological tests** measuring anti-COVID-19 IgM and IgG have been approved for mass use

- **Population wide testing strategies** are being tested and will be key to get the viral spread under control
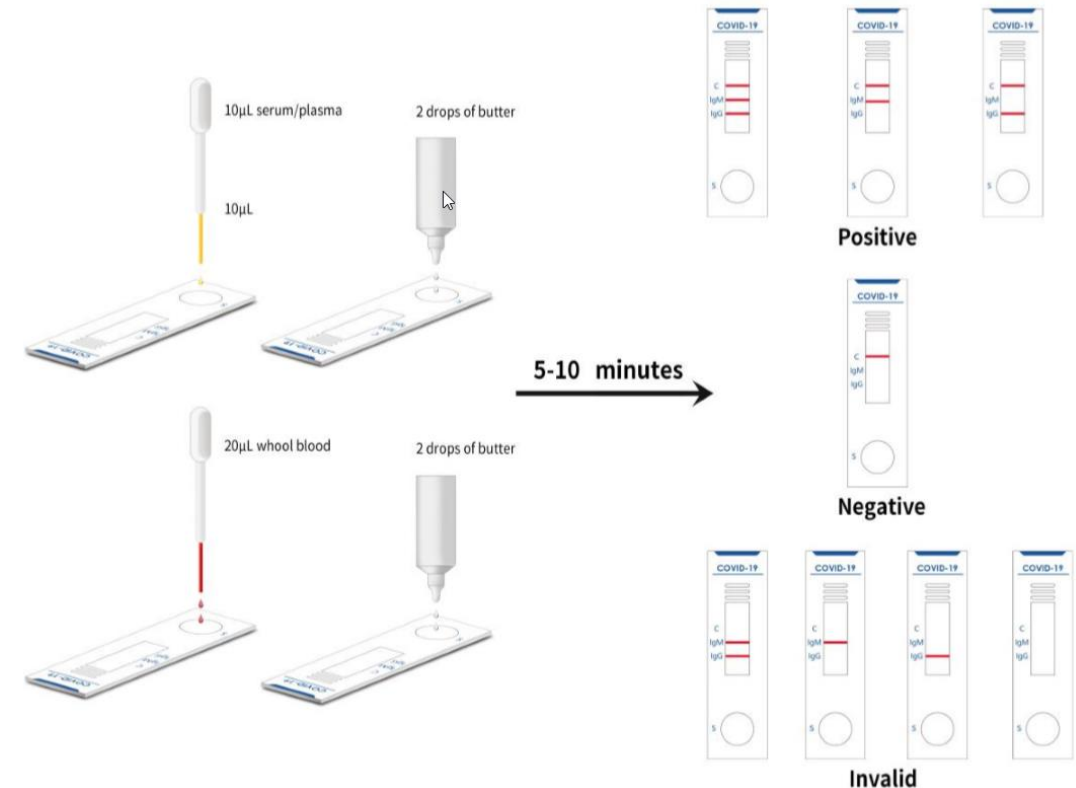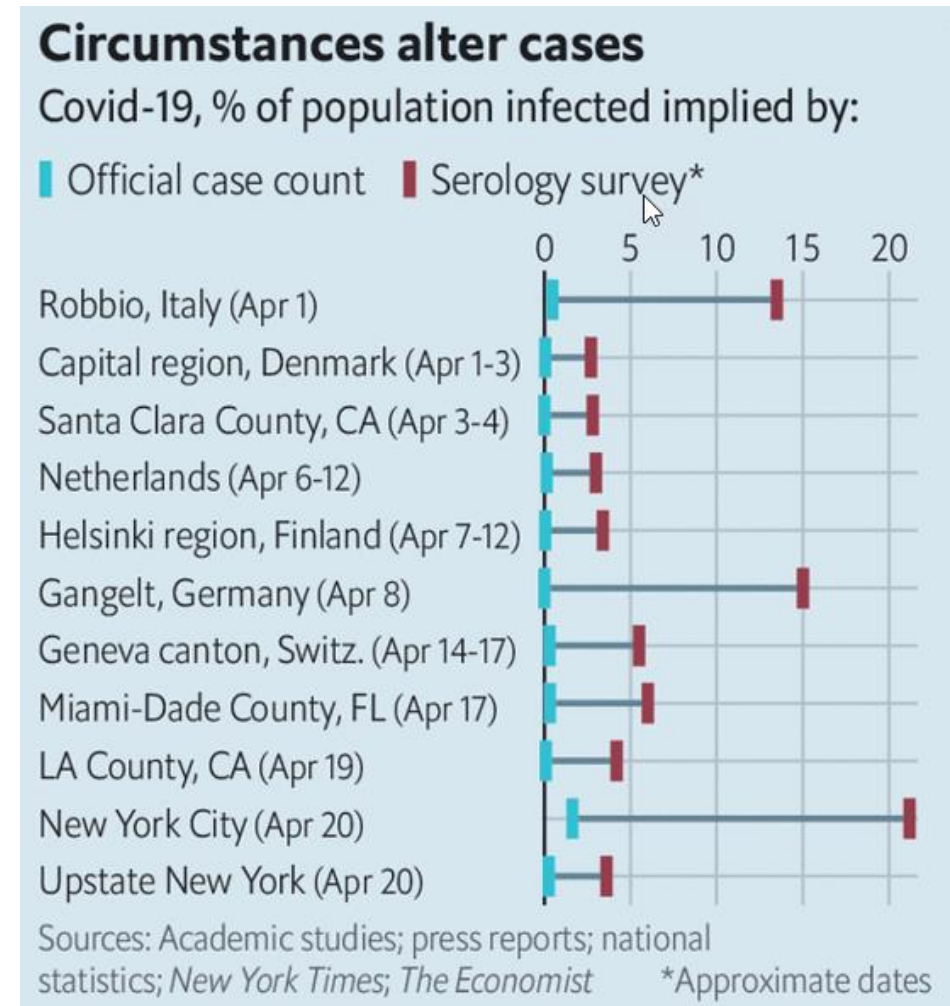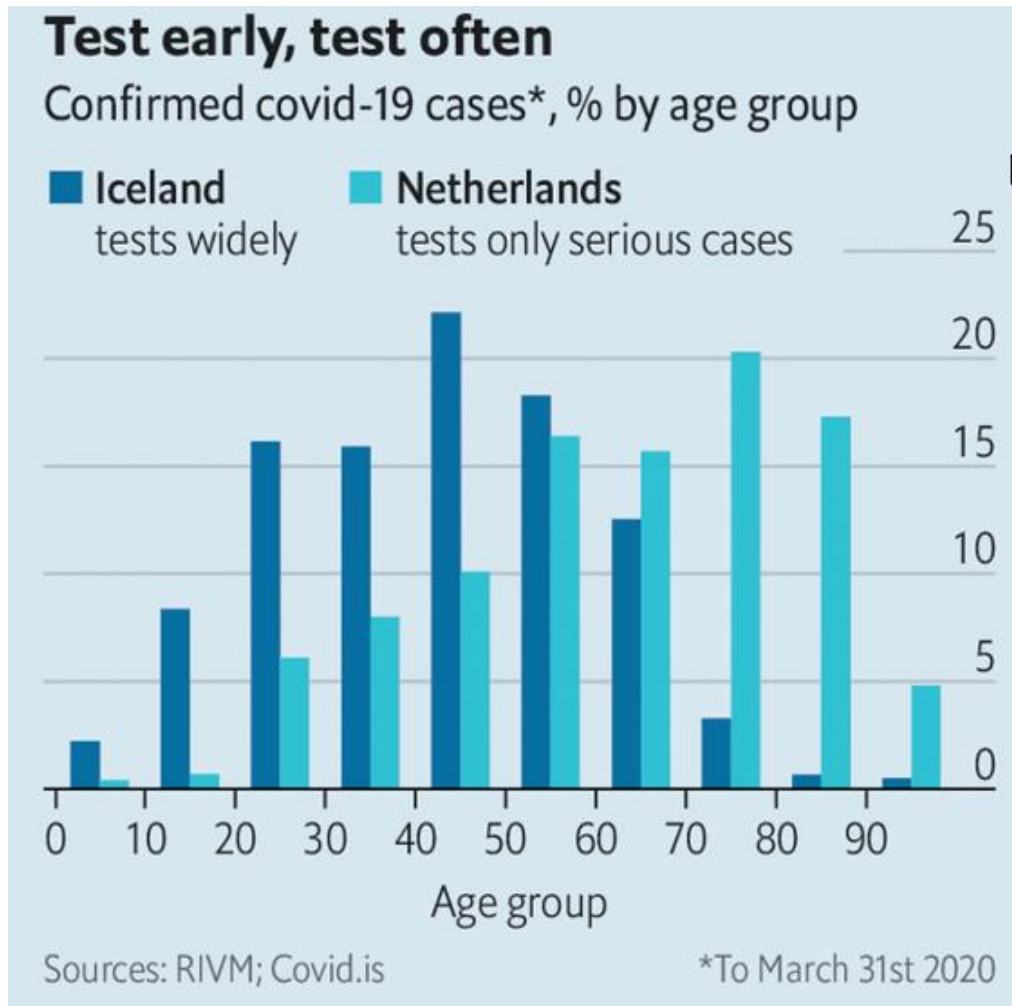

Source: MedicalSystem IgM/ IgG antibody COVID-19 test

When to use diagnostic or serological tests?

# COVID-19 testing strategies differ from country to country

Test early, test often

Confirmed covid-19 cases*, % by age group

■ Iceland tests widely ■ Netherlands tests only serious cases

Age group

Sources: RIVM; Covid.is   *To March 31st 2020

Circumstances alter cases

Covid-19, % of population infected implied by:

▮ Official case count   ▮ Serology survey*

- Robbio, Italy (Apr 1)
- Capital region, Denmark (Apr 1-3)
- Santa Clara County, CA (Apr 3-4)
- Netherlands (Apr 6-12)
- Helsinki region, Finland (Apr 7-12)
- Gangelt, Germany (Apr 8)
- Geneva canton, Switz. (Apr 14-17)
- Miami-Dade County, FL (Apr 17)
- LA County, CA (Apr 19)
- New York City (Apr 20)
- Upstate New York (Apr 20)

Sources: Academic studies; press reports; national statistics; *New York Times; The Economist*   *Approximate dates

Source: The Economist

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Limited treatment available to treat COVID-19 patients

- **No specific treatments are available** for the treatment of COVID-19

- There is one approved **antivirals** available (remdesivir); however, other antivirals are being used as part of clinical trials

- Mainstay of management is optimized supportive care to **relieve symptoms** and to **support organ function** in more severe illness

- All **cases should be isolated** and monitored in a hospital setting; however, home care may be suitable for some patients with mild illness

- Management involves the following principles:
  - **Isolation of suspected** and confirmed cases, and appropriate infection prevention and control measures (standard, droplet, airborne, and contact precautions)
  - **Managing sepsis** (if suspected)
  - Supportive therapies (e.g., oxygen, fluid management, analgesics/antipyretics, empirical **antimicrobials**, intubation, mechanical ventilation)
  - Close monitoring for signs of deterioration

- Patients with impending or established respiratory failure should be admitted to the **intensive care unit**

Source: BMJ Best Practice (adopted)

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Clinical development of first US COVID-19 patient
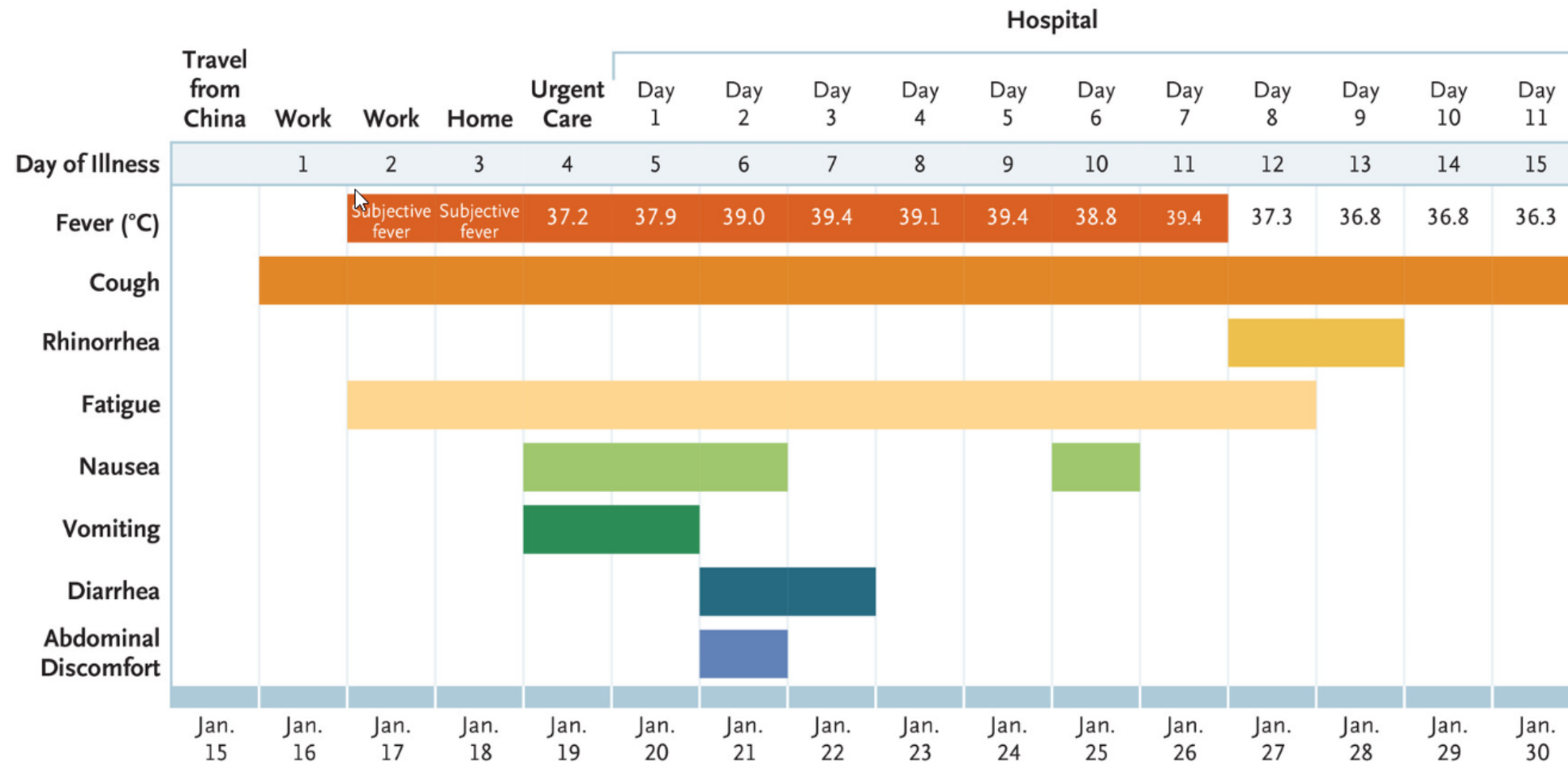
Viral lifecycle and potential COVID-19 drug targets
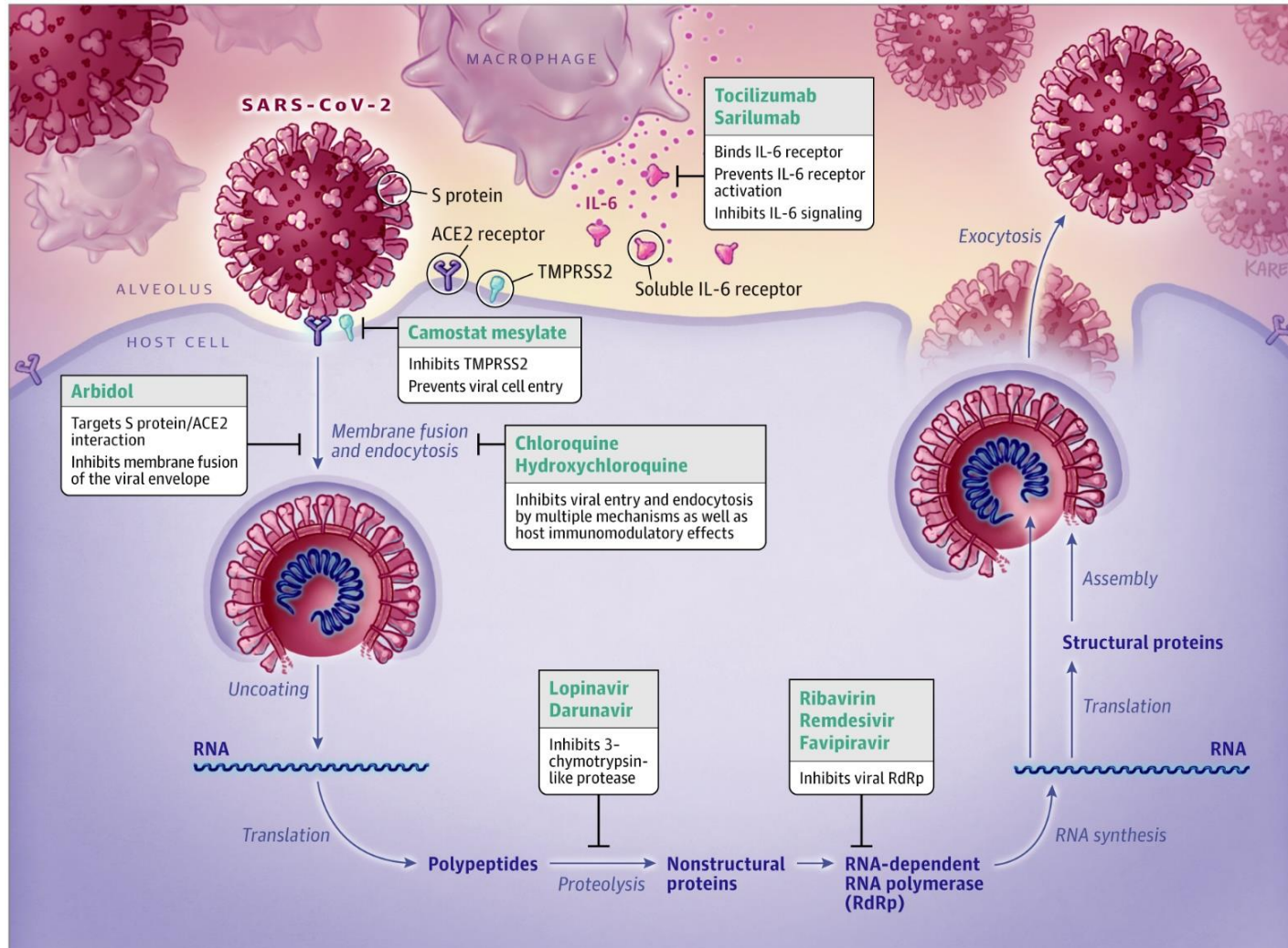
Proposed targets of select repurposed and investigational products are listed

Abbreviations:
- ACE2: angiotensin-converting enzyme 2
- S protein: spike protein
- TMPRSS2: type 2 transmembrane serine protease

Source: JAMA. April 13, 2020.
doi:10.1001/jama.2020.6019

Many promising clinical COVID-19 treatment trials are ongoing

Source: https://www.av.co/covid-treatments, 18 May 2020

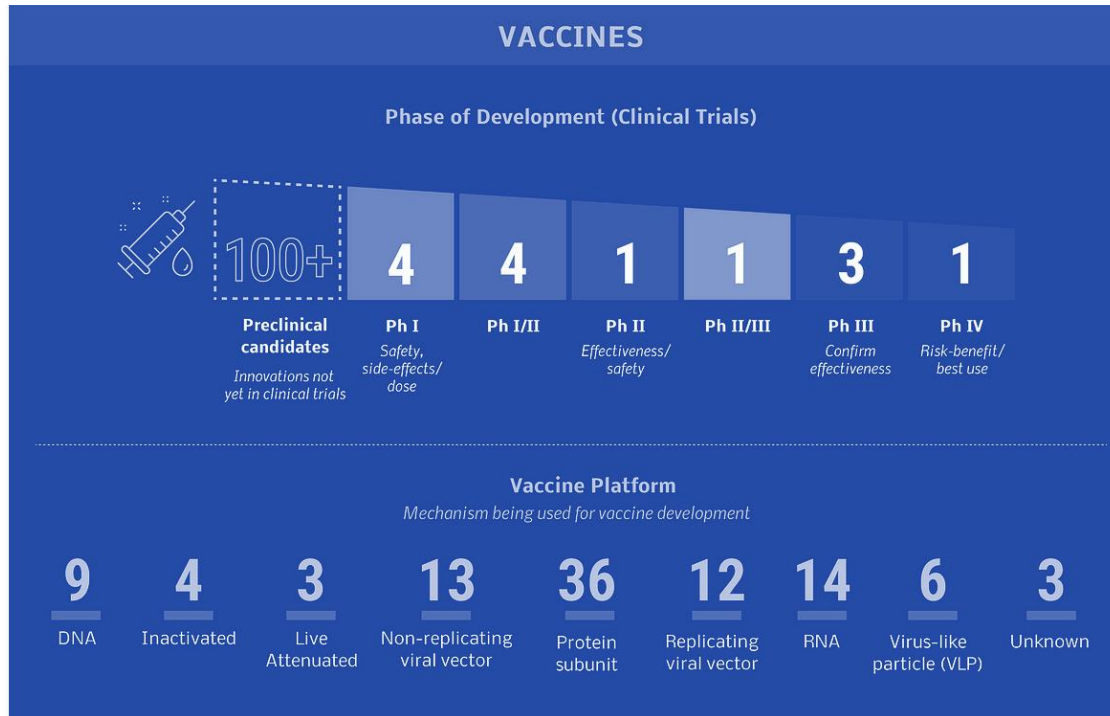**FDA Coronavirus Treatment Acceleration Program:**

- FDA is fast tracking several drugs. **Study protocols** are reviewed within **24 hours** in many cases and reviewing **expanded access** requests within **3 hours**.

WHO streamlining clinical trials:

- To join forces, WHO launched Solidarity trial, which will **reduce the time taken by 80%**. Following treatment options are part of the program:

  ➢ Remdesivir (received approval)
  ➢ Lopinavir/Ritonavir
  ➢ Lopinavir/Ritonavir with Interferon beta-1a
  ➢ Chloroquine or Hydroxychloroquine

Already 13 COVID-19 vaccine candidates are progressing through clinical trials

VACCINES

Phase of Development (Clinical Trials)

100+	4	4	1	1	3	1
Preclinical candidates	Ph I	Ph I/II	Ph II	Ph II/III	Ph III	Ph IV
Innovations not yet in clinical trials	*Safety, side-effects/ dose*		*Effectiveness/ safety*		*Confirm effectiveness*	*Risk-benefit/ best use*

Vaccine Platform
Mechanism being used for vaccine development

9	4	3	13	36	12	14	6	3
DNA	Inactivated	Live Attenuated	Non-replicating viral vector	Protein subunit	Replicating viral vector	RNA	Virus-like particle (VLP)	Unknown

Earliest vaccine availability:
Under best-case assumptions early-mid 2021

Source: https://www.av.co/covid-vaccines, 18 May 2020

COVID-19 vaccine pipeline (as of May 13)

- **13 vaccine candidates** in clinical trials; 90+ preclinical candidates

- **7 advanced** targeted COVID-19 vaccines in **phase I/II** (two unspecific vaccines in phases II/III)

- **Target population:** Preferred applicability for all ages, critical/minimal for adults, including elderly.

- **Effectiveness:** WHO accepts a minimum protection of at least six months to 1 year with an **efficacy of 50-70%** on a population basis.

- **Natural immunity:** SARS and MERS coronavirus epidemics suggests that natural immunity could last **up to three years** or more

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Consumer behaviours
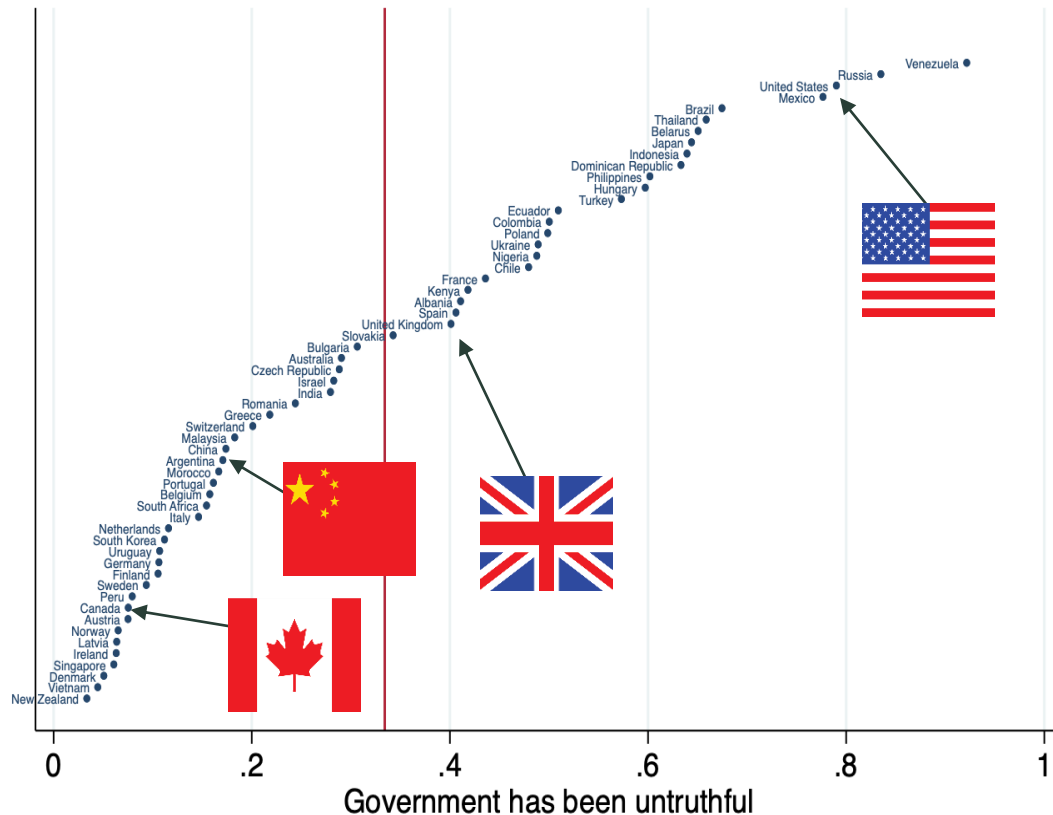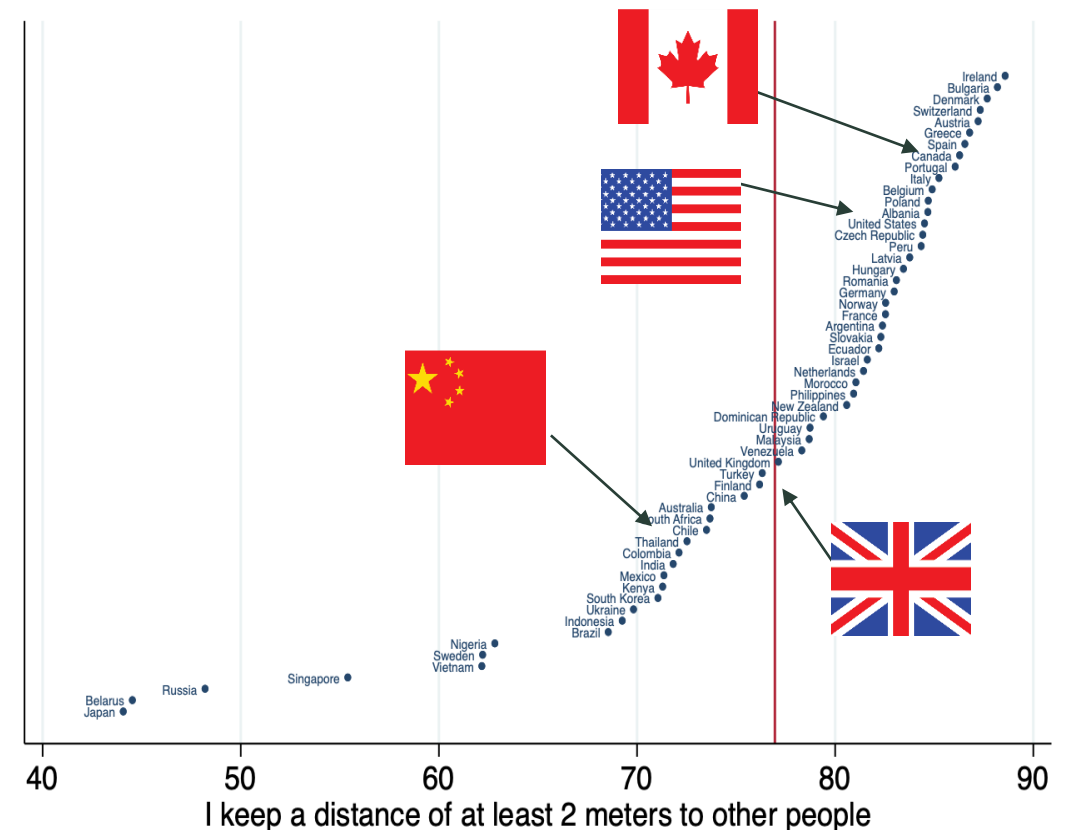
03

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As we relax lock-down measures, level of trust and social distancing behaviour will be key in managing a second wave

"Government has been untruthful"

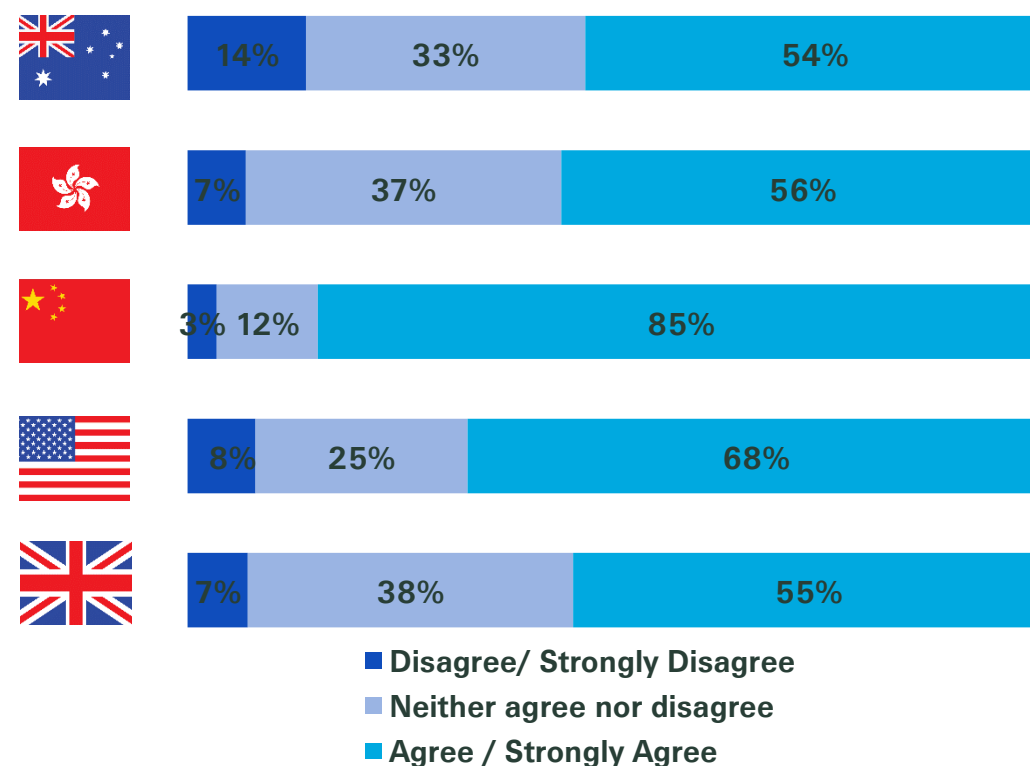"I keep a distance of at least 2 meters to the other people"

Data from Caria, Fetzer, Fiorin, Goetz, Gomez, Haushofer, Hensel, Ivchenko, Jachimowicz, Kraft-Todd, Reutskaja, Roth, Witte, Yoeli (2020). Measuring Worldwide COVID-19 Attitudes and Beliefs, http://www.covid19-survey.org

Younger age segments seek life insurance but there is some distrust regarding pay-out guarantees in selected markets
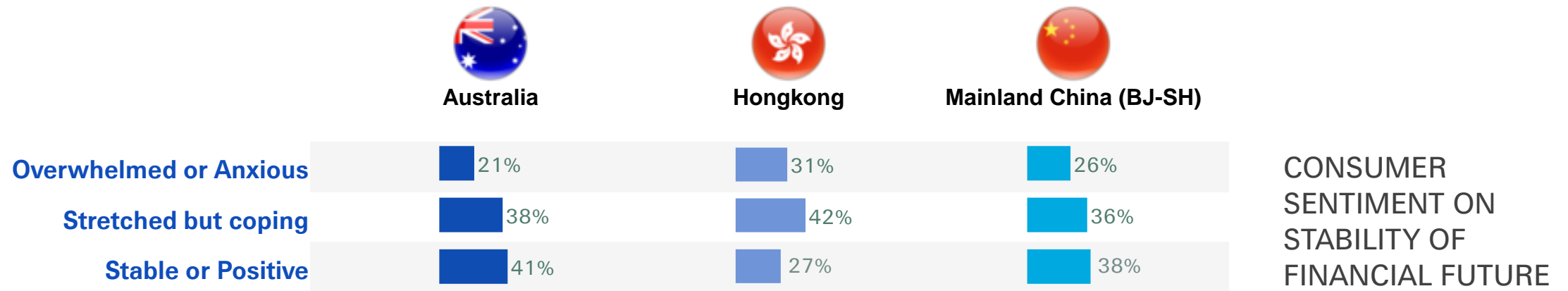
Has the coronavirus made you more or less likely to think about buying a life insurance policy?
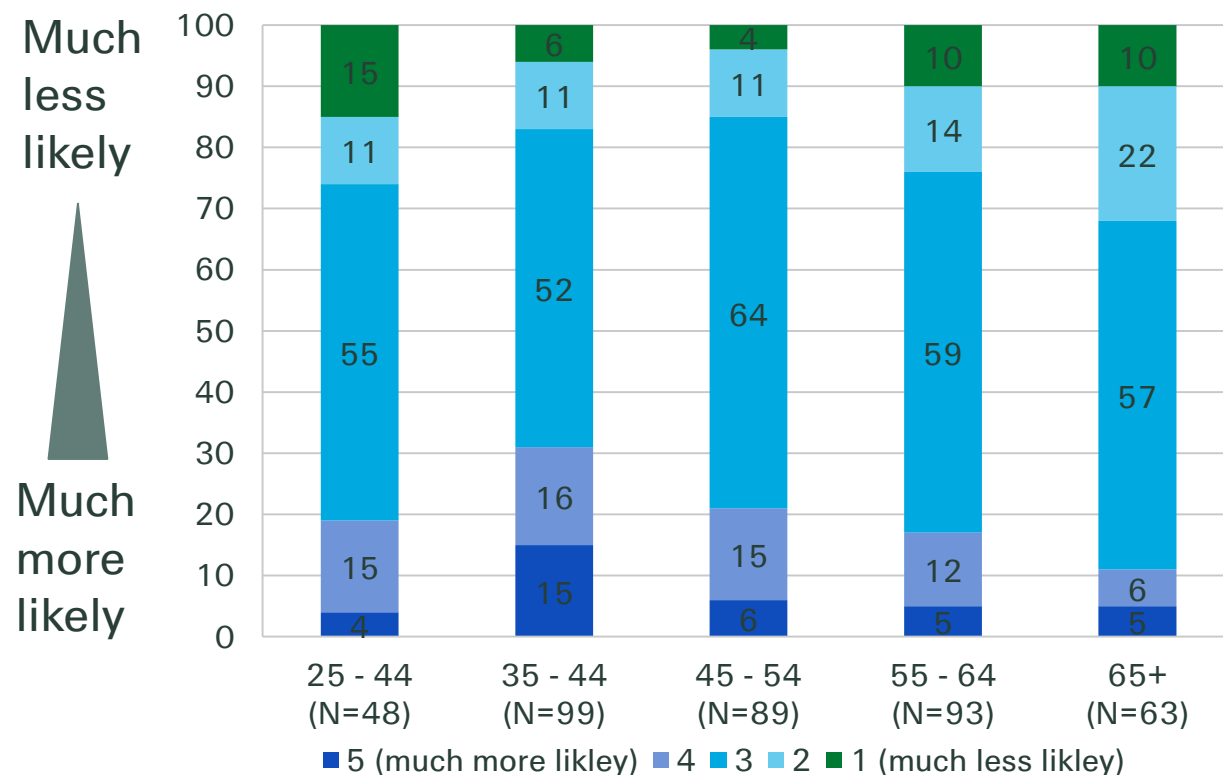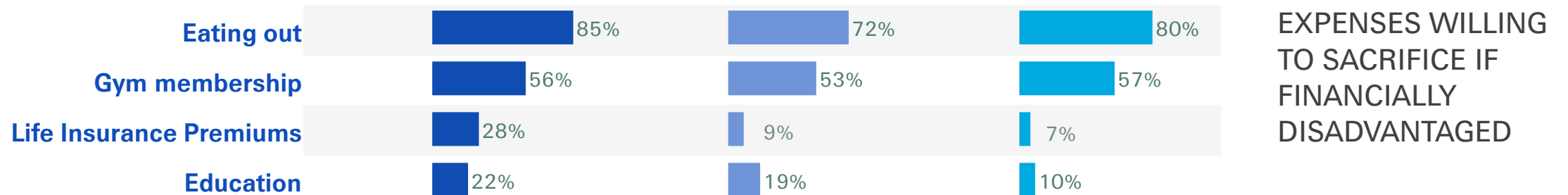
If someone "has" life insurance, and in the coming weeks will die, do you think insurers will pay?

Much less likely

Much more likely

	25 - 44 (N=48)	35 - 44 (N=99)	45 - 54 (N=89)	55 - 64 (N=93)	65+ (N=63)
1 (much less likley)	15	6	4	10	10
2	11	11	11	14	22
3	55	52	64	59	57
4	15	16	15	12	6
5 (much more likley)	4	15	6	5	5

■ 5 (much more likley) ■ 4 ■ 3 ■ 2 ■ 1 (much less likley)

Country	Disagree/ Strongly Disagree	Neither agree nor disagree	Agree / Strongly Agree
Australia	14%	33%	54%
Hong Kong	7%	37%	56%
China	3%	12%	85%
USA	8%	25%	68%
UK	7%	38%	55%

■ Disagree/ Strongly Disagree
■ Neither agree nor disagree
■ Agree / Strongly Agree

Source: Will Trump (Life Capital) & Alpha March 2020

COVID-19 has strongly affected the financial stability of up to a third of people across key Asian markets making them think about cutting expenses

	Australia	Hongkong	Mainland China (BJ-SH)	
Overwhelmed or Anxious	21%	31%	26%	CONSUMER SENTIMENT ON STABILITY OF FINANCIAL FUTURE
Stretched but coping	38%	42%	36%	
Stable or Positive	41%	27%	38%	

Eating out and gym memberships are the most disposable luxuries

|	Australia	Hongkong	Mainland China (BJ-SH)	
Eating out	85%	72%	80%	EXPENSES WILLING TO SACRIFICE IF FINANCIALLY DISADVANTAGED
Gym membership	56%	53%	57%	
Life Insurance Premiums	28%	9%	7%	
Education	22%	19%	10%	

Nearly half of all respondents are more concerned about mental health

How (much more) concerned about mental health now because of COVID-19? – by country
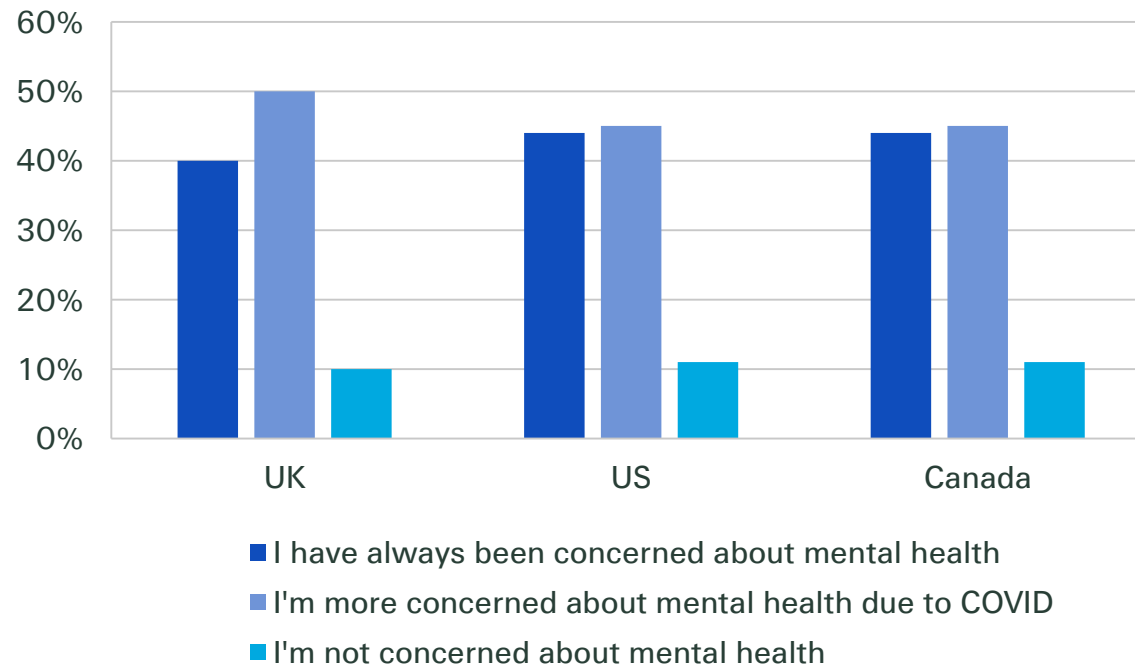

- ■ I have always been concerned about mental health
- ■ I'm more concerned about mental health due to COVID
- ■ I'm not concerned about mental health

How (much more) concerned about mental health now because of COVID-19? – by age

- ■ I have always been concerned about mental health
- ■ I'm more concerned about mental health due to COVID
- ■ I'm not concerned about mental health
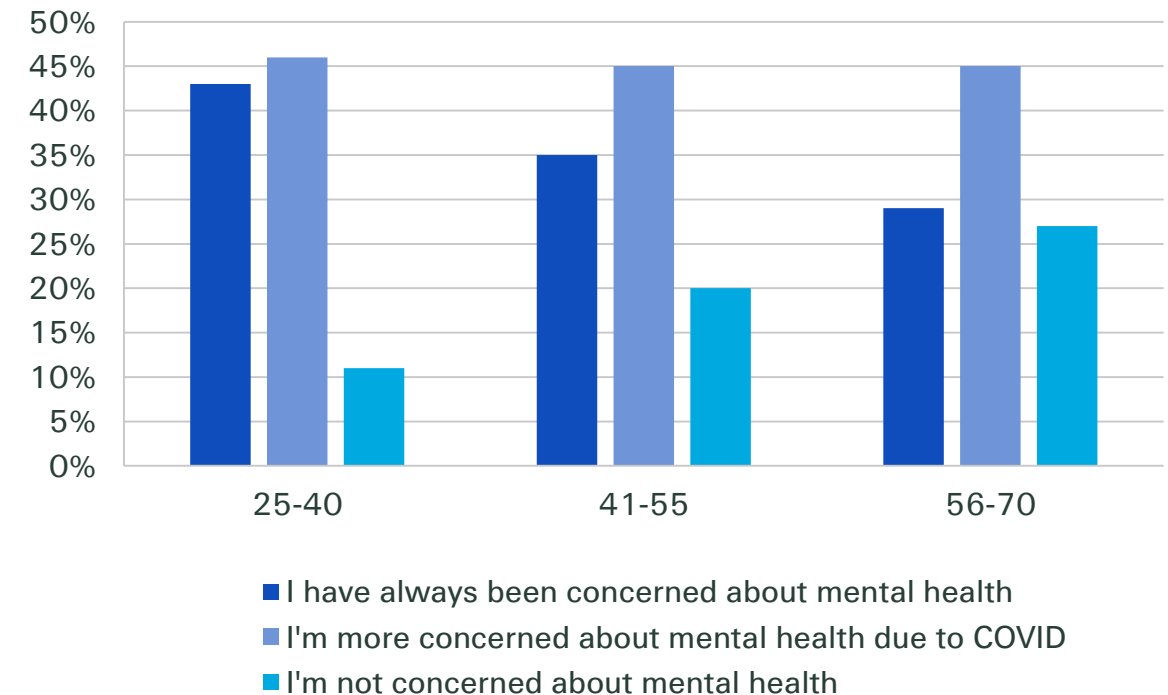
Key messages

- **Increase in mortality,** in particular for **older age**, **co-morbid** and **male** population

- **Unknown mid/long term** impact on **mortality** due to uncertainty of future interventions, vaccine and drug pipeline

- Increased **risk awareness** and concern around **economic situation** and **mental health**
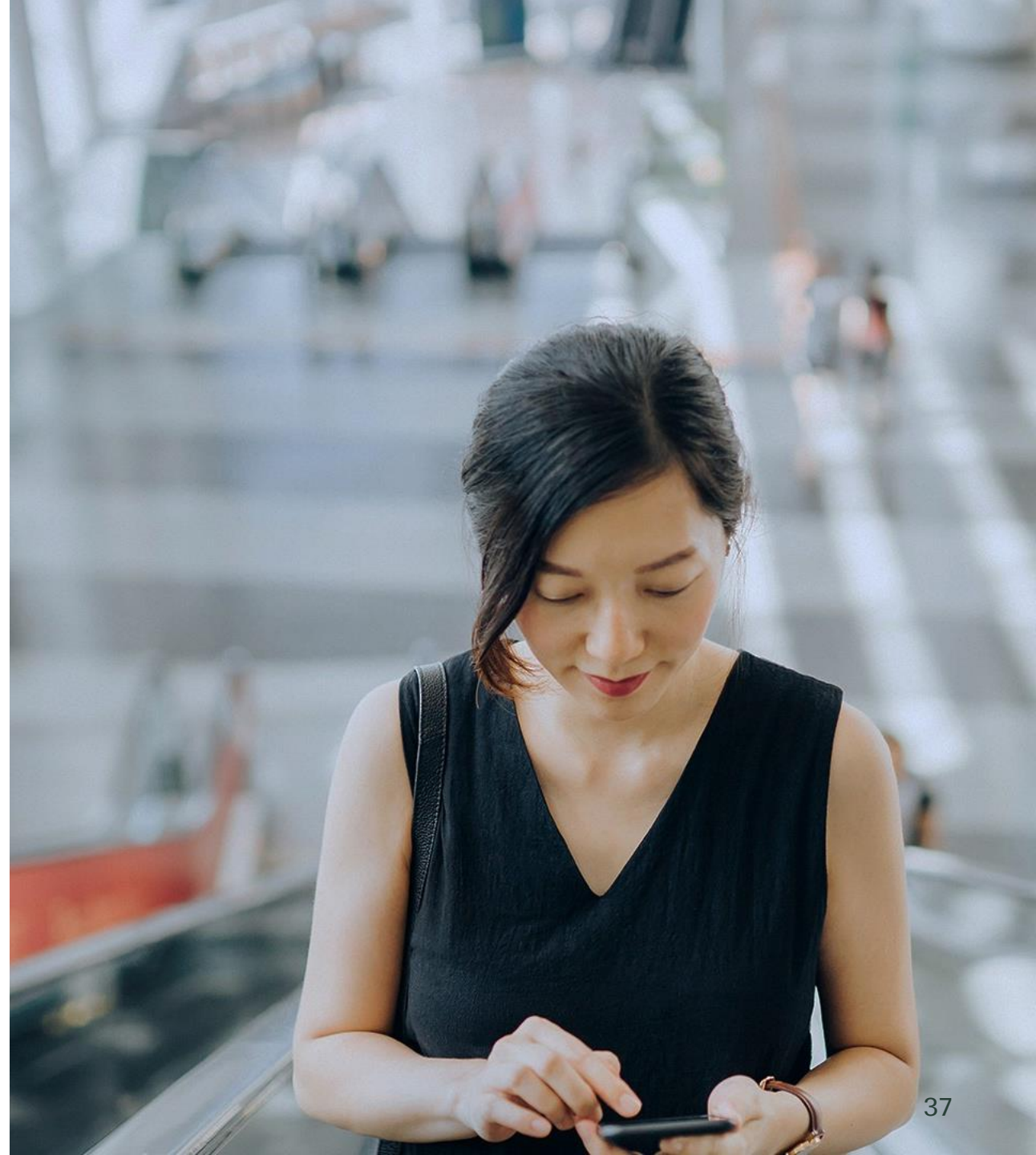
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Any questions?

Thank you!

Contact us

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Disclaimer

The COVID-19 epidemic is rapidly evolving with many unknown developments and high uncertainties.

What we present today is a time in moment picture which will become quickly outdated as governments and healthcare systems are taking steps to fight the spread of COVID-19.

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