THE COVID-19 PANDEMIC

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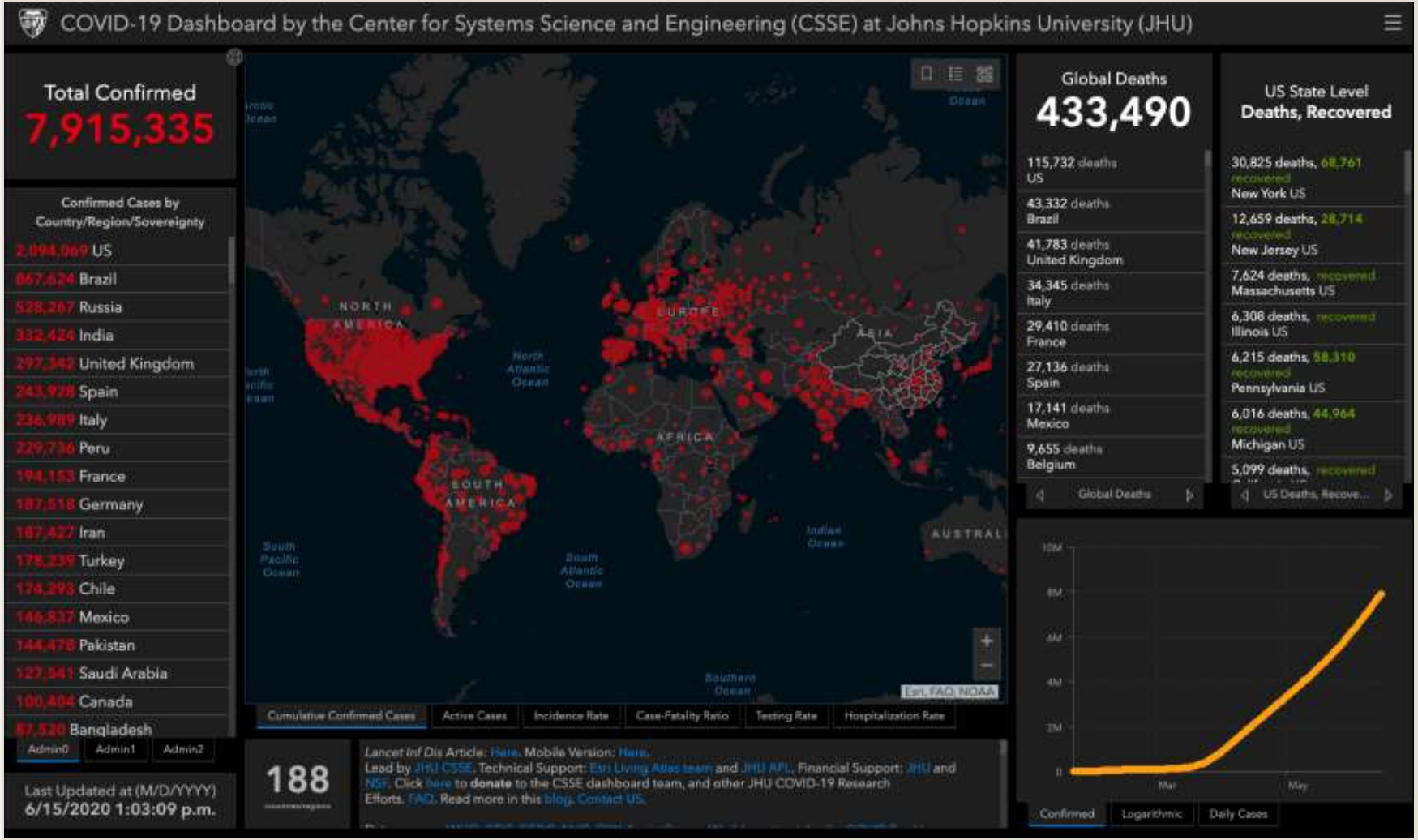
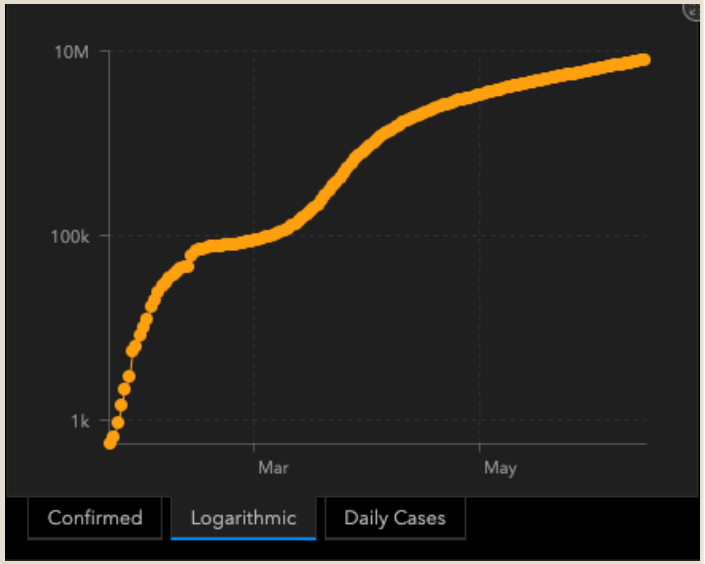
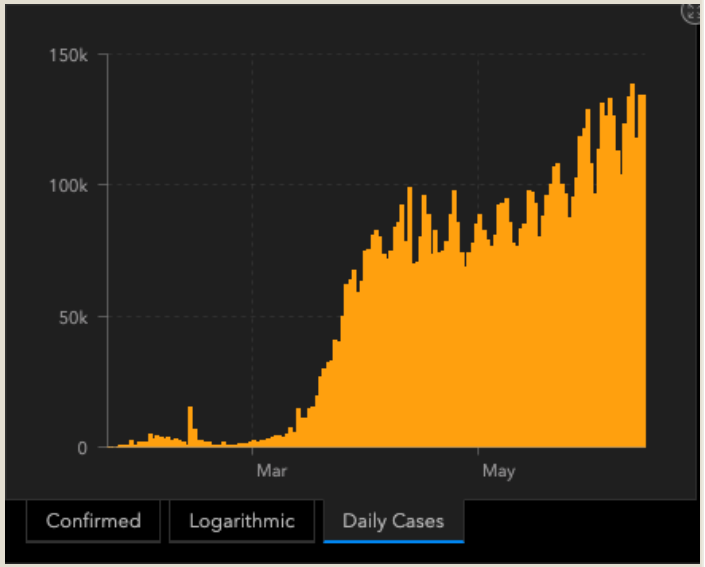
Hyderabad and New Delhi

The Pandemic







INDIA

Now | Yesterday | 2 Days Ago | Columns | Search:

All | Europe | North America | Asia | South America | Africa | Oceania

#	Country, Other	Total Cases	New Cases	Total Deaths	New Deaths	Total Recovered	Active Cases	Serious, Critical	Tot Cases/ 1M pop	Deaths/ 1M pop	Total Tests	Tests/ 1M pop	Population
	World	8,007,804	+23,635	435,855	+674	4,135,274	3,436,675	54,451	1,027	55.9			
1	USA	2,162,228		117,858		870,050	1,174,320	16,704	6,534	356	24,794,617	74,927	330,917,584
2	Brazil	867,882		43,389		453,568	370,925	8,318	4,084	204	1,604,784	7,552	212,492,226
3	Russia	537,210	+8,246	7,091	+143	284,539	245,580	2,300	3,681	49	15,100,000	103,473	145,931,893
4	India	332,783		9,523	+3	169,748	153,512	8,944	241	7	5,774,133	4,186	1,379,381,861
5	UK	295,889		41,698		N/A	N/A	392	4,360	614	6,772,602	99,787	67,870,494
6	Spain	291,008		27,136		N/A	N/A	617	6,224	580	4,826,516	103,232	46,754,035
7	Italy	236,989		34,345		176,370	26,274	209	3,919	568	4,620,718	76,419	60,465,391
8	Peru	229,736		6,688		115,579	107,469	1,113	6,972	203	1,360,839	41,300	32,949,791
9	Germany	187,671		8,870		172,600	6,201	447	2,240	106	4,694,147	56,034	83,772,567
10	Iran	187,427		8,837		148,674	29,916	2,781	2,233	105	1,244,074	14,821	83,941,948
11	Turkey	178,239		4,807		151,417	22,015	717	2,114	57	2,632,171	31,225	84,296,986
12	Chile	174,293		3,323		143,704	27,266	1,715	9,121	174	840,150	43,967	19,108,779
13	France	157,220		29,407		72,859	54,954	869	2,409	451	1,384,633	21,215	65,267,451
14	Mexico	146,837	+4,147	17,141	+269	108,110	21,586	378	1,139	133	406,547	3,155	128,870,121
15	Pakistan	144,478	+5,248	2,729	+97	53,721	88,028	111	655	12	897,650	4,068	220,673,722
16	Saudi Arabia	127,541		972		84,720	41,849	1,855	3,666	28	1,106,398	31,805	34,787,354
17	Canada	98,787		8,146		60,272	30,369	1,937	2,618	216	2,152,700	57,060	37,727,154
18	Bangladesh	87,520		1,171		18,730	67,619	1	532	7	504,465	3,065	164,613,988
19	China	83,181	+49	4,634		78,370	177		58	3			1,439,323,776
20	Qatar	79,602		73		56,898	22,631	231	28,350	26	290,714	103,538	2,807,805

India

Coronavirus Cases:

333,255

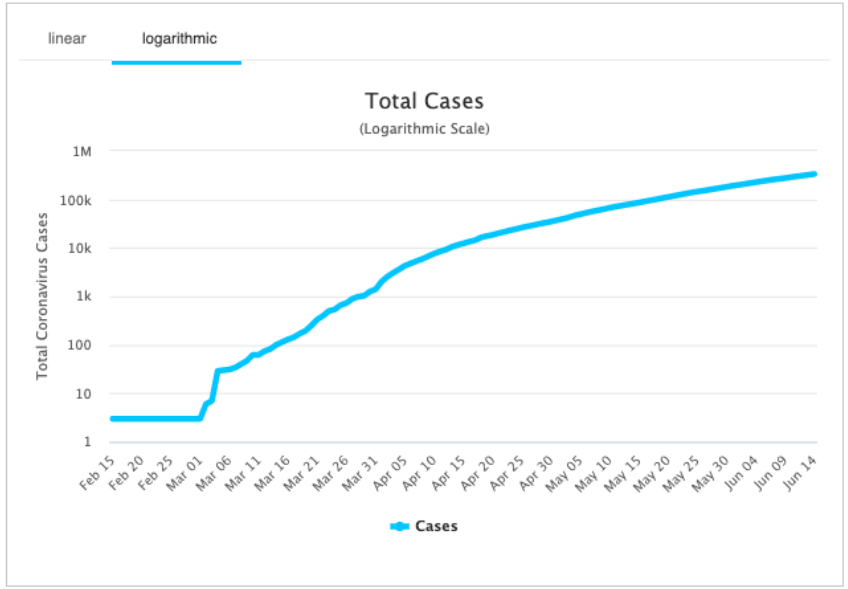
Deaths:

9,524

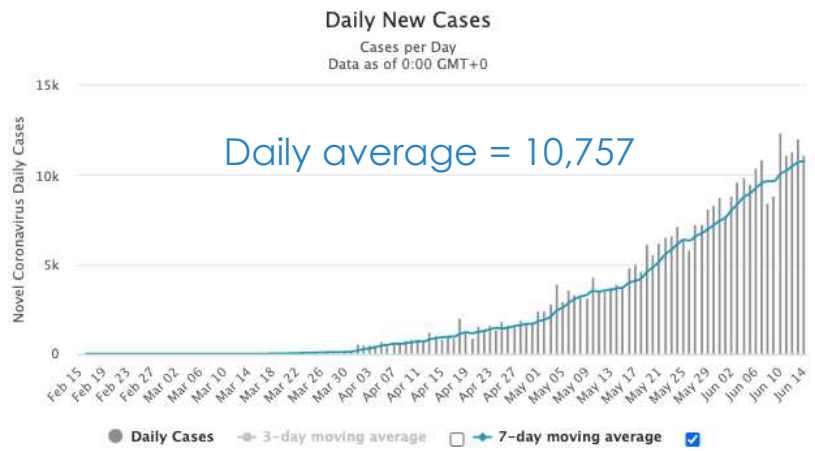
Recovered:

169,817

Total Coronavirus Cases in India

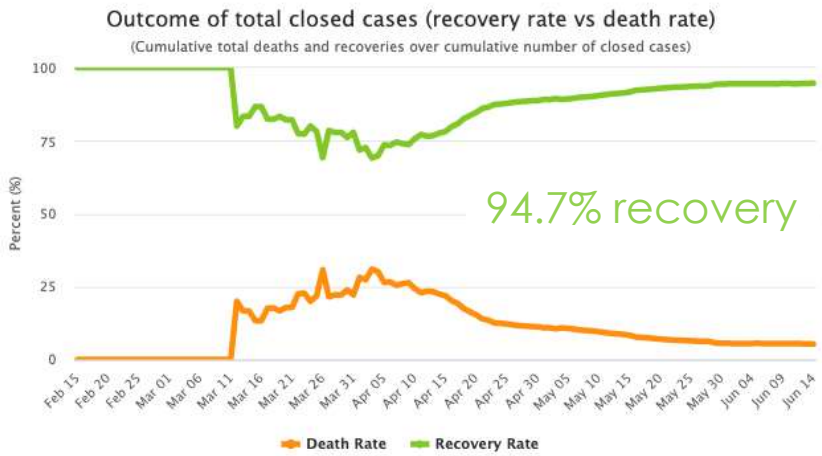


Daily New Cases in India

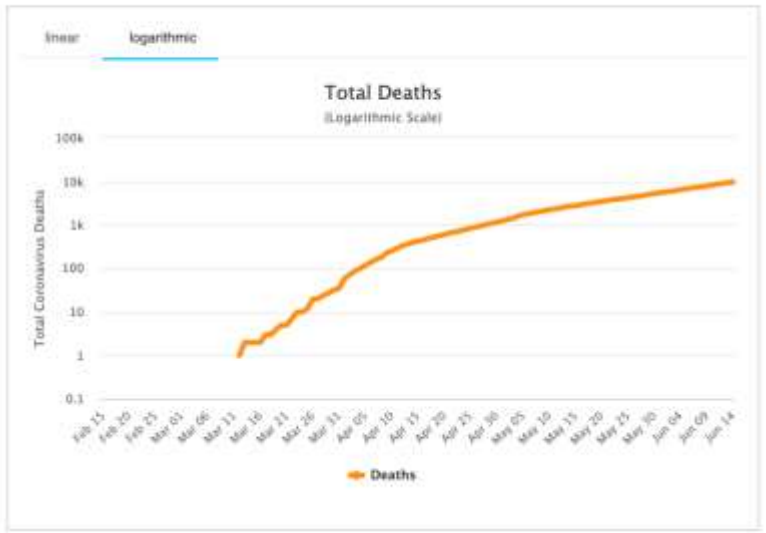


https://www.worldometers.info/coronavirus/country/india/

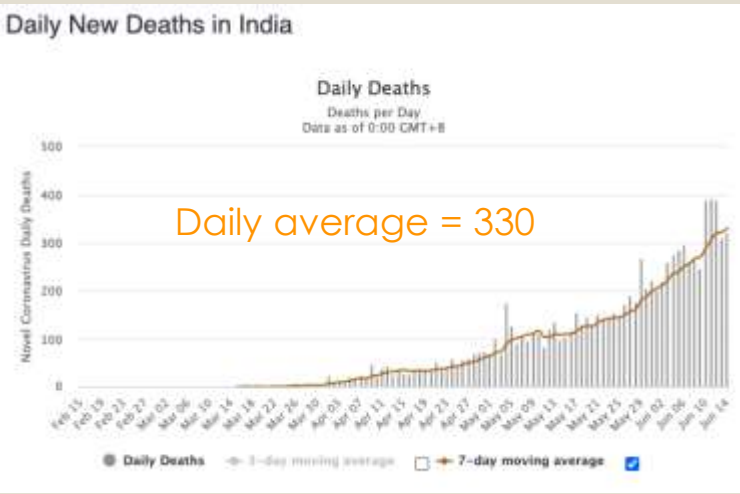
Outcome of Cases (Recovery or Death) in India



Total Coronavirus Deaths in India



Daily New Deaths in India



Was the nationwide lockdown successful?

Positives

- Recovery rate from 9% to 50%
- Doubling rate from 5.4 to 16 days
- Testing capacity ~ 1 lakh per day
- Without any intervention, models showed ~ 50 lakh infections; saw 1.12 lakh confirmed cases
- CFR and death/Mn low

Negatives

- Cases increased from 657 to 198,609 (300 fold)
- Deaths increased from 12 to 5,408 (450 fold)
- Daily case increase from 121 to 8,782 (72 fold)
- Testing still low ~4000/Mn people
- Internal migration from cities to small towns and villages

State of the Union

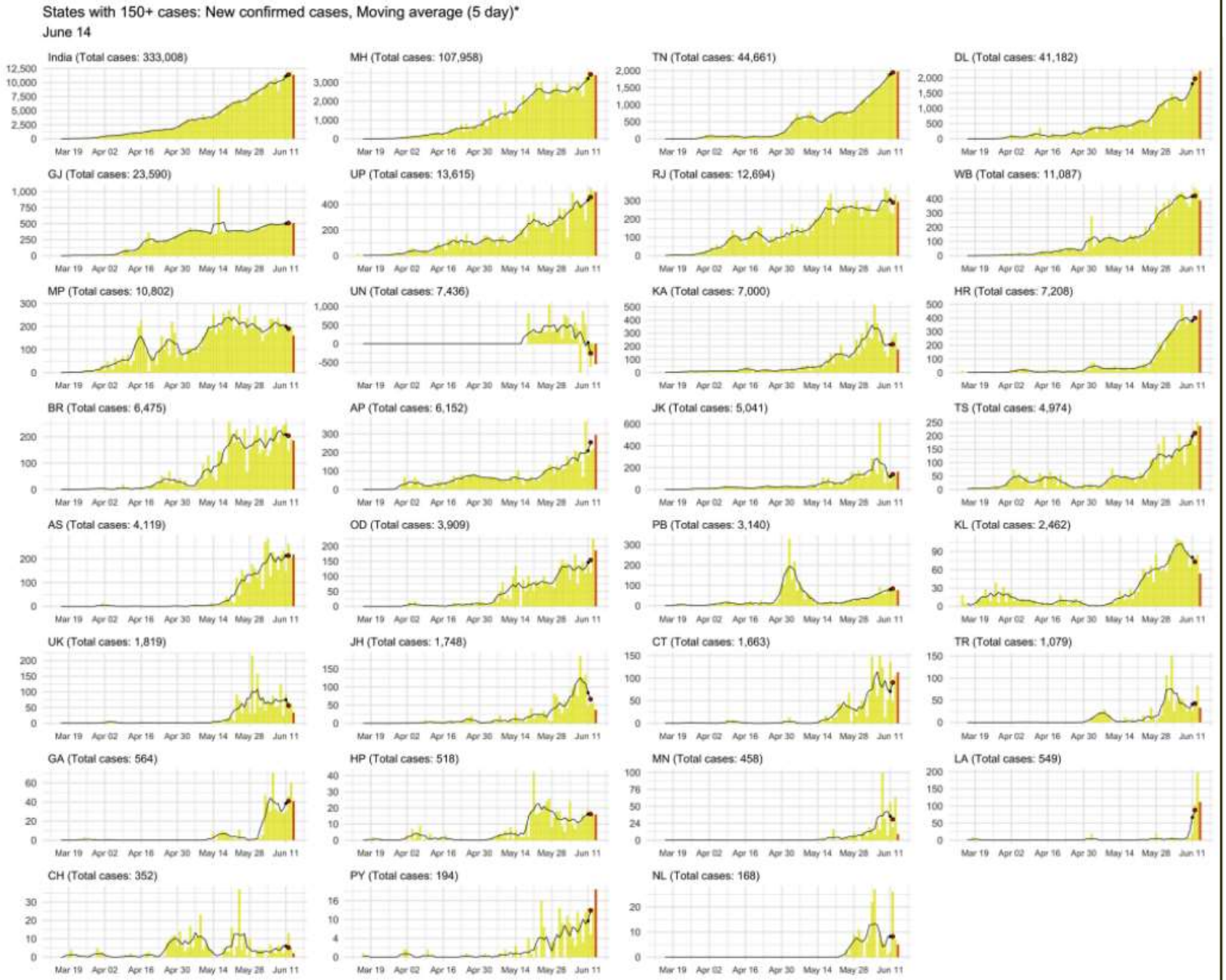
- 75% new cases are still coming from 3 states –

Maharashtra

Tamil Nadu

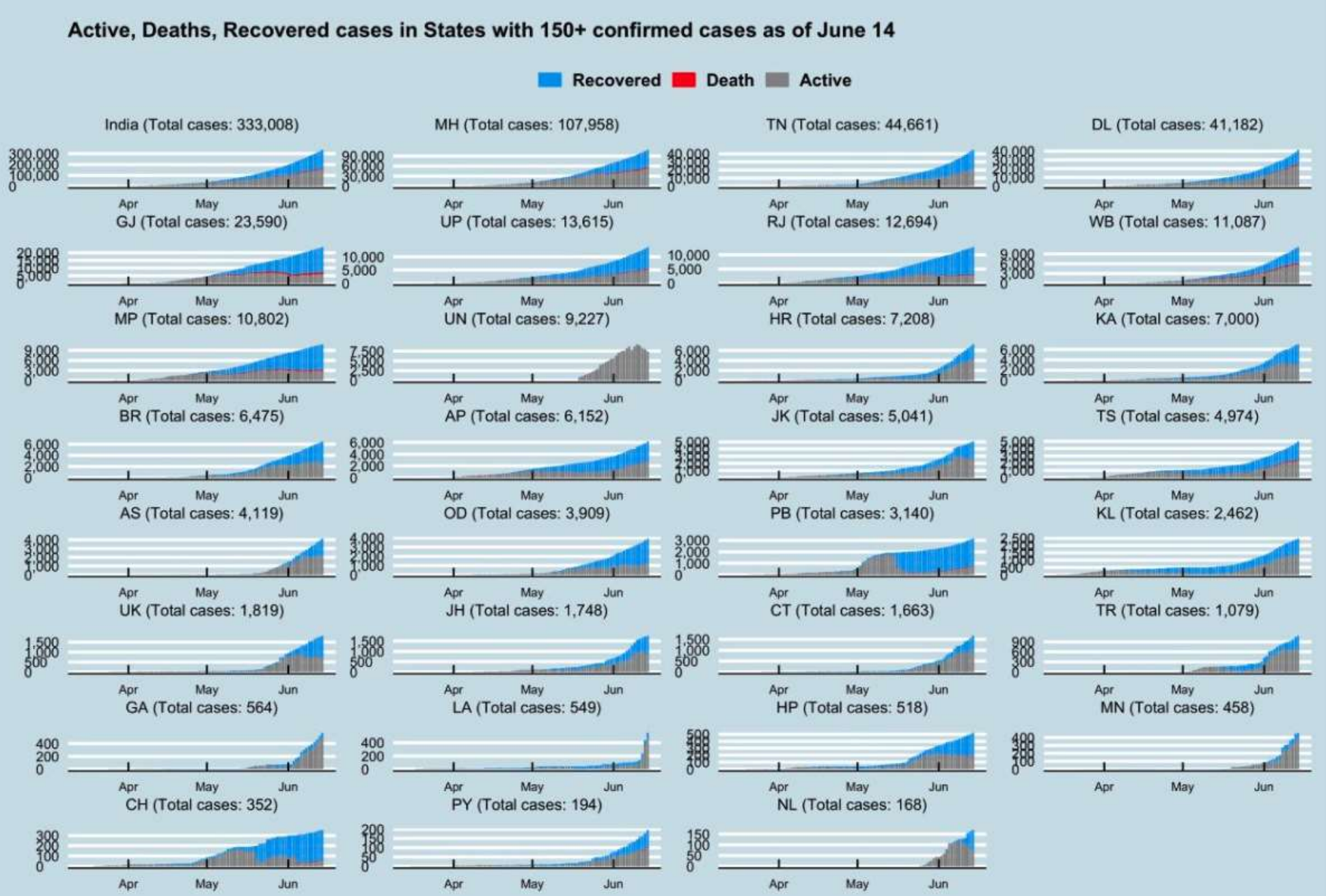
Delhi

- For consecutive days Delhi reports highest increases



State of the Union

How are states recovering?



State of the Union

Death per Million population

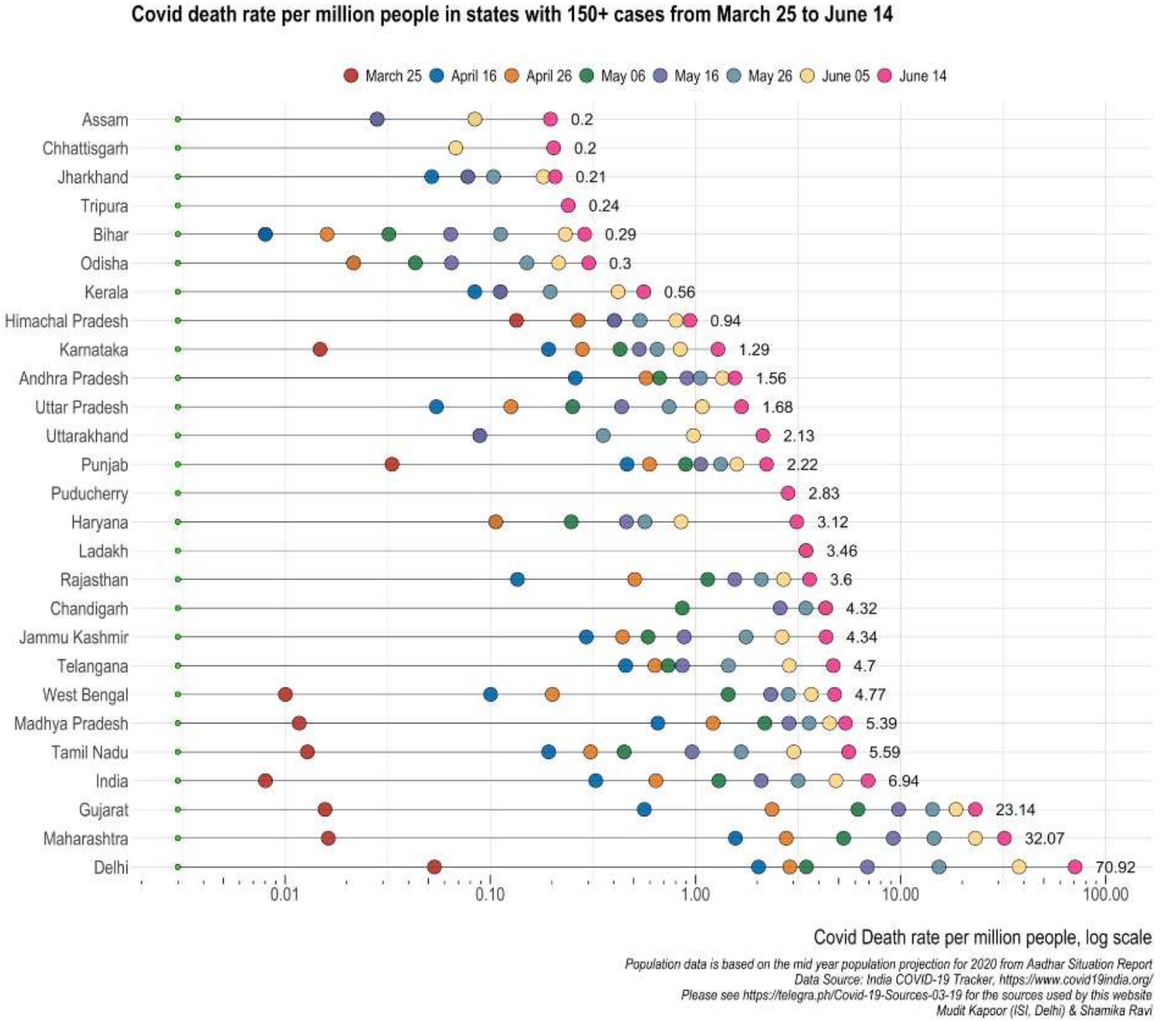
- National average 6.94
- 3 states above average

Delhi

Maharashtra

Gujarat

- Delhi ~ 10x national average



State of the Union

- Outlier states

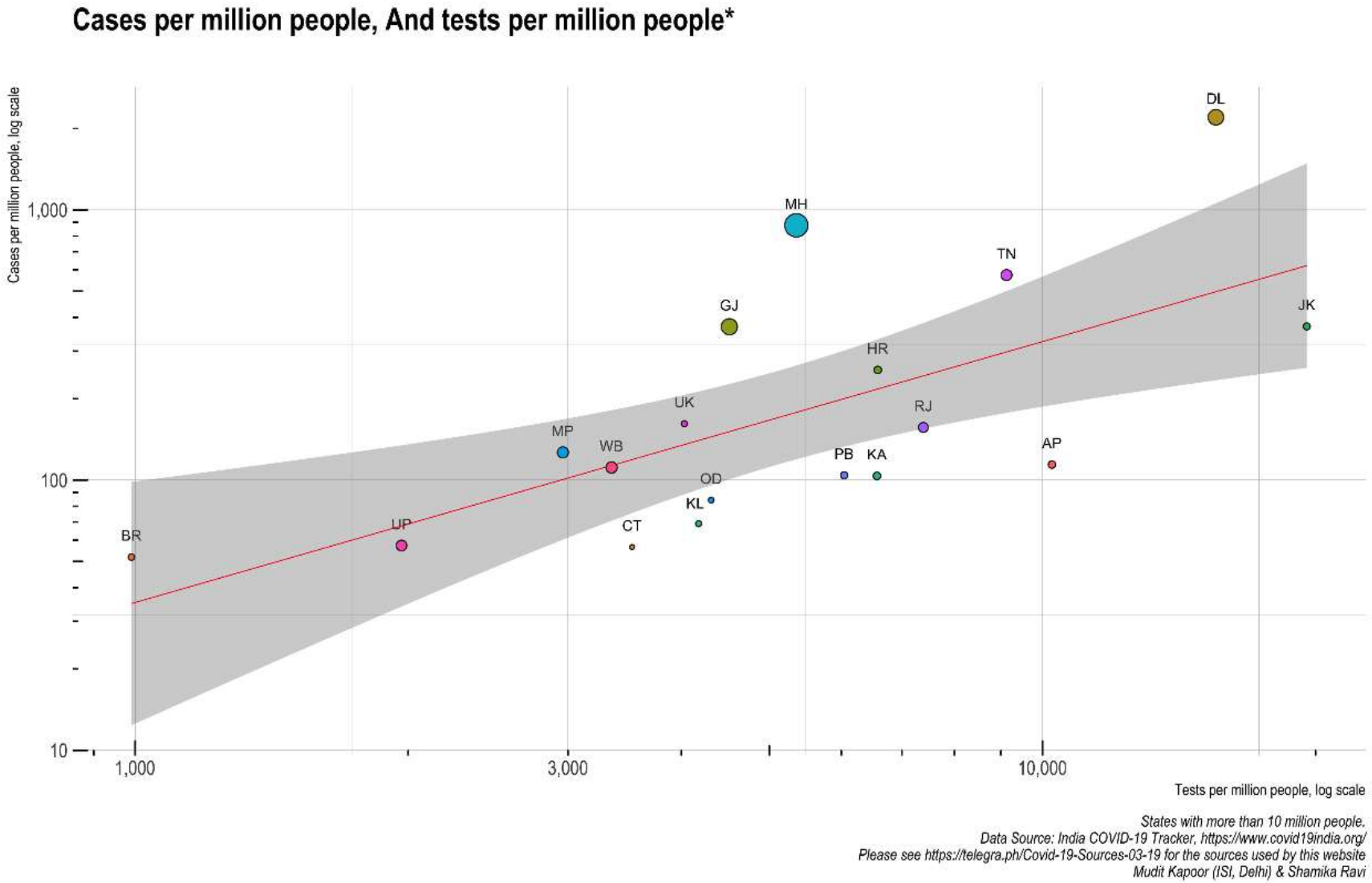
Delhi

Tamil Nadu

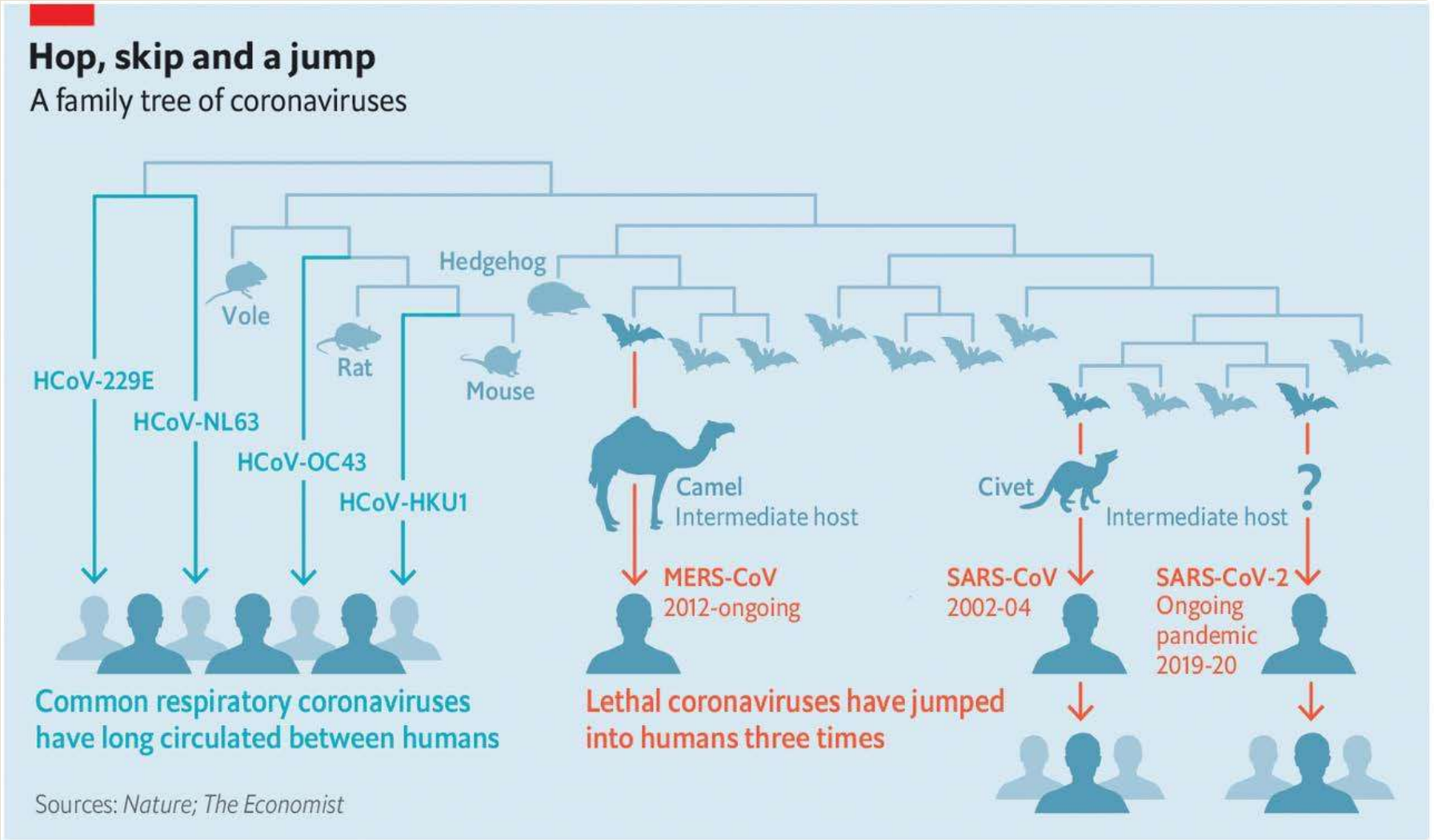
Maharashtra

Gujarat

- Need to test a lot more to control outbreak



Where did it come from?



The Economist

2519 cases
866 deaths

8098 cases
744 deaths

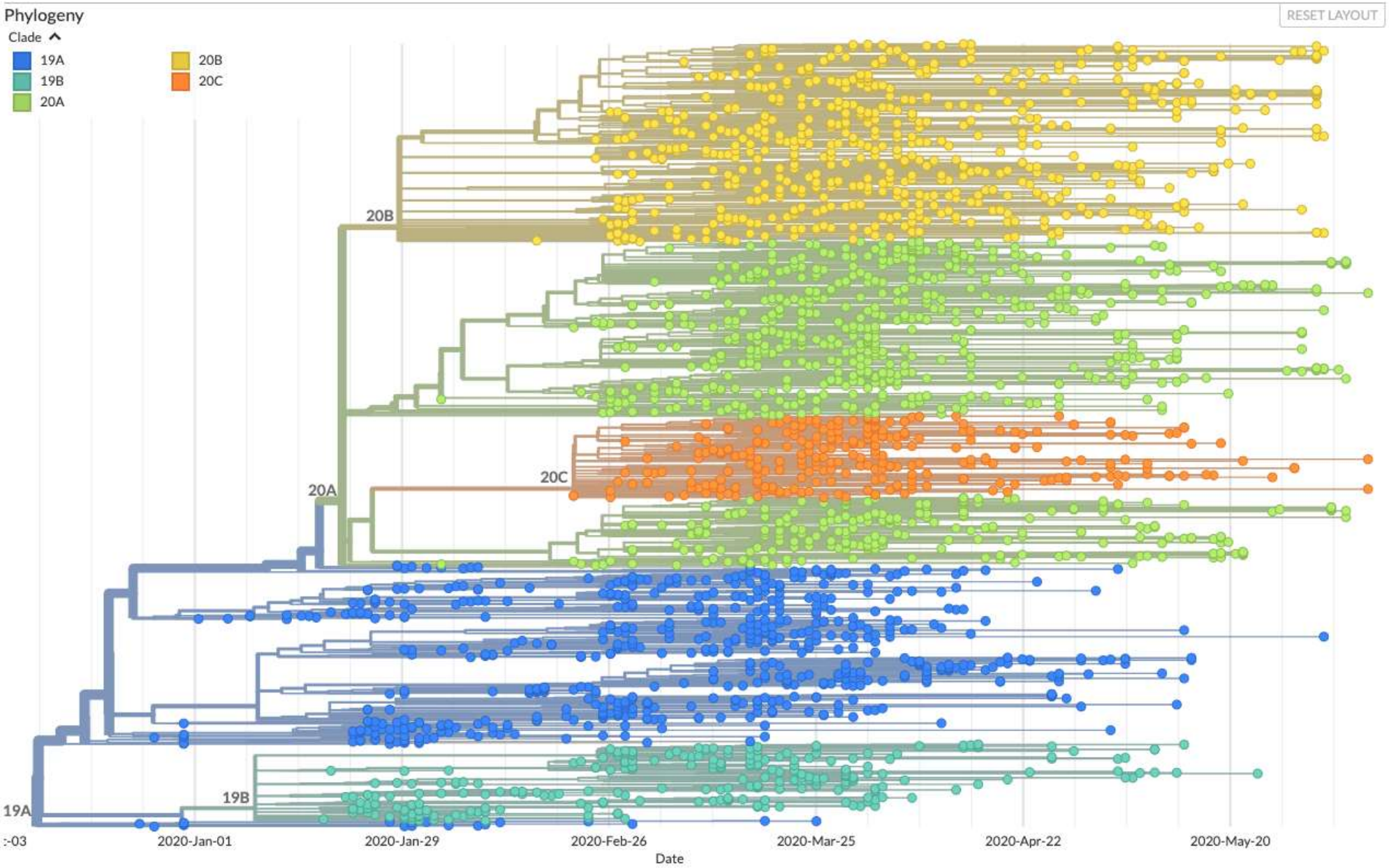
??

Genomic epidemiology of novel coronavirus - Global subsampling

Maintained by the Nextstrain team. Enabled by data from GISAID

Showing 2779 of 2779 genomes sampled between Dec 2019 and Jun 2020.

46,000 genomes in GISAID



Genomic epidemiology of novel coronavirus - Global subsampling

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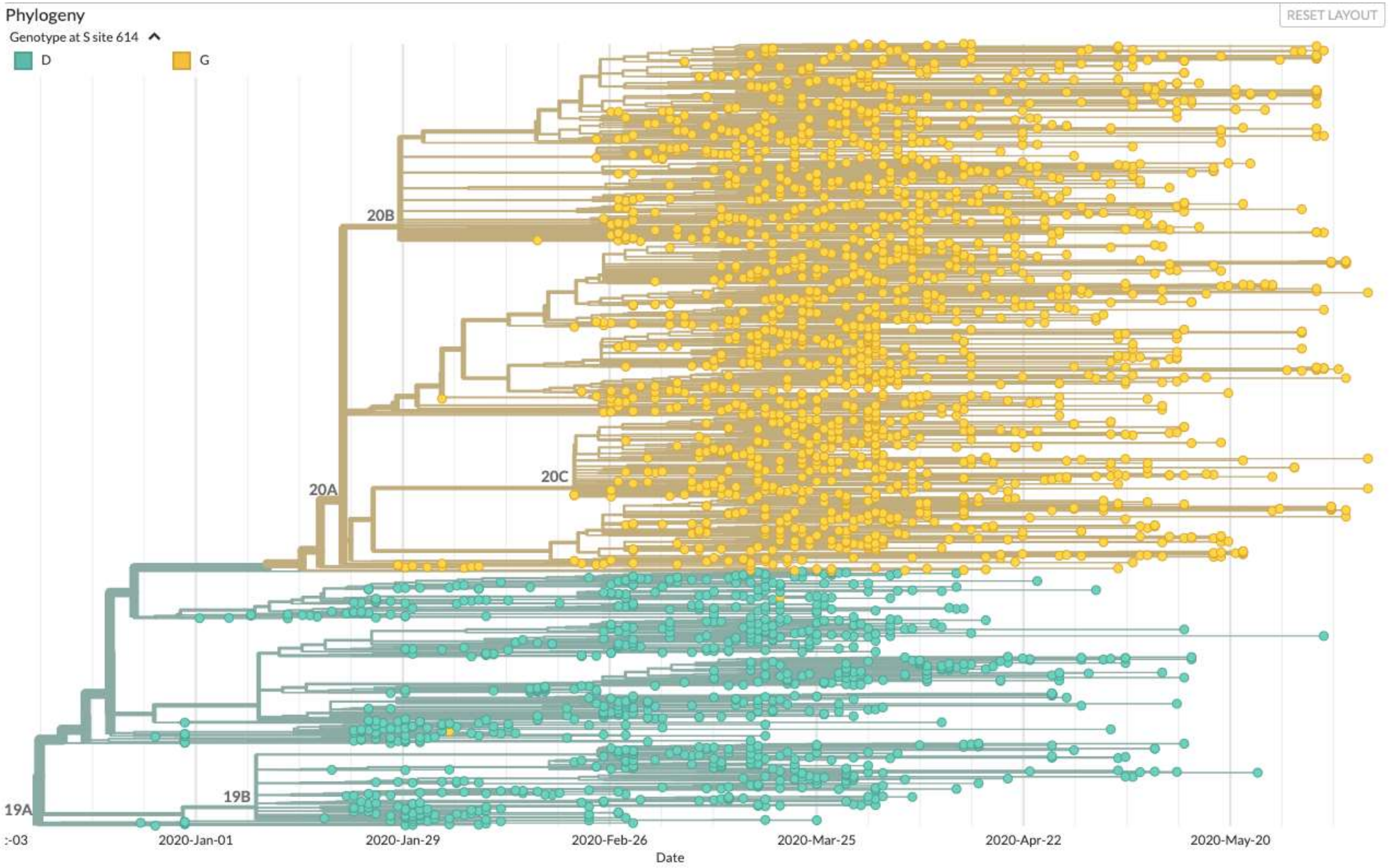
Spike protein
D614G mutation



Genomic epidemiology of novel coronavirus - Global subsampling

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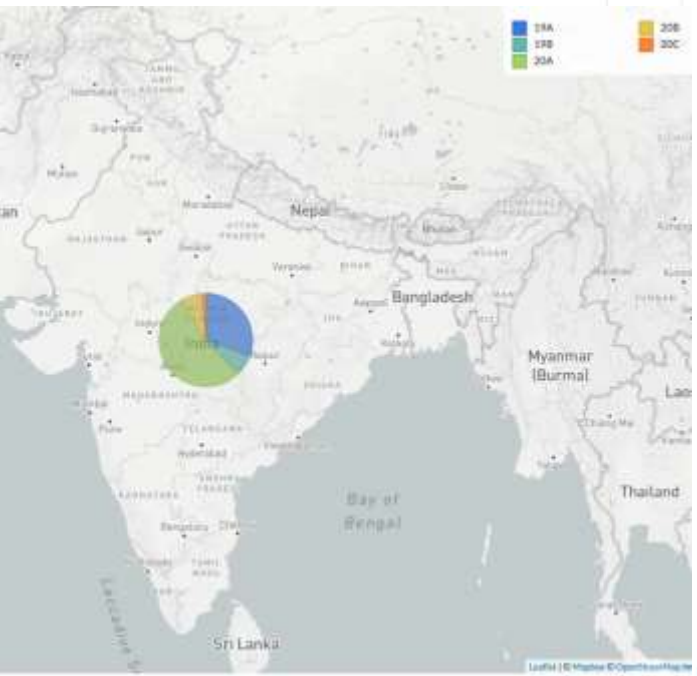
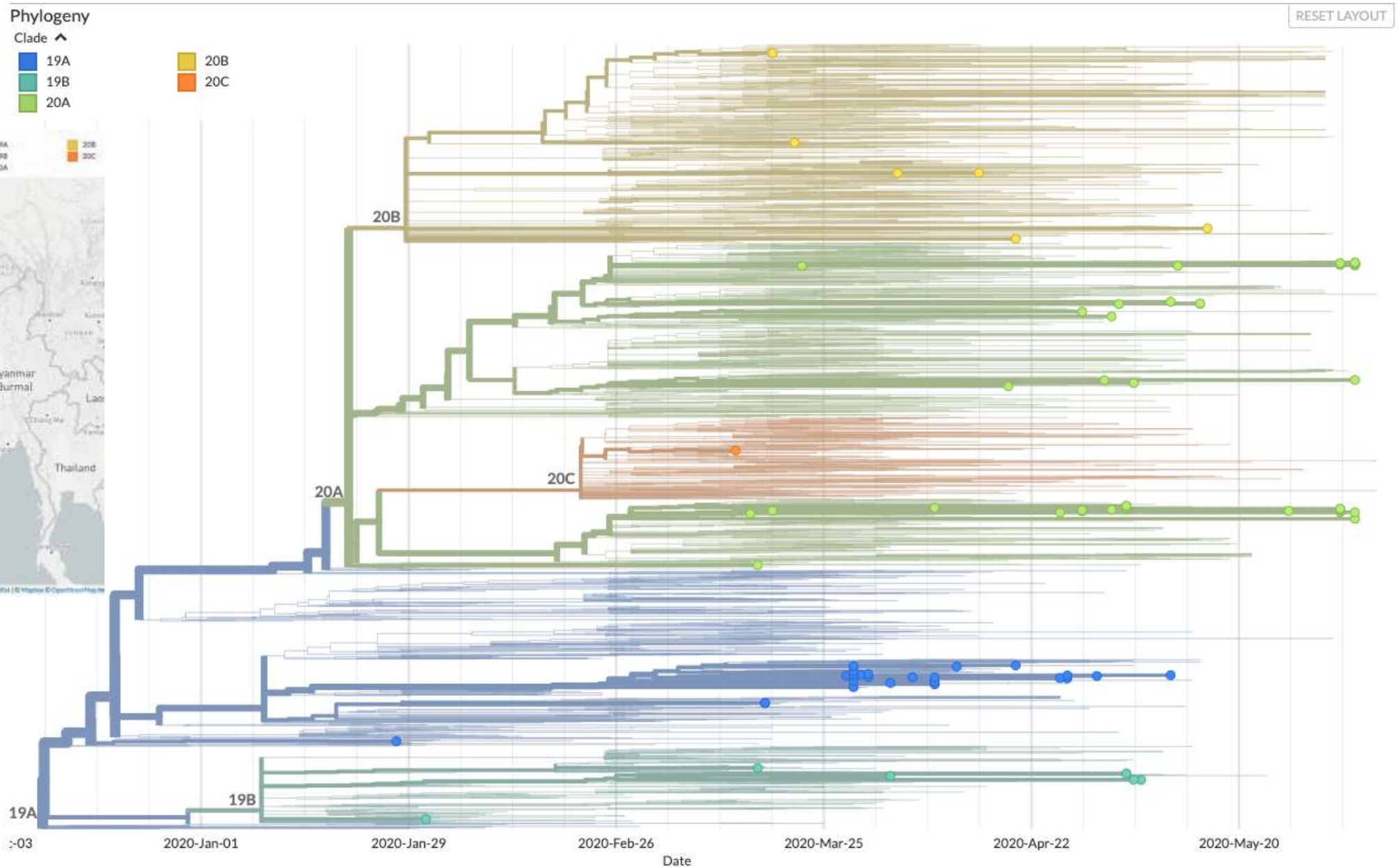
Showing 82 of 2779 genomes sampled between Jan 2020 and Jun 2020. Filtered to × India (82).

Clades in India





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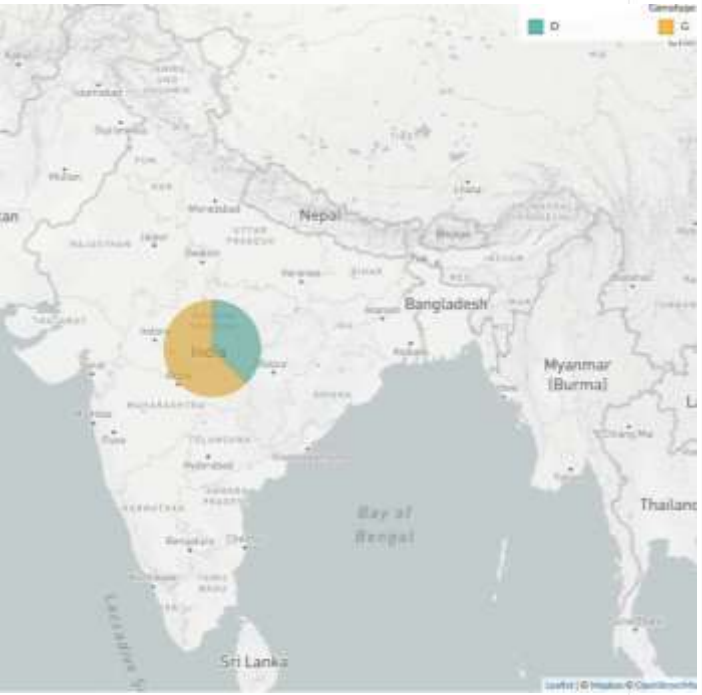
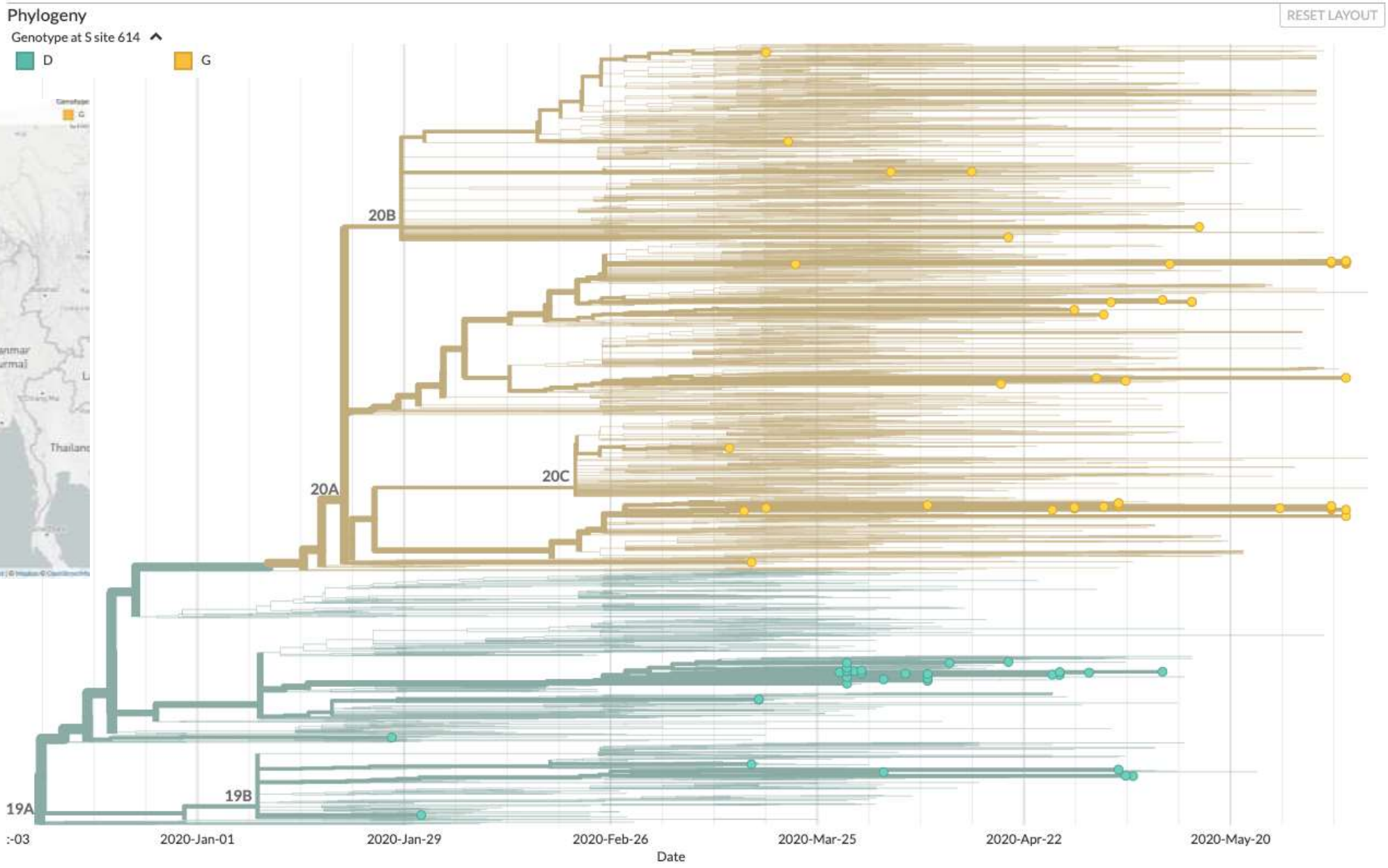
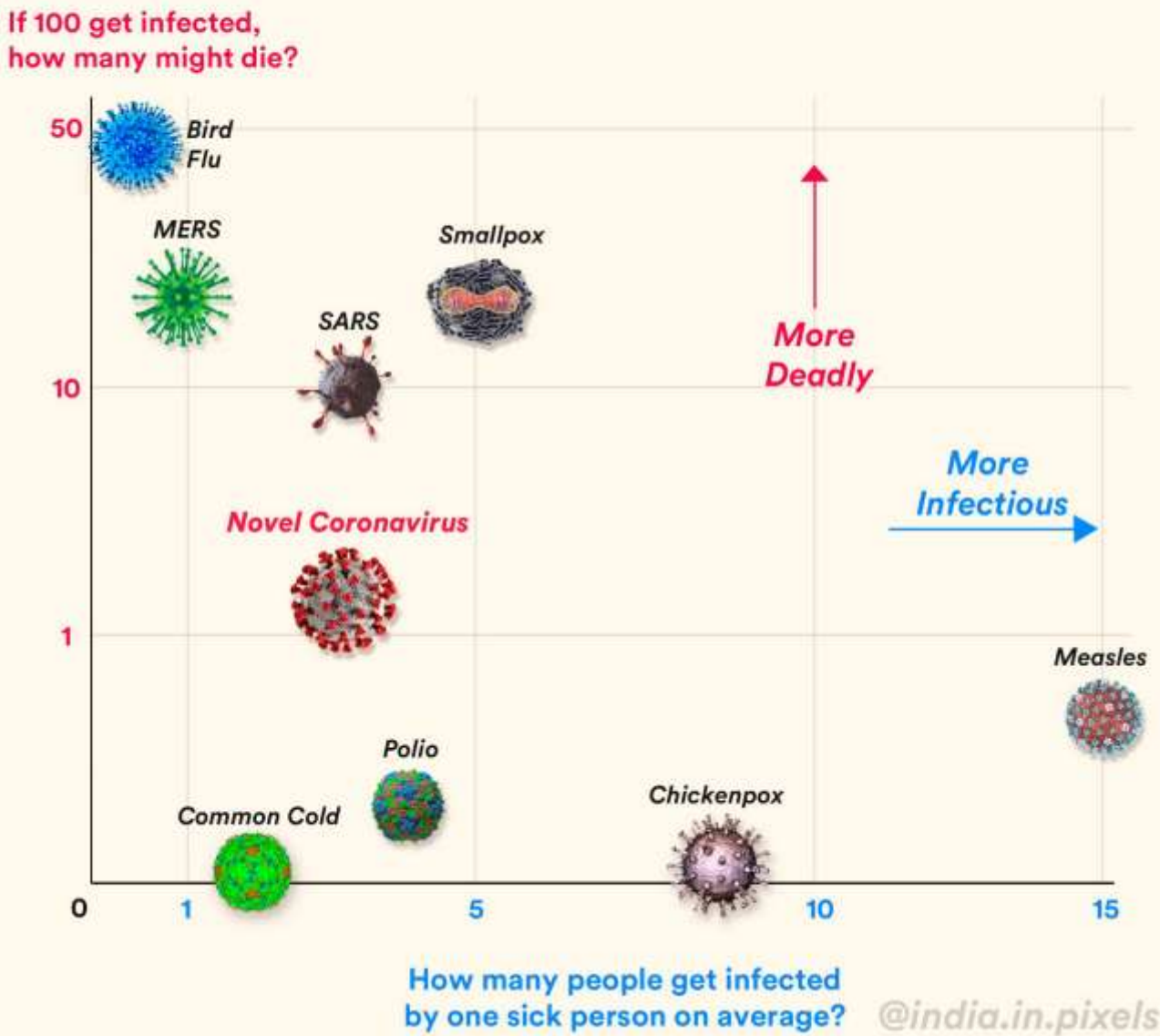
Spike protein D614G mutation in India

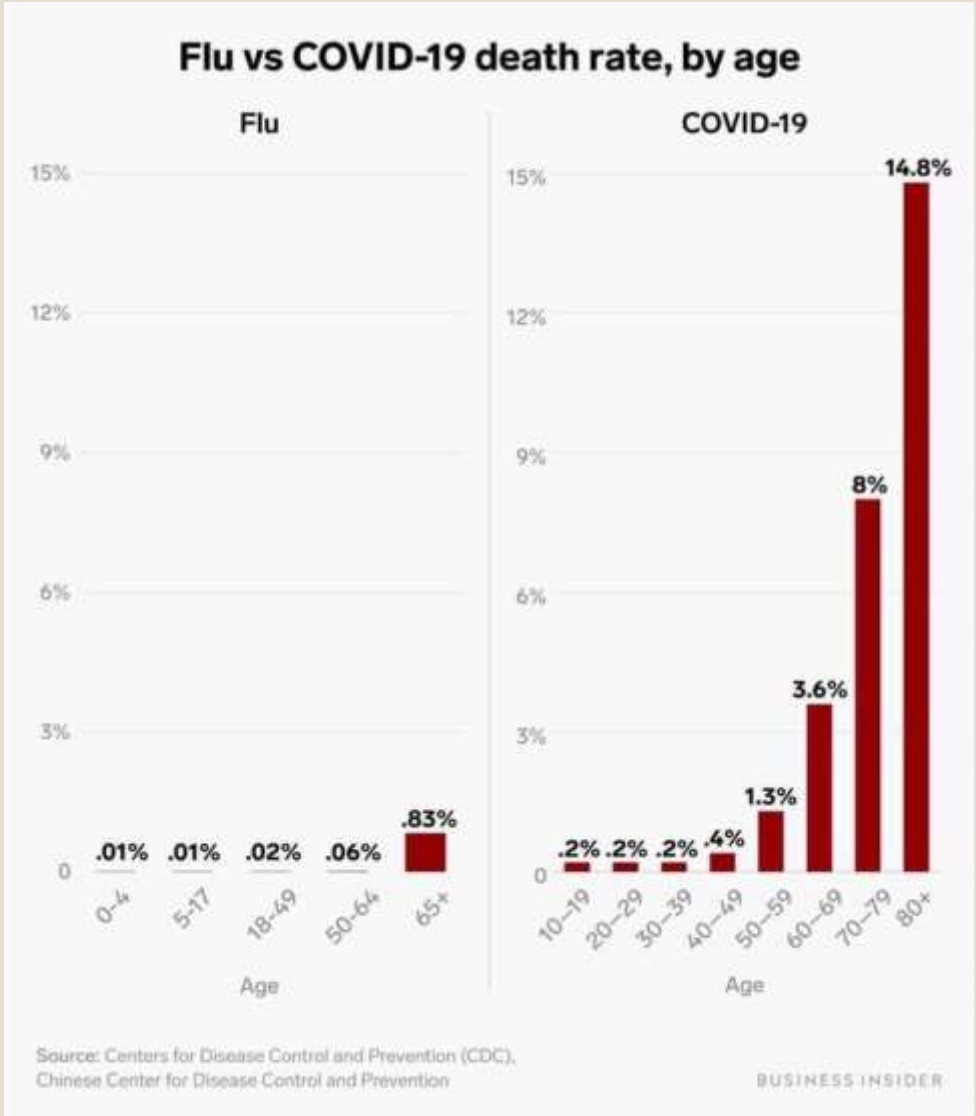




Infectivity vs Lethality for Diseases

Source: New York Times





The Virus

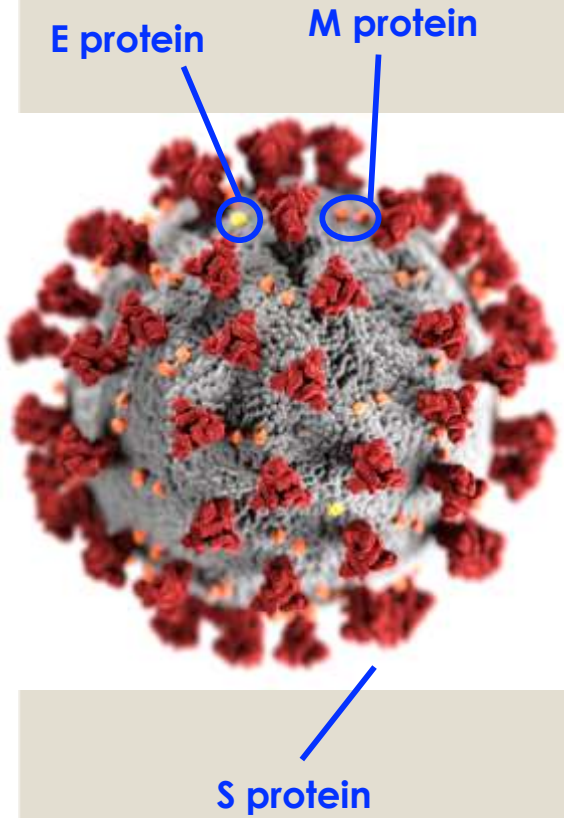


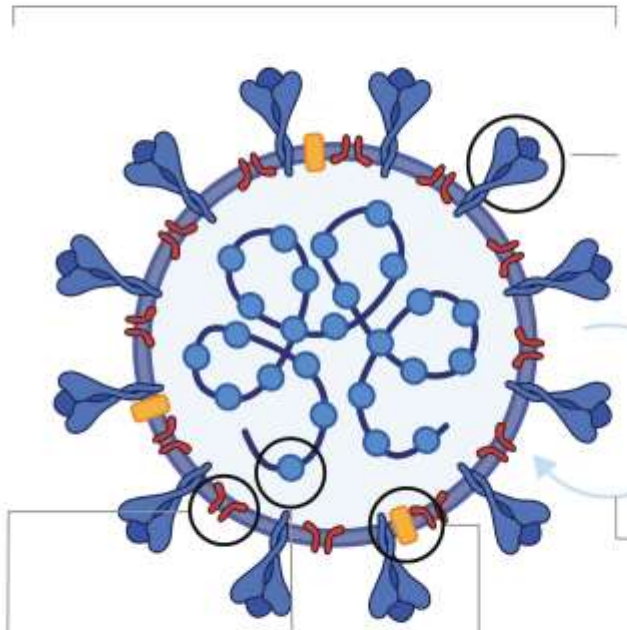
Image: CDC, USA

eLife
published in eLife, March 31st, 2020
https://elifesciences.org/articles/57309

Size & Content

Diameter: ≈100 nm
Volume: ~10^6 nm^3 = 10^{-3} fL
Mass: ~10^3 MDa ≈ 1 fg

1 mL sputum
~10^7 viruses



Spike trimer
Length: ≈10 nm
Copies per virion: ≈100
(300 monomers, measured for SARS-CoV-1)
Affinity to ACE2 receptor K_d: ≈1-30 nM
primed by TMPRSS2

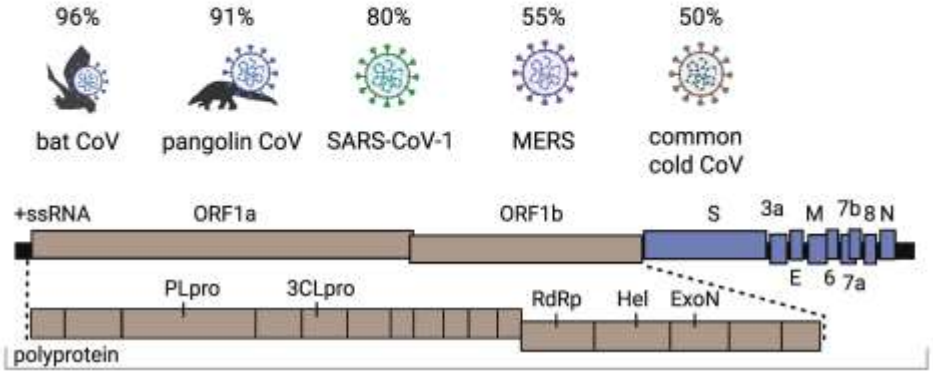
Membrane protein
≈2000 copies
(measured for SARS-CoV-1)

Nucleoprotein
≈1000 copies
(measured for SARS-CoV-1)

Envelope protein
≈20 copies
(100 monomers, measured for TGEV coronavirus)

Genome

Nucleotide identity to SARS-CoV-2



Length: ≈30kb; β-coronavirus with 10-14 ORFs (24-27 proteins)

Evolution rate: ~10^{-3} nt^{-1} yr^{-1} (measured for SARS-CoV-1)
Mutation rate: ~10^{-6} nt^{-1} $cycle^{-1}$ (measured for MHV coronavirus)

Replication Timescales

in tissue-culture
Virion entry into cell: ~10 min (measured for SARS-CoV-1)
Eclipse period: ~10 hrs (time to make intracellular virions)
Burst size: ~10^3 virions (measured for MHV coronavirus)

Virus replication and drugs

(A) Neutralizing Antibodies

(B) Hydroxychloroquine

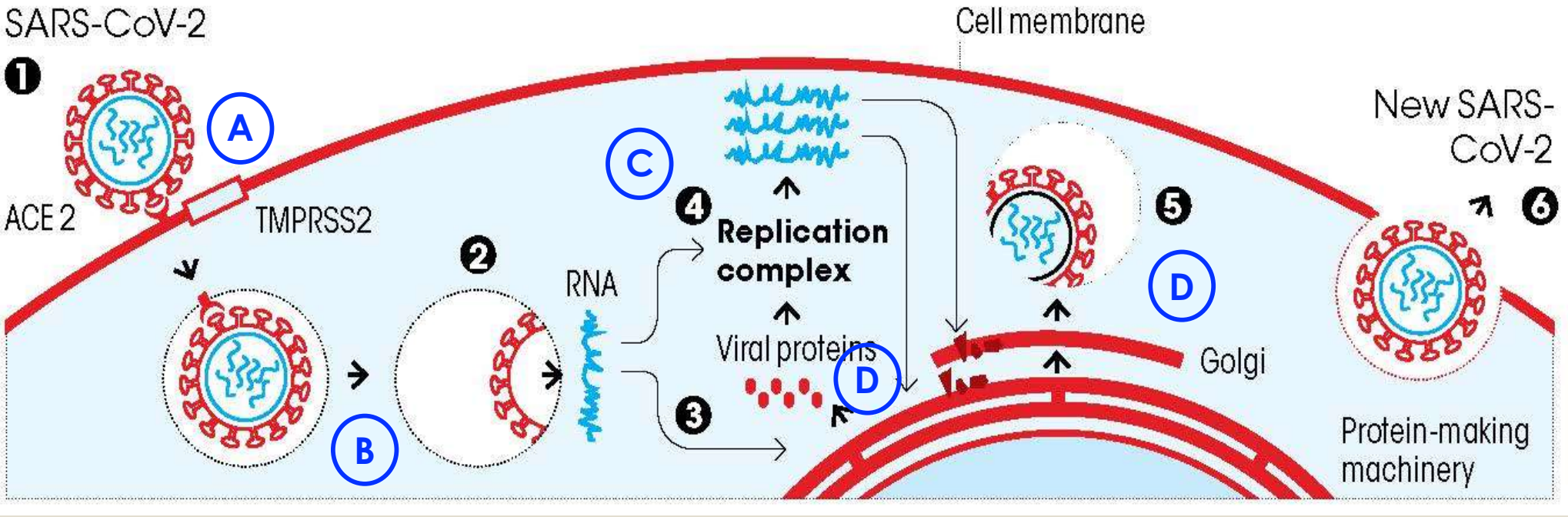
(C) Remdesivir, Favipiravir

(D) Ritonavir, Lopinavir

Angiotensin-converting enzyme 2 (ACE2) is an enzyme attached to the outer surface of human cells in the lungs, arteries, heart, kidney, and intestines. Both SARS CoV and SARS CoV2 use these cells as receptors for infecting humans.

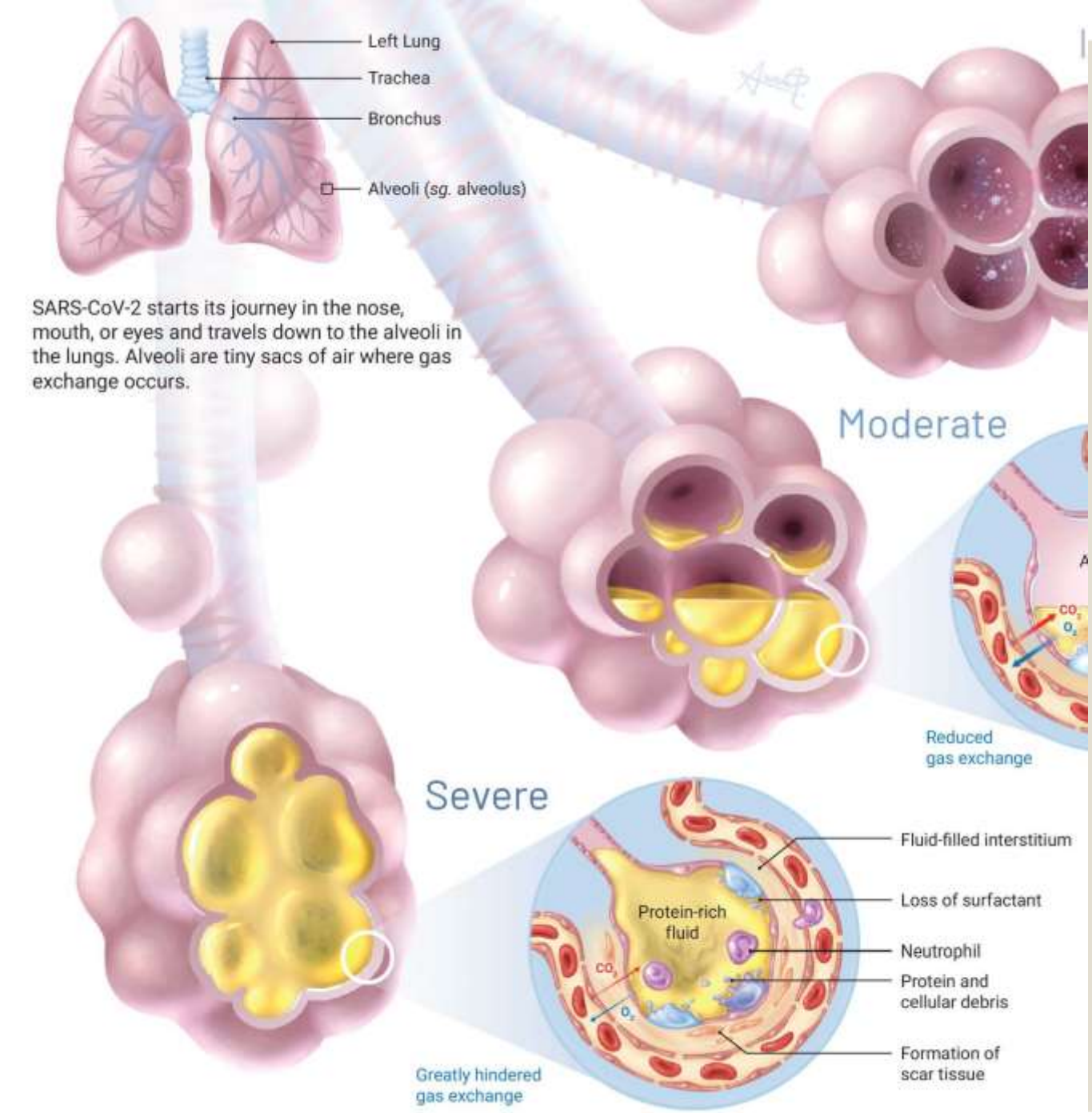
But SARS-CoV-2 went through mutations which has enabled it to **bind with ACE2 more efficiently,** making it more successful at human to human transmission.

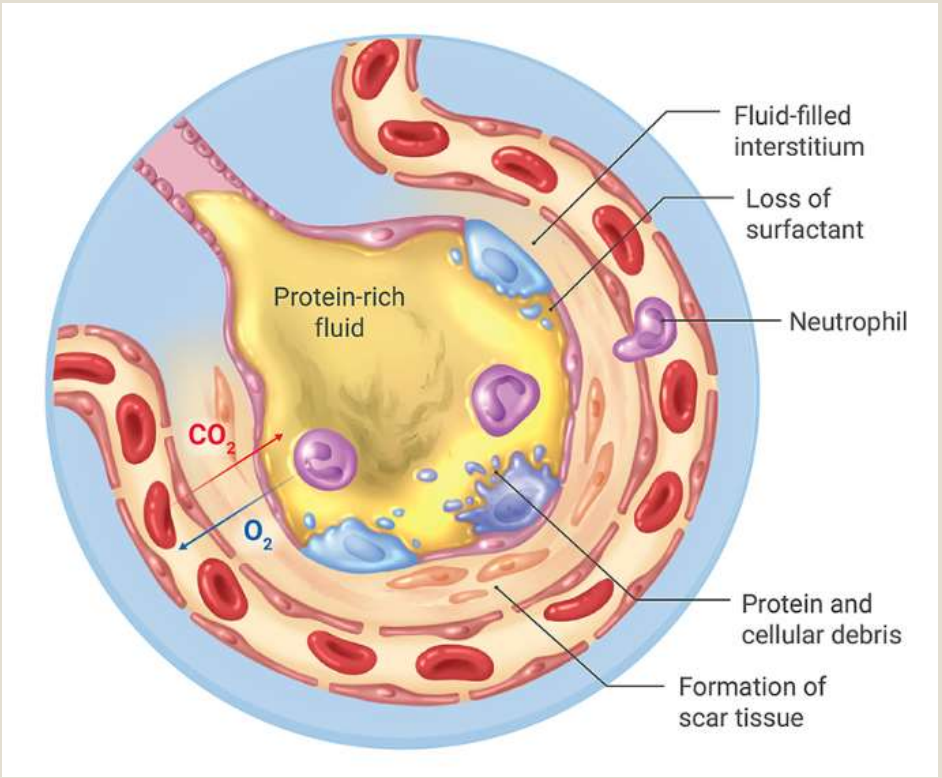
This invisible feature on the crown of SARS-CoV-2 is the reason why it has a death toll of **265,000 compared to 914 by its cousin, SARS-CoV**



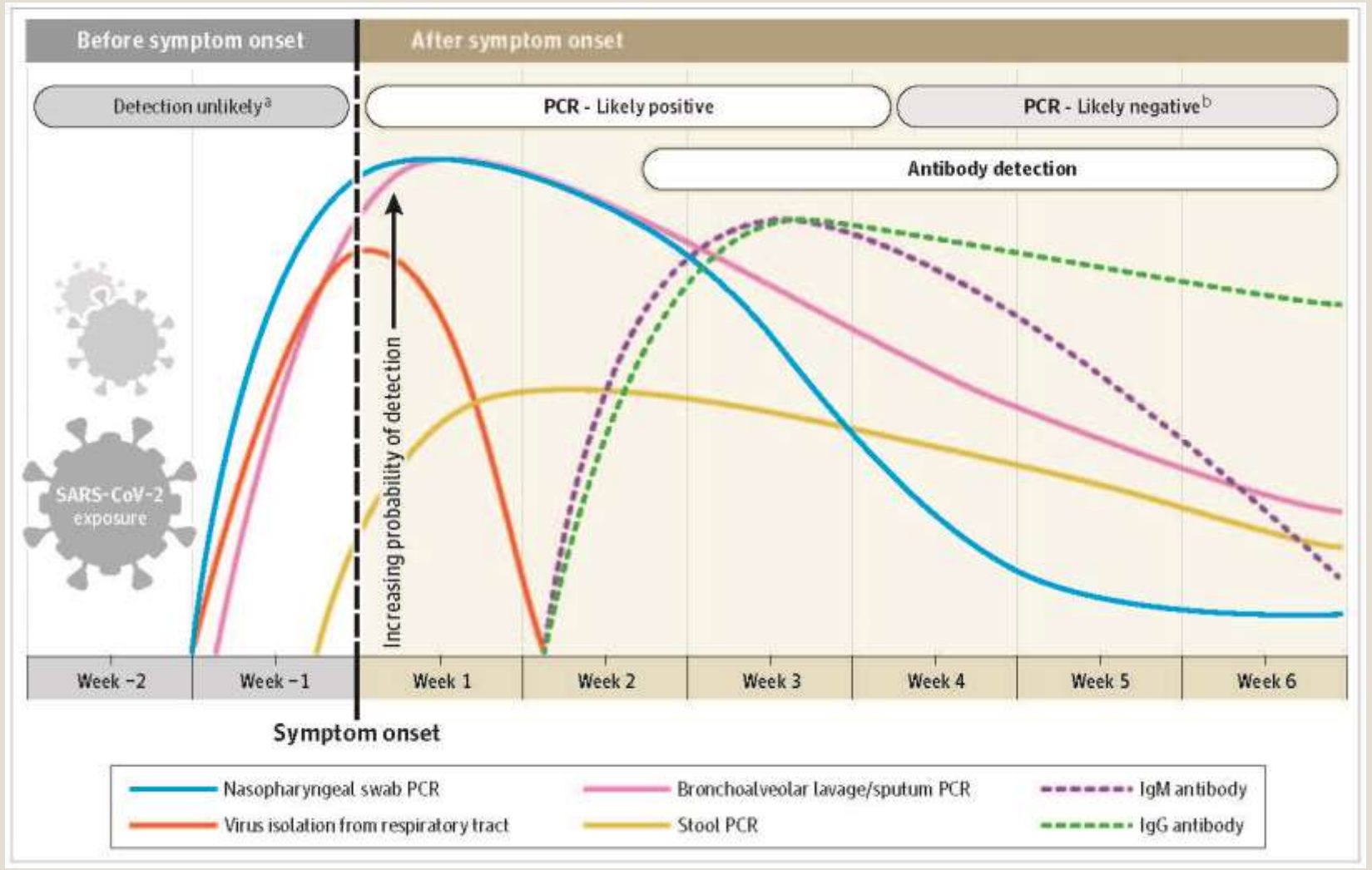
Source: Down To Earth; 16-31 May 2020

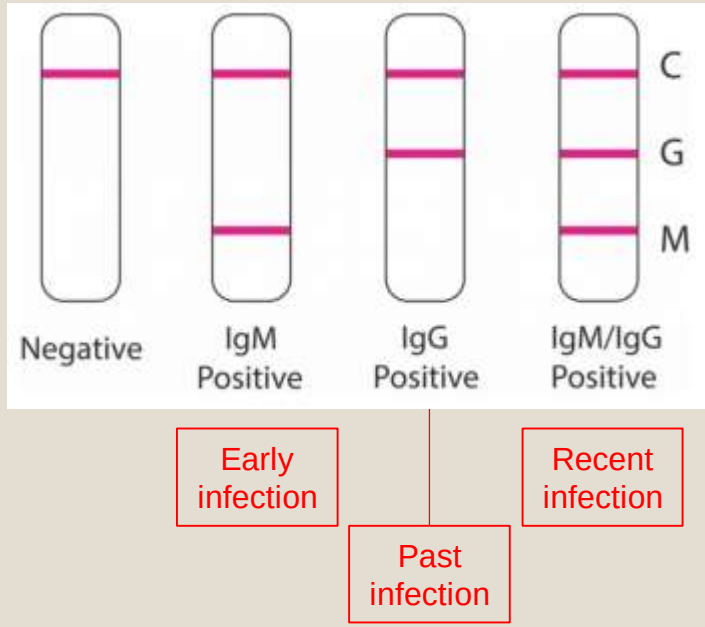
Pneumonia


Left Lung
Trachea
Bronchus
Alveoli (sg. alveolus)
SARS-CoV-2 starts its journey in the nose, mouth, or eyes and travels down to the alveoli in the lungs. Alveoli are tiny sacs of air where gas exchange occurs.
Moderate
Reduced gas exchange
Severe
Fluid-filled interstitium
Loss of surfactant
Protein-rich fluid
Neutrophil
Protein and cellular debris
Formation of scar tissue
Greatly hindered gas exchange


Fluid-filled interstitium
Loss of surfactant
Protein-rich fluid
Neutrophil
CO_2
O_2
Protein and cellular debris
Formation of scar tissue

Testing for Covid-19

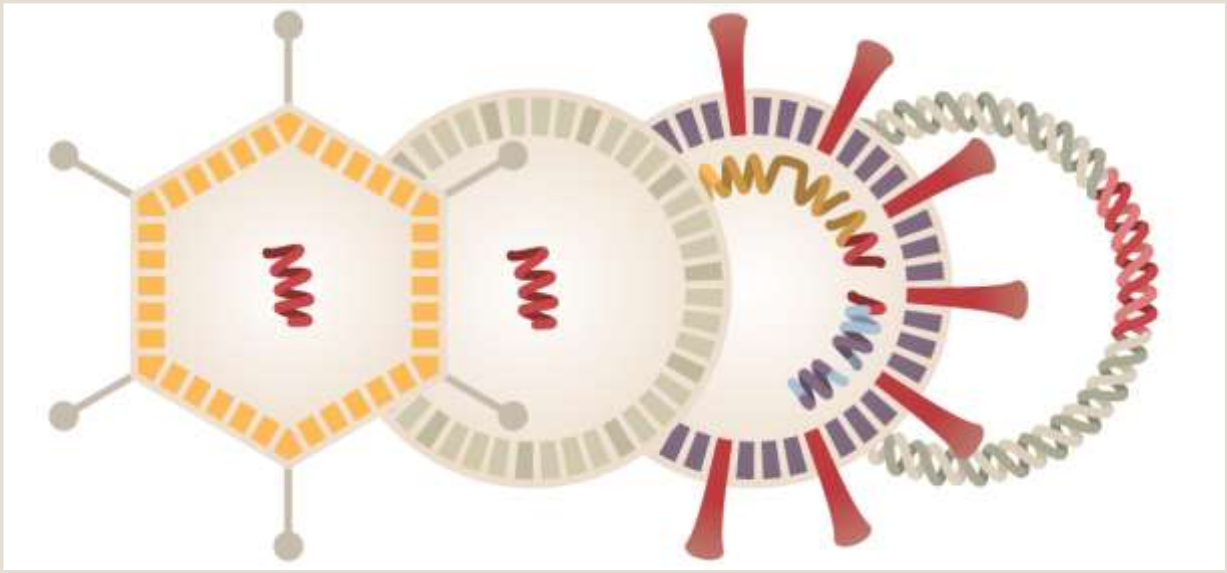




Drug trials: Phase III - IV

Drug candidate	Description	Existing disease approval	Trial sponsor(s)	Location(s)	Expected results
Remdesivir	antiviral; adenosine nucleotide analog inhibiting RNA synthesis in coronaviruses	investigational[78]	Gilead, WHO, INSERM, NIAID	China, Japan initially; expanded internationally in Global Solidarity and Discovery Trials, and US NIAID ACTT Trial	April (Chinese, Japanese trials) to mid-2020
Hydroxychloroquine or chloroquine	antiparasitic and antirheumatic; generic made by many manufacturers	malaria, rheumatoid arthritis, lupus (International)[84][85]	CEPI, WHO, INSERM	Multiple sites in China; Global Solidarity and Discovery Trials, Europe, international	April 2020 (Chinese trials); mid-2020
Favipiravir	antiviral against influenza	influenza (China)[87]	Fujifilm	China	April 2020
Lopinavir/ritonavir without or with Rebif	antiviral, immune suppression	investigational combination; lopinavir/ritonavir approved[89]	CEPI, WHO, UK Government, Univ. of Oxford, INSERM	Global Solidarity and Discovery Trials, multiple countries	mid-2020
Sarilumab	human monoclonal antibody against interleukin-6 receptor	rheumatoid arthritis (USA, Europe)[90]	Regeneron-Sanofi	Multiple countries	Spring 2020
ASC-09 + ritonavir	antiviral	combination not approved; ritonavir approved for HIV[89]	Ascletis Pharma	Multiple sites in China	Spring 2020
Tocilizumab	human monoclonal antibody against interleukin-6 receptor	immunosuppression, rheumatoid arthritis (USA, Europe)[93]	Genentech-Hoffmann-La Roche	Multiple countries	mid-2020
Lenzilumab	humanized monoclonal antibody for relieving pneumonia	new drug candidate	Humanigen, Inc.	Multiple sites in the United States	September 2020
Dapagliflozin	sodium-glucose cotransporter 2 inhibitor	hypoglycemia agent[96]	Saint Luke's Mid America Heart Institute, AstraZeneca	Multiple countries	December 2020
CD24Fc	antiviral immunomodulator against inflammatory response	new drug candidate	OncoImmune, Inc.	Multiple sites in the United States	2021

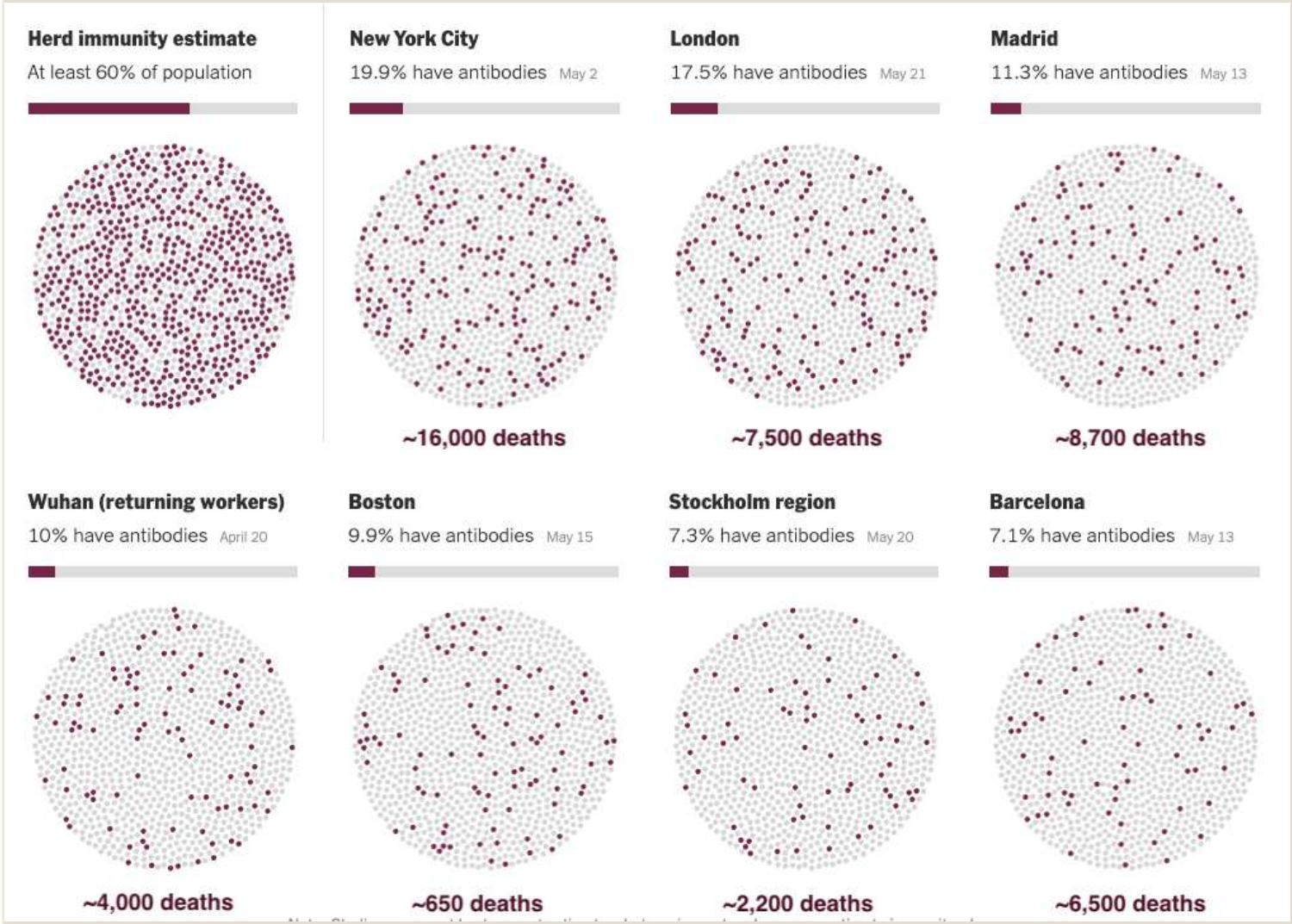
Covid-19 Vaccines



Developer	Type	Phase
Moderna	mRNA	2 (W)
BioNTech + Pfizer	mRNA	1/2 (W)
Inovio	DNA	1
Oxford + AstraZen	Viral vec (ChAd)	2/3 (W)
CanSino Bio	Viral vec (Ad5)	2
Novavax	Protein	1/2
Clover + GSK	Protein	1
SinoVac	Whole virus	1/2
SinoPharm	Whole virus	1/2
Chinese Acad Sci	Whole virus	1
Beth Israel +J&J	Viral vec (Ad26)	PC (W)
Merck + IAVI	Viral vec (VSV)	PC (W)

The New York Times; 10 June 2020

Herd immunity



Should India go for herd immunity?

India population = 138 crores

If 60% infections for herd immunity,

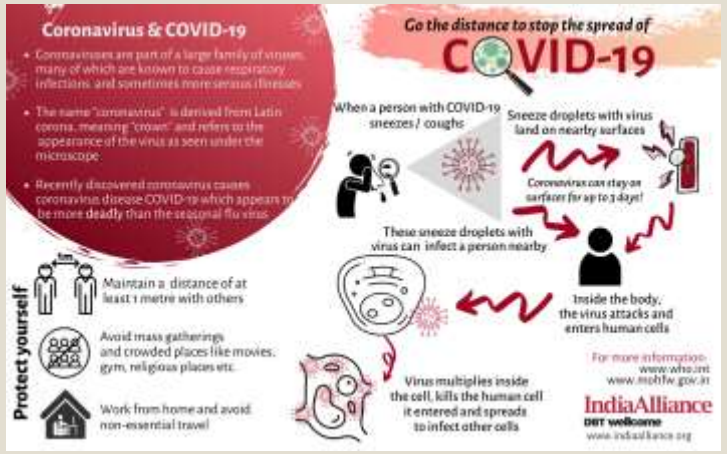
Infected people = 83 crores

- If population mortality = 0.5%

~ 40 lakh deaths

- If population mortality = 0.08%

~ 6.6 lakh deaths


Coronavirus & COVID-19
Coronaviruses are part of a large family of viruses, many of which are known to cause respiratory infections and sometimes more serious illnesses
The name "coronavirus" is derived from Latin corona, meaning "crown" and refers to the appearance of the virus as seen under the microscope
Recently discovered coronavirus causes coronavirus disease COVID-19 which appears to be more deadly than the seasonal flu virus
Go the distance to stop the spread of
COVID-19
When a person with COVID-19 sneezes / coughs
Sneeze droplets with virus land on nearby surfaces
Coronavirus can stay on surfaces for up to 3 days!
These sneeze droplets with virus can infect a person nearby
Inside the body, the virus attacks and enters human cells
Virus multiplies inside the cell, kills the human cell it entered and spreads to infect other cells
Protect yourself
Maintain a distance of at least 1 metre with others
Avoid mass gatherings and crowded places like movies, gym, religious places etc.
Work from home and avoid non-essential travel
For more information:
www.who.int
www.mohfw.gov.in
IndiaAlliance
DBT wellcome
www.indiaalliance.org

कोरोनावायरस और कोविड -19
COVID-19 दूरी ज़रूरी है
जब COVID-19 से प्रभावित व्यक्ति छींकता या खांसता है
पास की सतहों पर वायरस भरी छींक या खांसी बूंदें गिर जाती हैं
कोरोनावायरस 9 दिनों तक सतहों पर रह सकता है
इन बूंदों में मौजूद वायरस, पास में उपस्थित व्यक्ति को संक्रमित कर सकता है
शरीर के अंदर, वायरस हमला करता है और मानव कोशिकाओं में प्रवेश करता है
वायरस मानव कोशिका के अंदर खुद को गुणा करता है, उस कोशिका को मारता है और फैल कर अन्य कोशिकाओं को संक्रमित करता है
अपनी रक्षा करें
दूसरों के साथ कम से कम 1 मीटर की दूरी बनाए रखें
सामूहिक समारोहों और भीड़ वाली जगहों जैसे फिल्म घर, जिम, धार्मिक स्थल, आदि में न जाएं
घर से काम करें और गैर जरूरी यात्रा से बचें
अधिक जानकारी के लिए
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Suno Bat ki Baat
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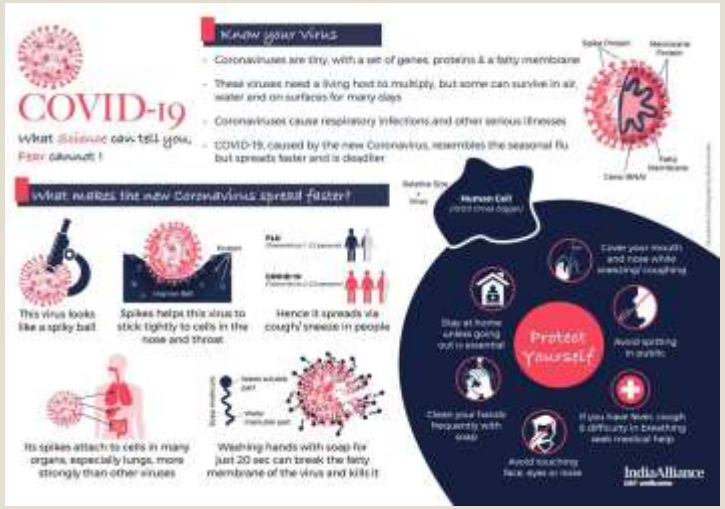
BRIEF ABOUT ME
I AM A HERO, NOT A MONSTER
MY SUPER POOP (GUANO)
MY SUPER IMMUNITY


COVID-19
What Science can tell you.
Fear cannot !
Know your Virus
Coronaviruses are tiny, with a set of genes, proteins & a fatty membrane
These viruses need a living host to multiply, but some can survive in air, water and on surfaces for many days
Coronaviruses cause respiratory infections and other serious illnesses
COVID-19, caused by the new Coronavirus, resembles the seasonal flu but spreads faster and is deadlier
What makes the new Coronavirus spread faster?
This virus looks like a spiky ball
Spikes helps this virus to stick tightly to cells in the nose and throat
Hence it spreads via cough/ sneeze in people
Its spikes attach to cells in many organs, especially lungs, more strongly than other viruses
Washing hands with soap for just 20 sec can break the fatty membrane of the virus and kills it
Protect Yourself
Cover your mouth and nose while sneezing/ coughing
Avoid spitting in public
If you have fever, cough & difficulty in breathing seek medical help
Avoid touching face, eyes or nose
Clean your hands frequently with soap
Stay at home unless going out is essential
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COVID-19
How did I get to Humans?
Hi! I am SARS-CoV2, the new coronavirus.
To those me, listen to science, not rumours!
Who am I? Where do I come from? How do I look?
I am the 7th coronavirus to infect humans, I cause COVID-19
I don't belong to any country, I've no nationality
I use my spikes to enter human cells and get busy making copies of myself. I am told this makes people very sick and they can even die
I live in bats but don't make them sick
You can't see me but I look like a spiky ball
I am not human made. Scientists tell us that I resemble are viral predecessors. I am my own beast
I would live happily in bats and other wild animals, but human activities disturb them, and I come in contact with people
I can't spread too when you stay home!
Washing hands with soap and water for 20 seconds can kill me!
Medical professionals know me better, listen to them!
I can't get inside you easily if you avoid touching your face often!
To fight me, you need solidarity, not hatred. Be kind to each other!
Scientists are working day and night to find a vaccine. My end is near!
Stand aware!
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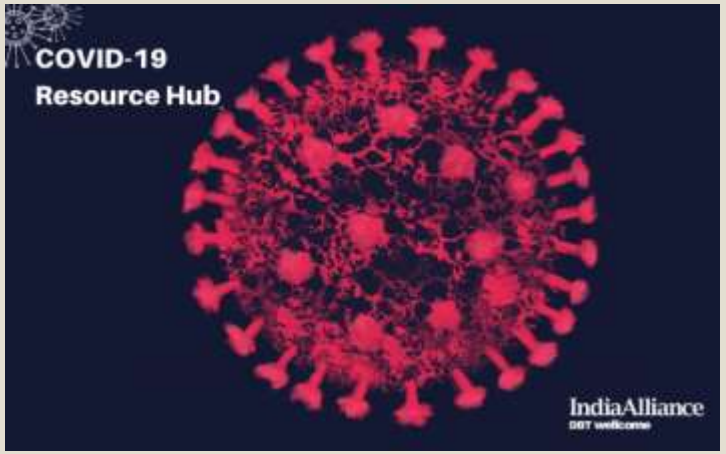
COVID-19
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Key messages

1. Follow government and WHO guidelines
2. Behave as an infected person; protect those around you
3. Be aware of myths
    a. “Strong” and ”Weak” strains of virus circulating in the world
    b. Chloroquine / Hydroxychloroquine as a preventive
    c. Past malaria or BCG vaccination protects you from Covid-19
    d. Summer temperatures will end the pandemic
4. Don’t wait for a drug or vaccine; break the transmission
5. Lockdowns are difficult; help those less fortunate