

COVID-19 Update

Anthony S. Fauci, M.D.

Director

**National Institute of Allergy and
Infectious Diseases**

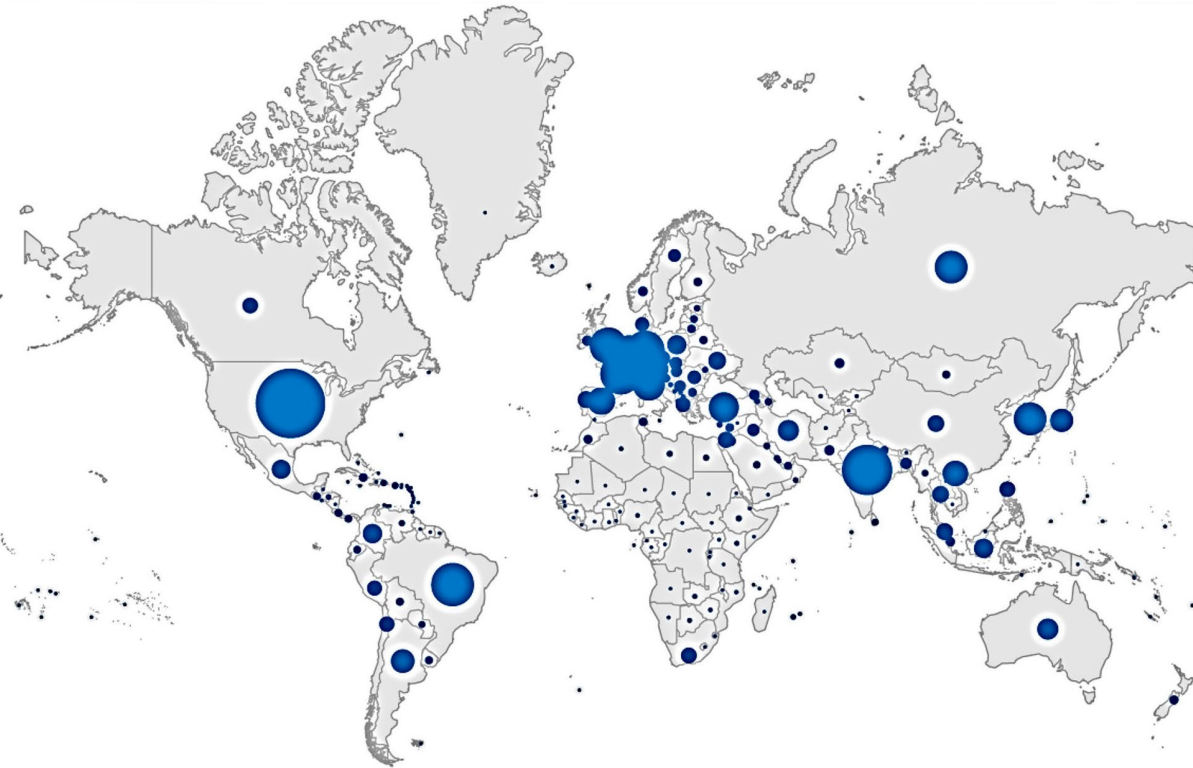
National Institutes of Health

June 9, 2022



The COVID-19 Pandemic

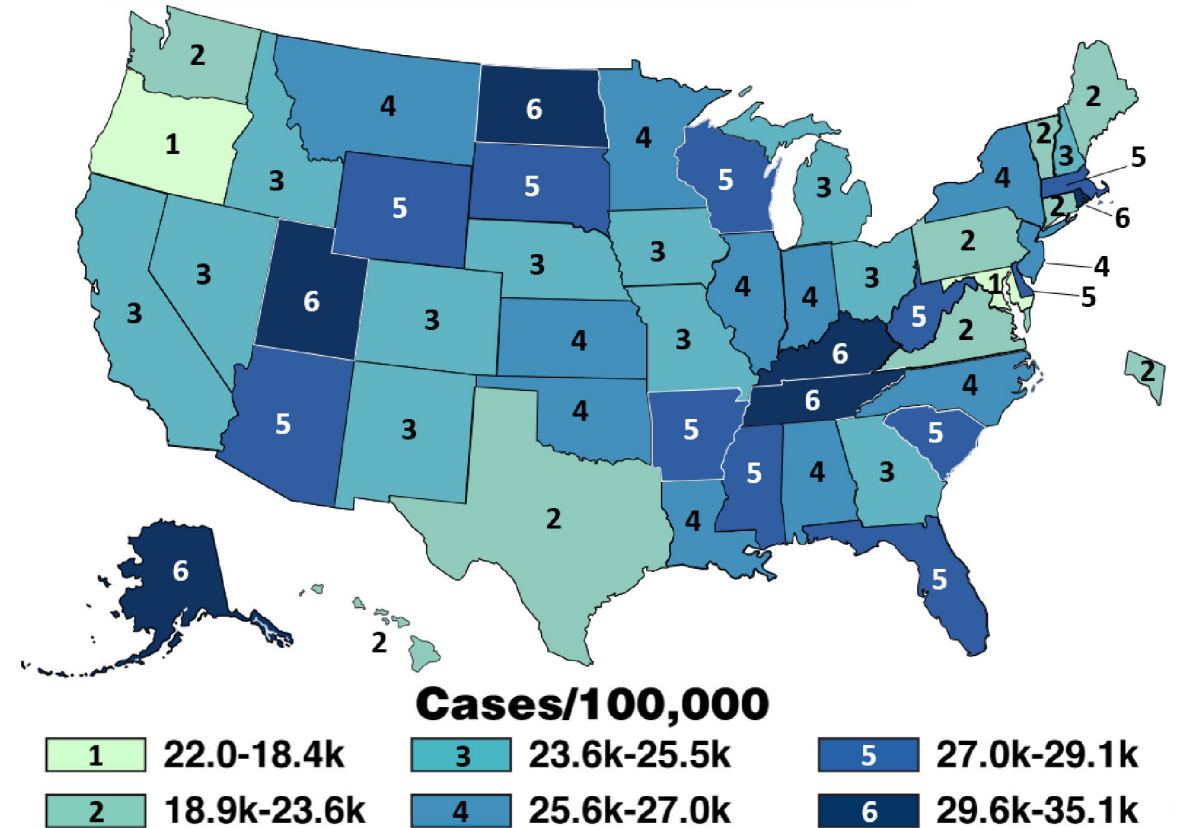
Globally



Reported cases: 526.6 million
Reported deaths: 6,287,117

Sources: WHO; KFF. Data as of 5/31/2022.

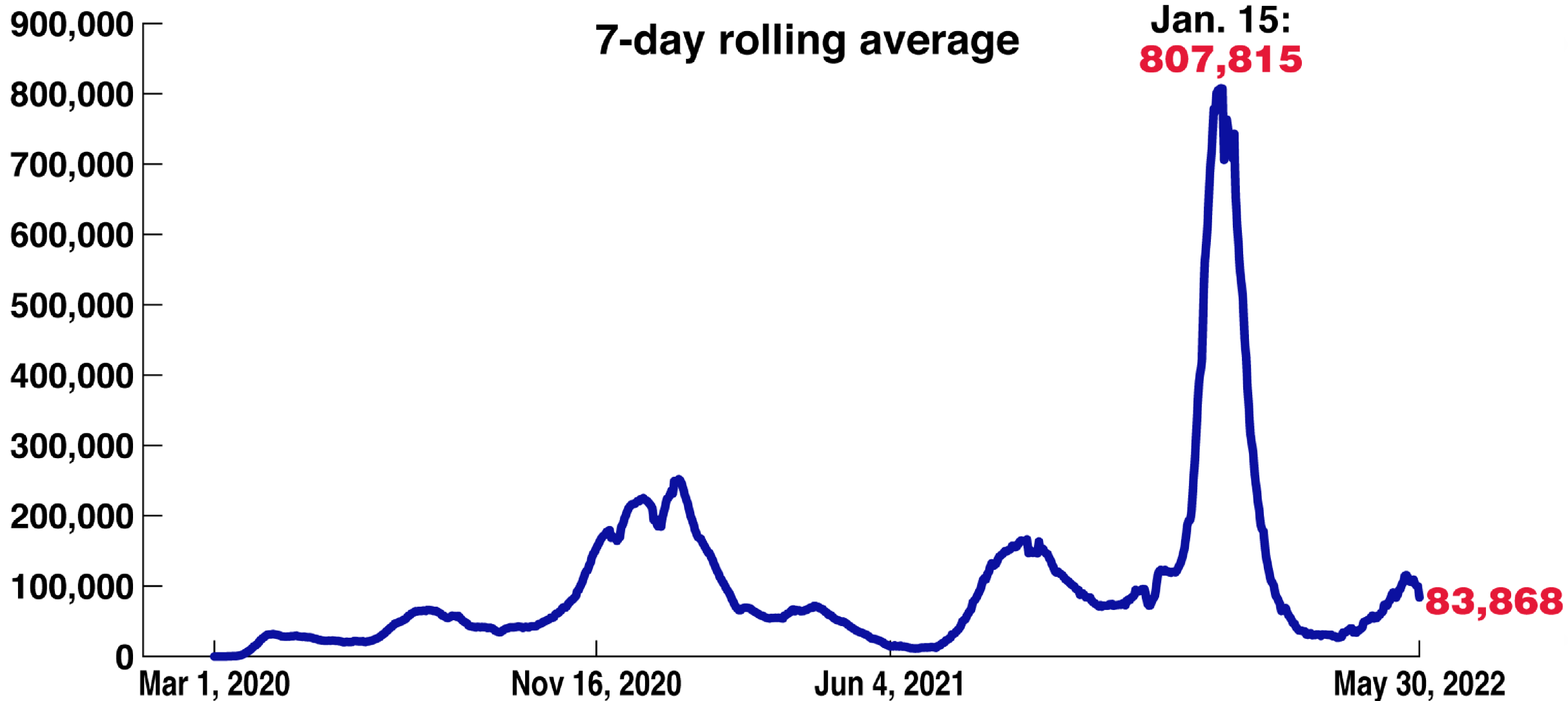
United States



Reported cases: 84.0 million
Reported deaths: 1,002,070

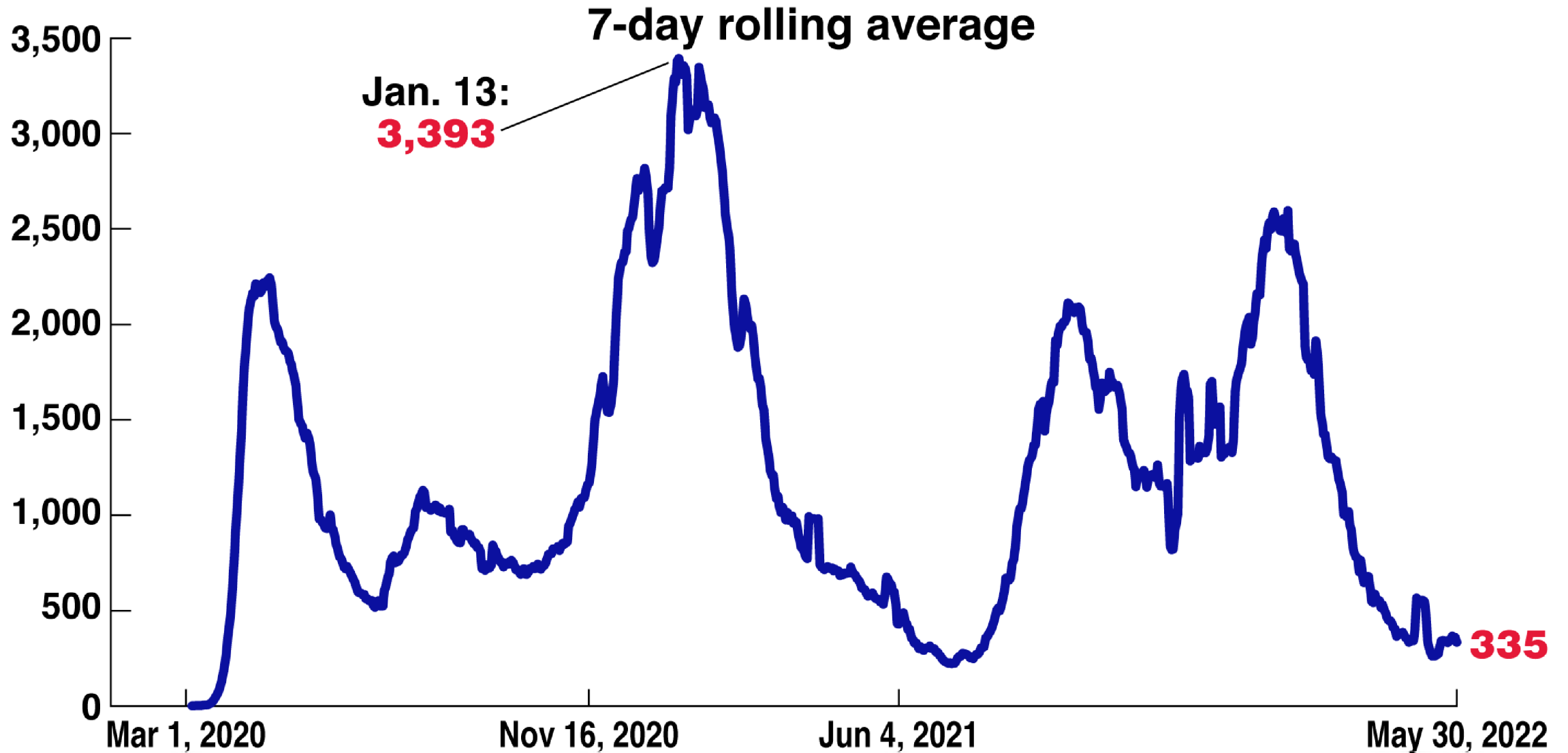
Source: CDC. Data as of 5/31/2022.

Daily New Confirmed COVID-19 Cases, United States

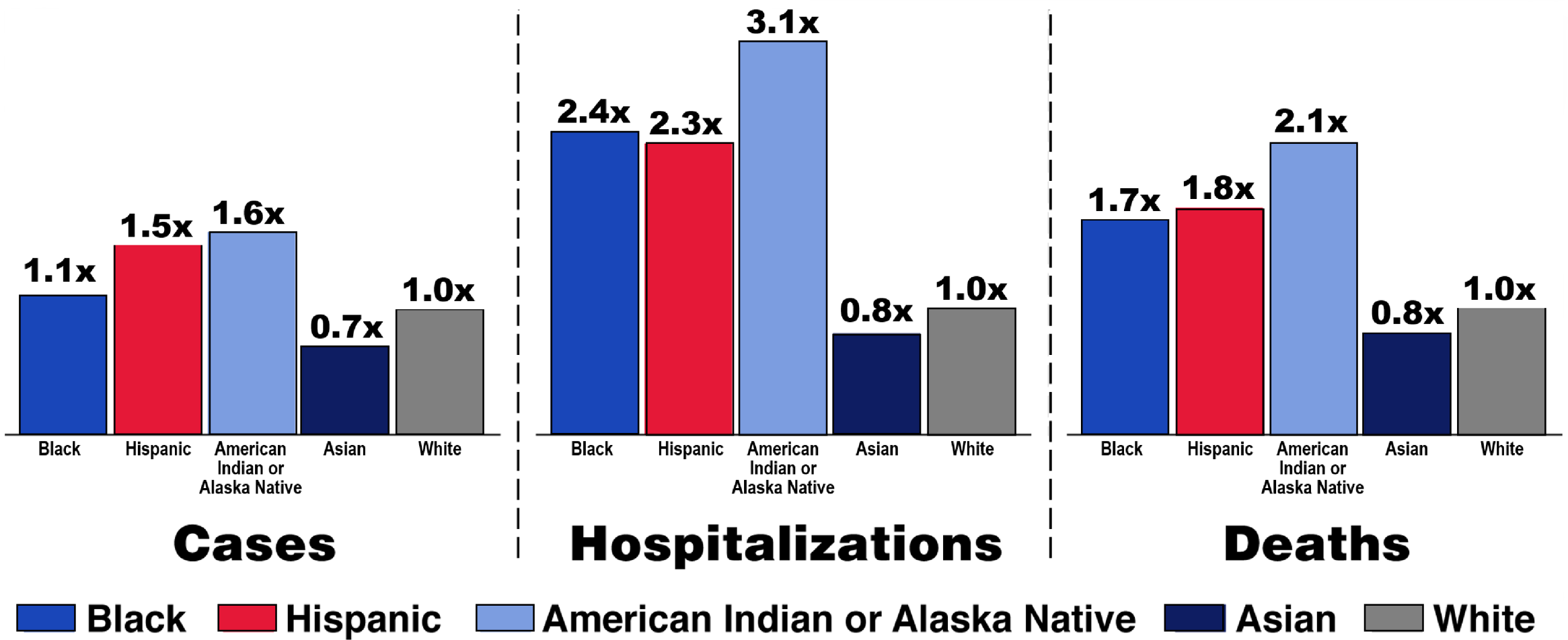


Source: Our World in Data

Daily New Confirmed COVID-19 Deaths, United States



Age-Adjusted Risk of COVID-19 Infection, Hospitalization, and Death, Compared to White People in the United States



Source: CDC, 4/29/2022.

COVID-19 Among Children (<18 Years) in the United States

- **Reported cases: 15,005,523**
- **Hospital admissions: 126,809***
- **Multisystem Inflammatory Syndrome in Children (MISC-C) cases: 8,210**
- **Deaths: 1,527**

WHO SARS-CoV-2 Variants of Concern (VOCs)

WHO name	Earliest documented samples
-----------------	------------------------------------

Alpha	9/2020
--------------	---------------

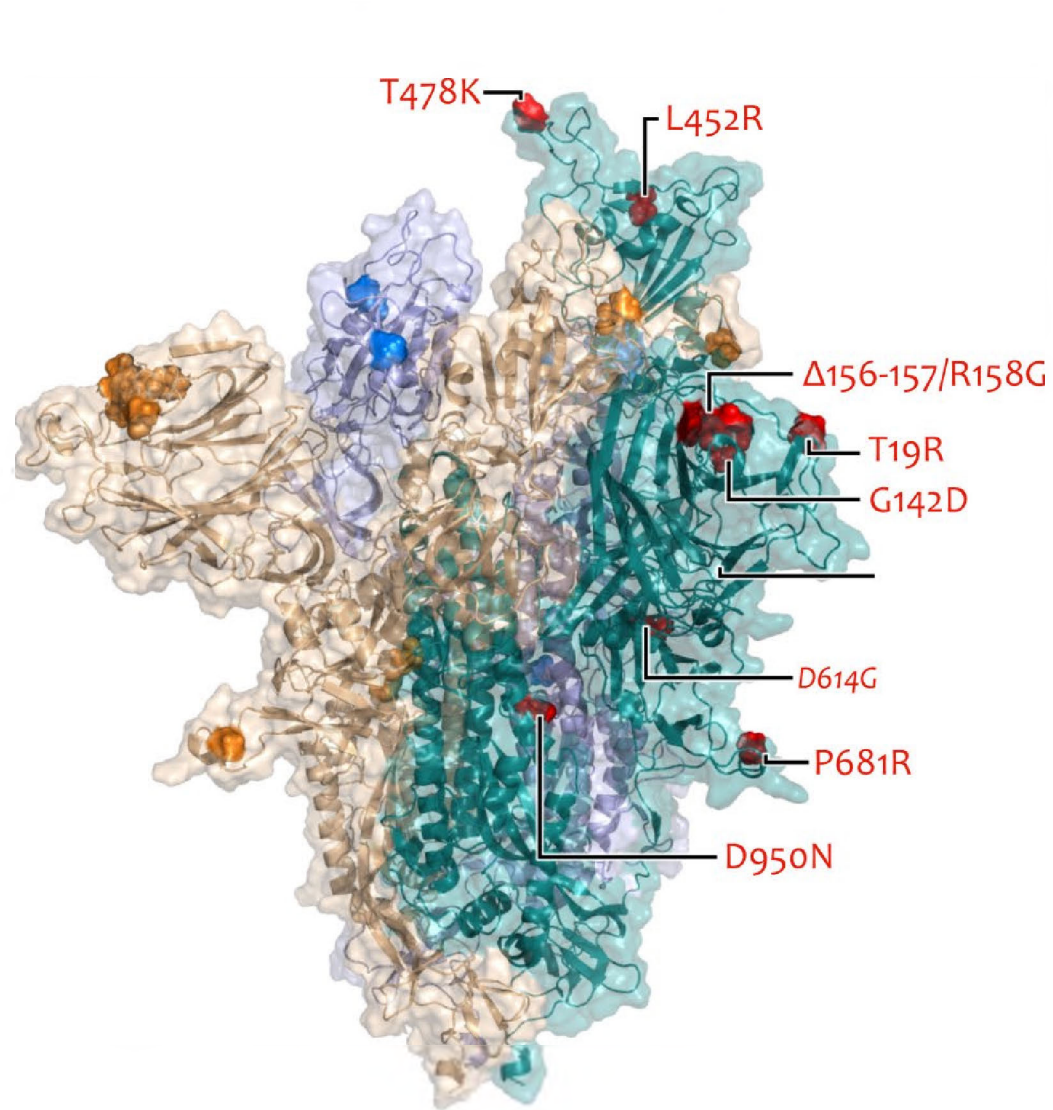
Beta	5/2020
-------------	---------------

Gamma	11/2020
--------------	----------------

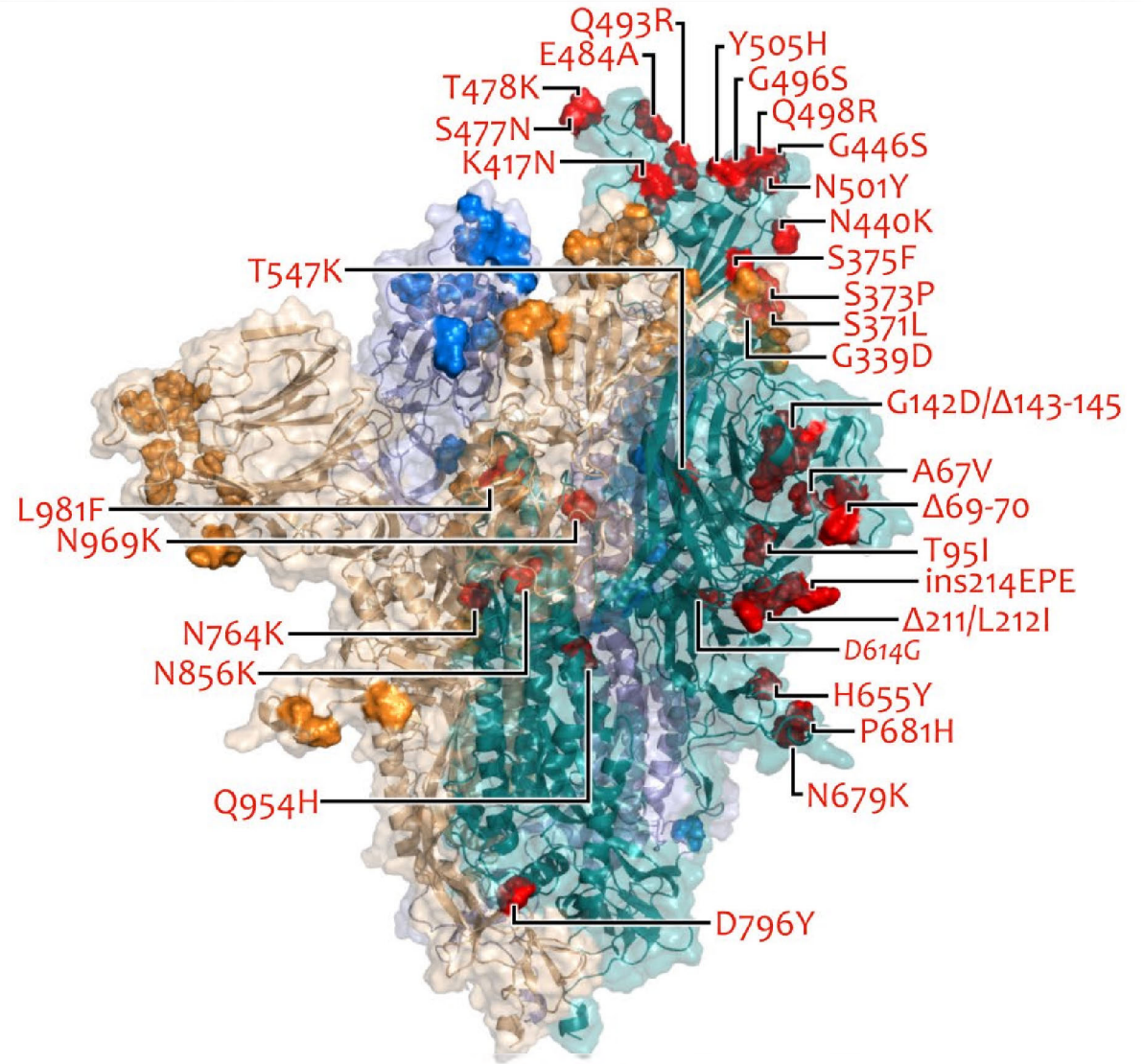
Delta	10/2020
--------------	----------------

Omicron	11/2021
----------------	----------------

SARS-CoV-2 Spike Protein Mutations

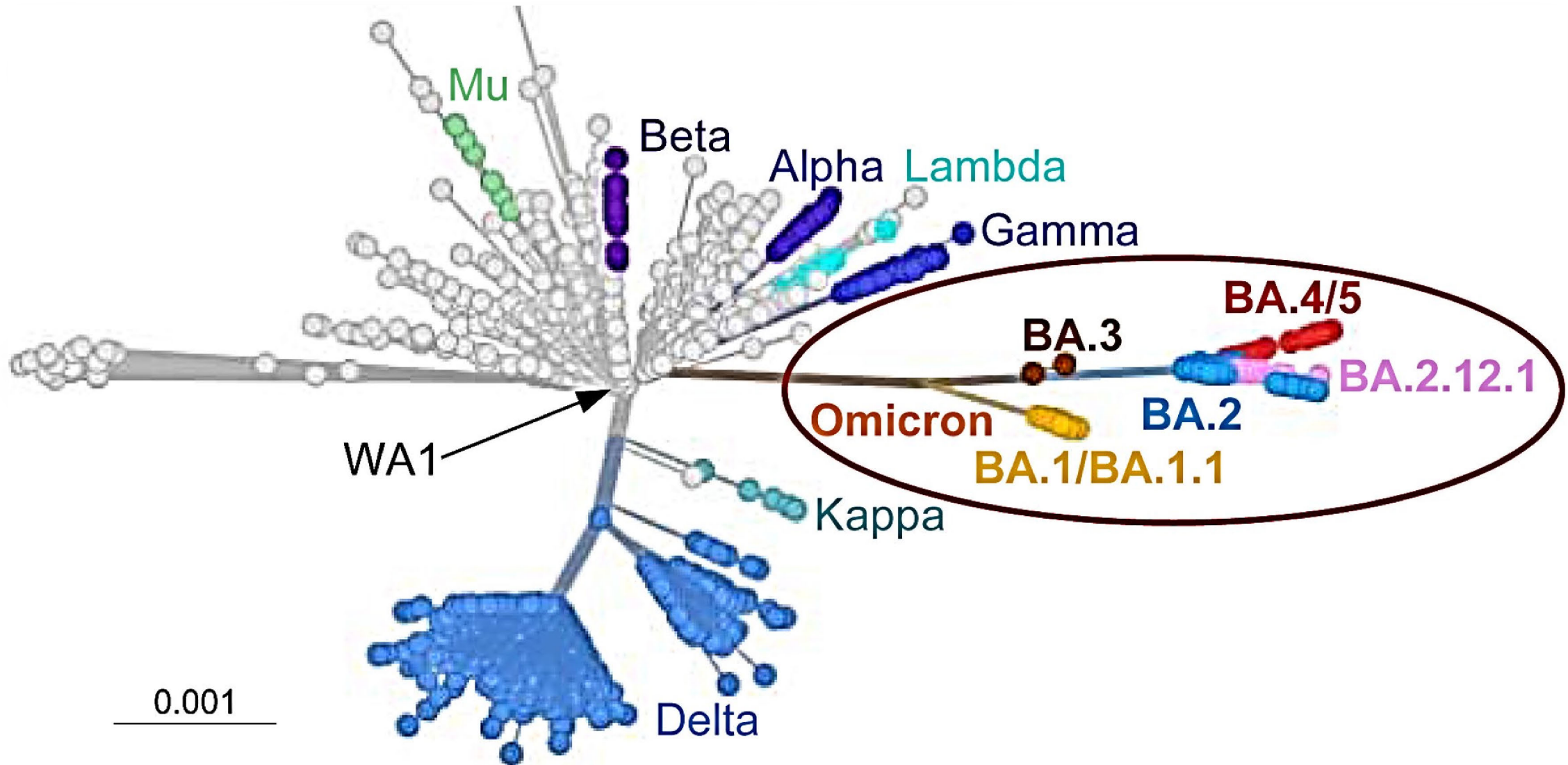


Delta (B.1.617.2)

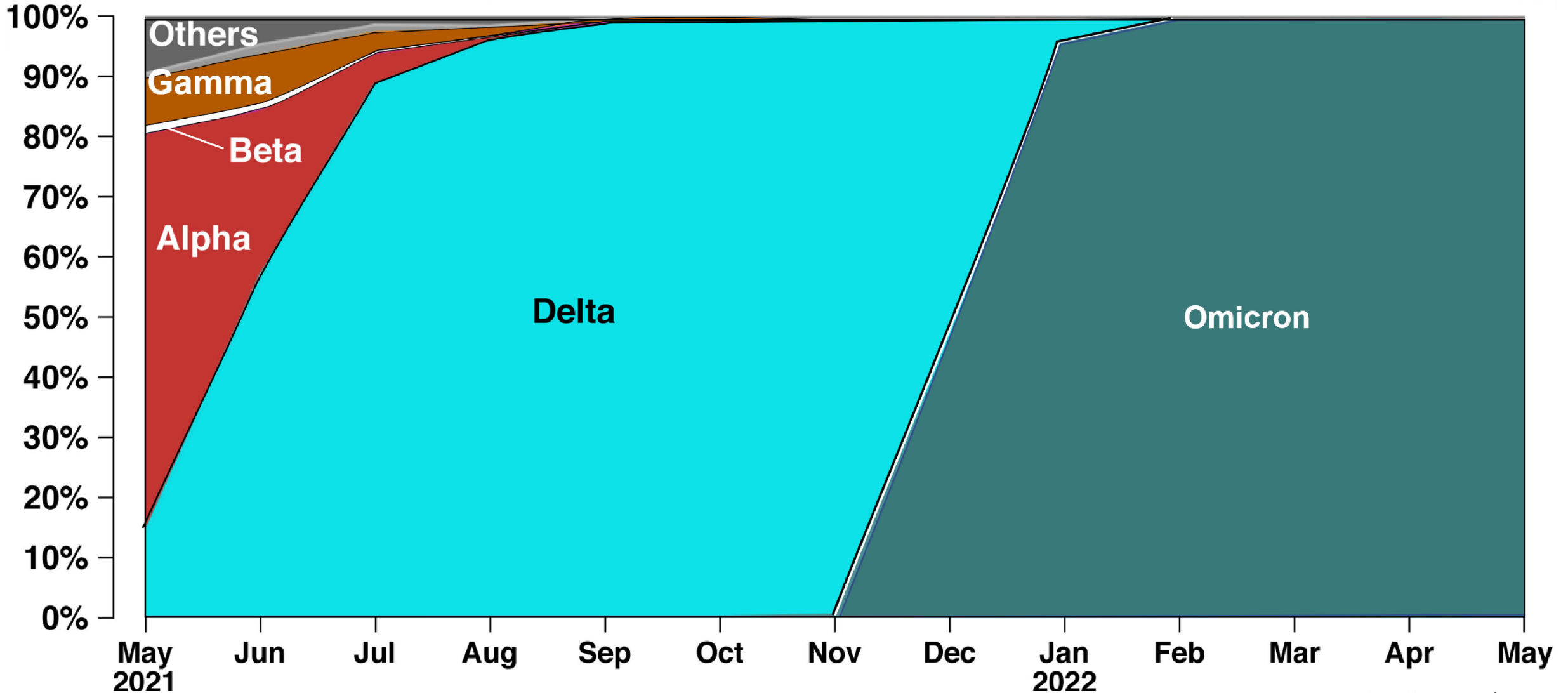


Omicron (BA.1)

SARS-CoV-2 “Family Tree”

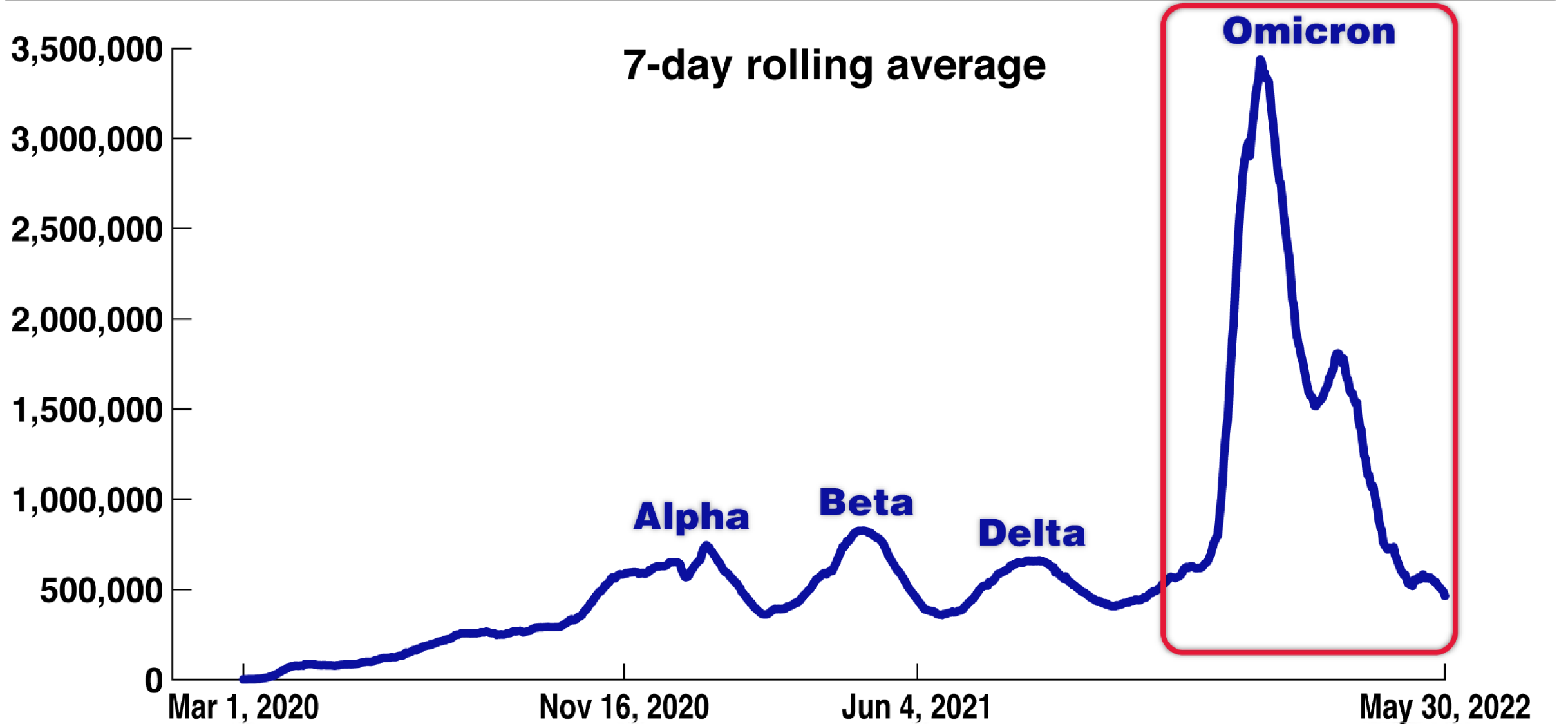


Timecourse of SARS-CoV-2 Variant Distribution, Global

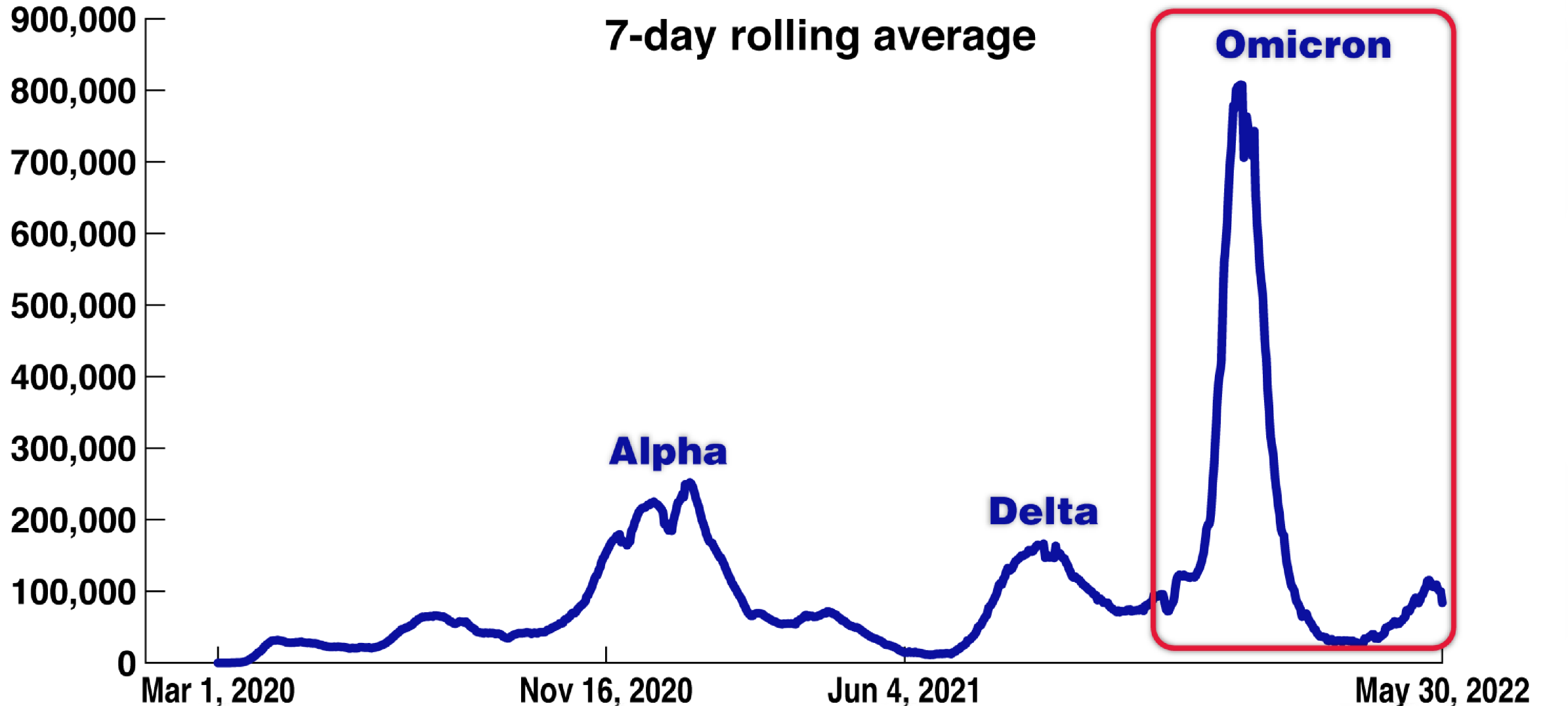


Source: GISAID, 5/24/2022

Daily New Confirmed COVID-19 Cases, World

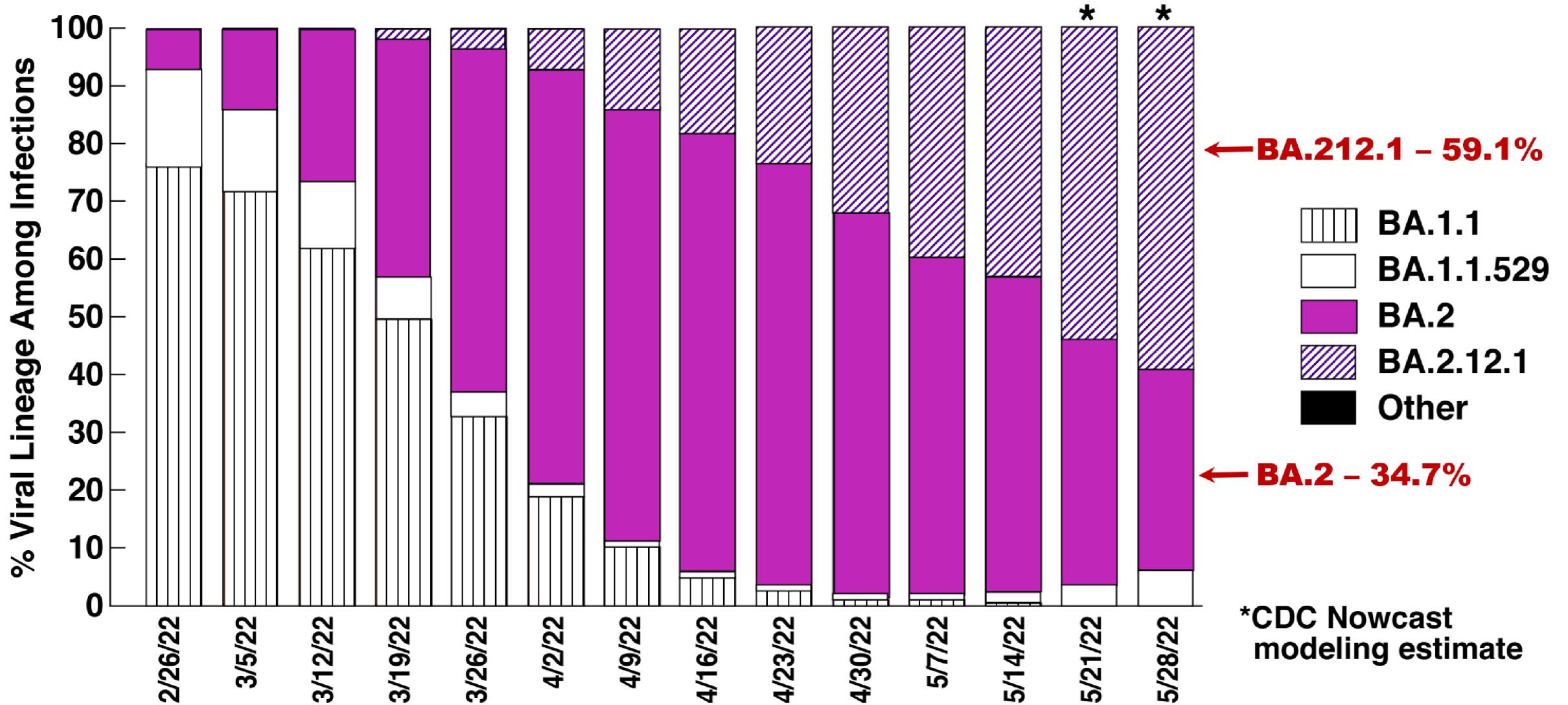


Daily New Confirmed COVID-19 Cases, United States



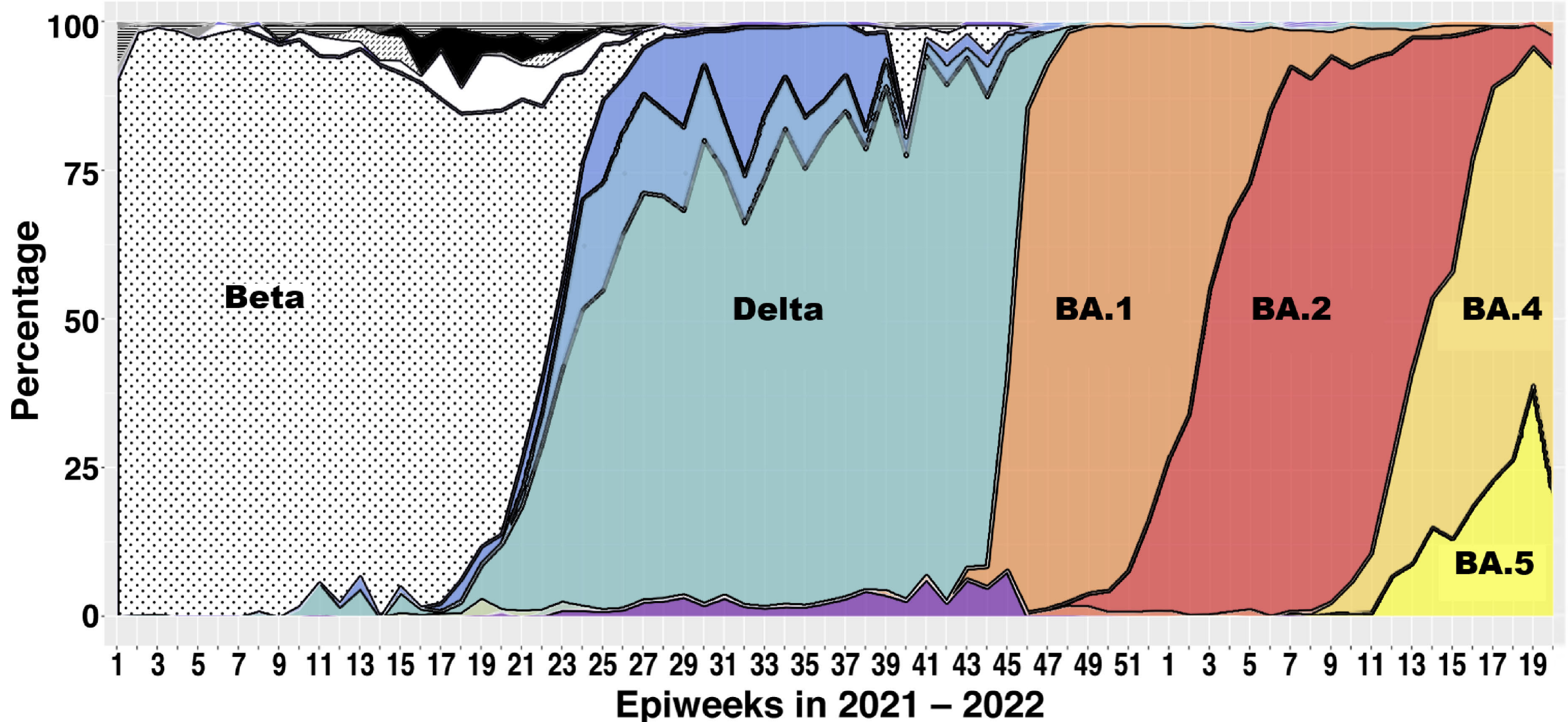
Source: Our World in Data

SARS-CoV-2 Variant Proportions, United States, Feb. 20 - May 28, 2022



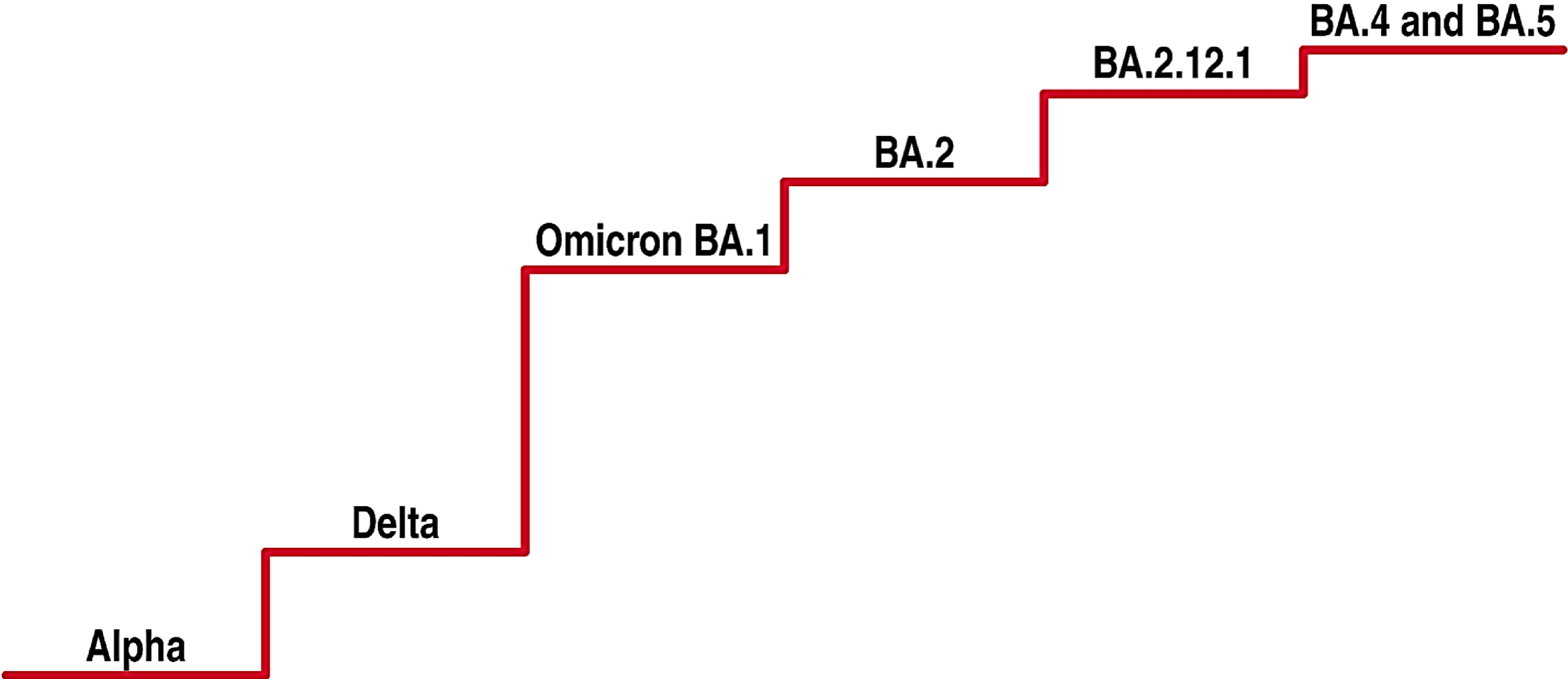
South Africa: BA.4, BA.5 Now Dominant

Prevalence of SARS-CoV-2 sequences by lineage and epiweek



Source: Network for Genomic Surveillance in South Africa (NGS-SA), May 27, 2022

SARS-CoV-2 Variants: Ladder of Transmissibility



Adapted from E Topol: Groundtruths Substack, May 4, 2022

**Waning immunity
to prior infection
and/or vaccination**

**Increased
transmissibility
of new variants**

**Relaxation of
mitigations
(masking, indoor
congregating)**

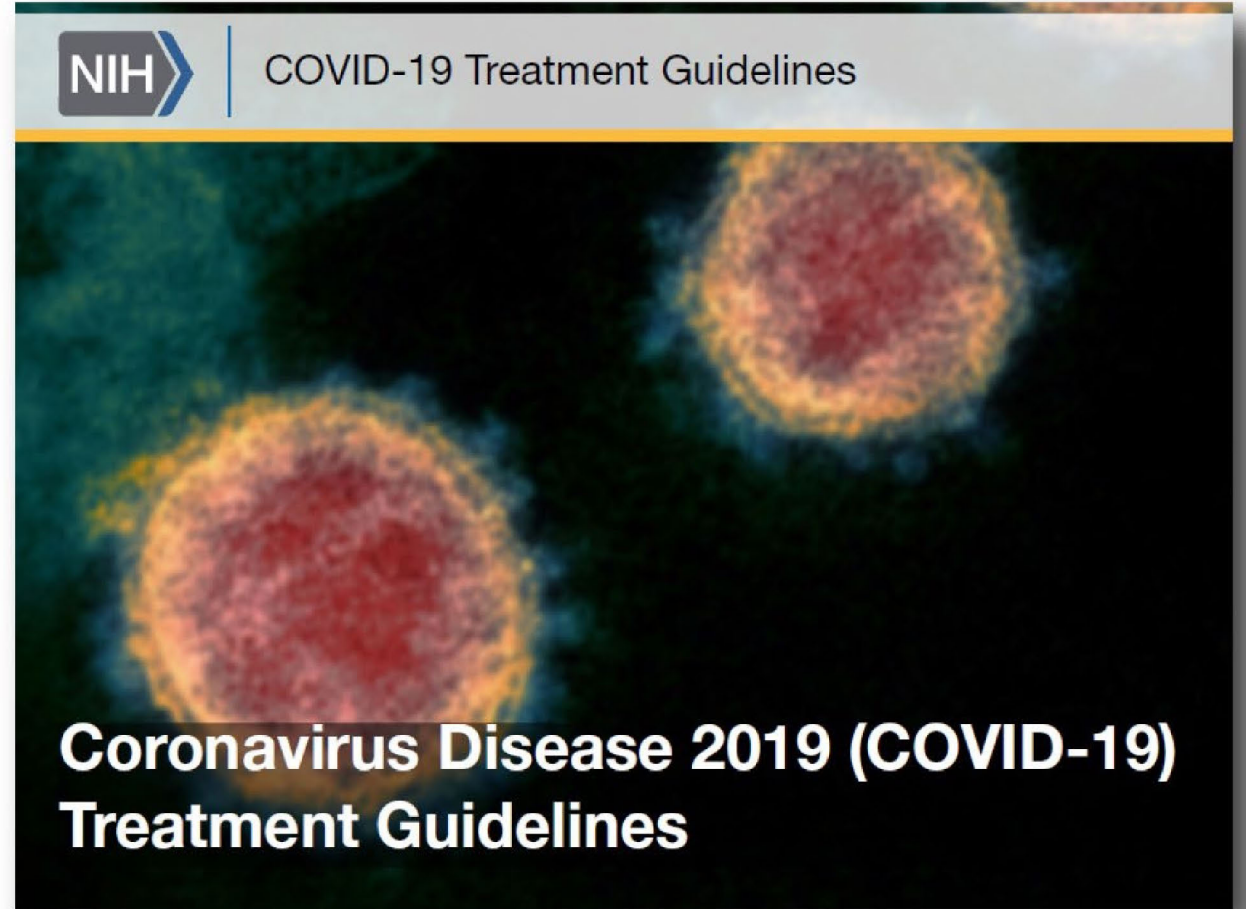
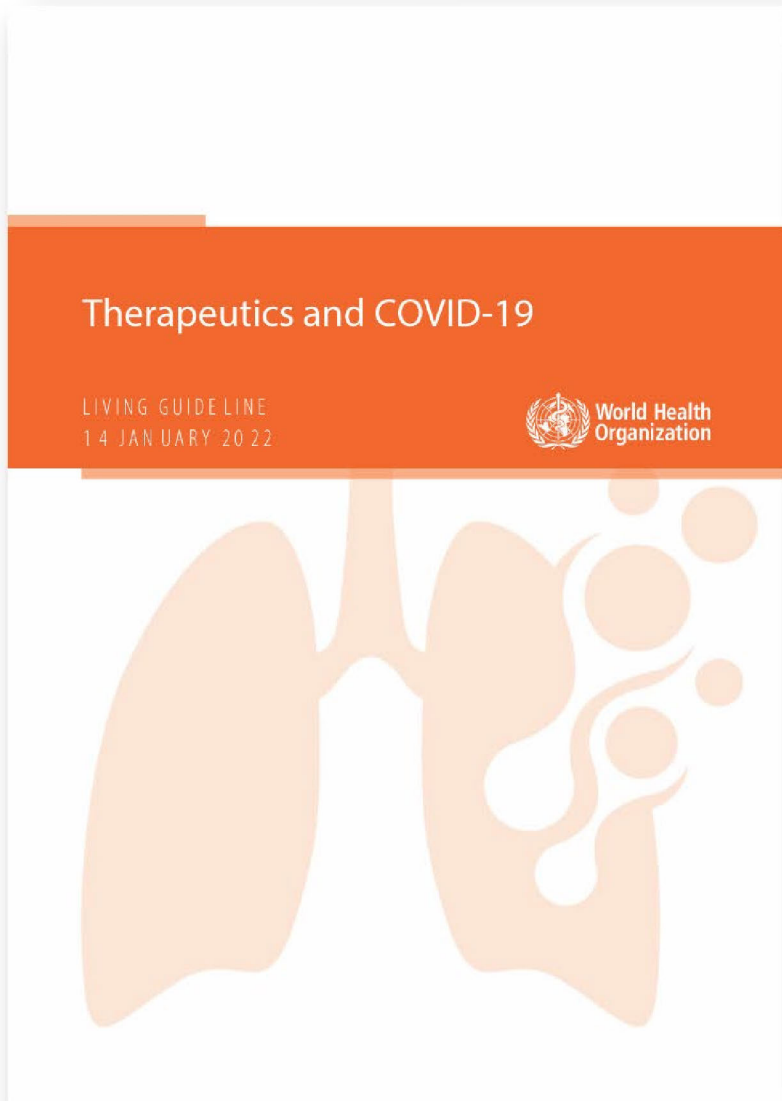
**Increase in
COVID-19 Cases**

Medical Management of the SARS-CoV-2-Infected Patient

Medical Management of the SARS-CoV-2-Infected Patient

- **Control of symptoms**
- **End-organ support**
- **Antivirals and immunomodulators**

COVID-19 Treatment: WHO and NIH Guidelines



Key COVID-19 Therapeutics, June 2022

Targeting the virus

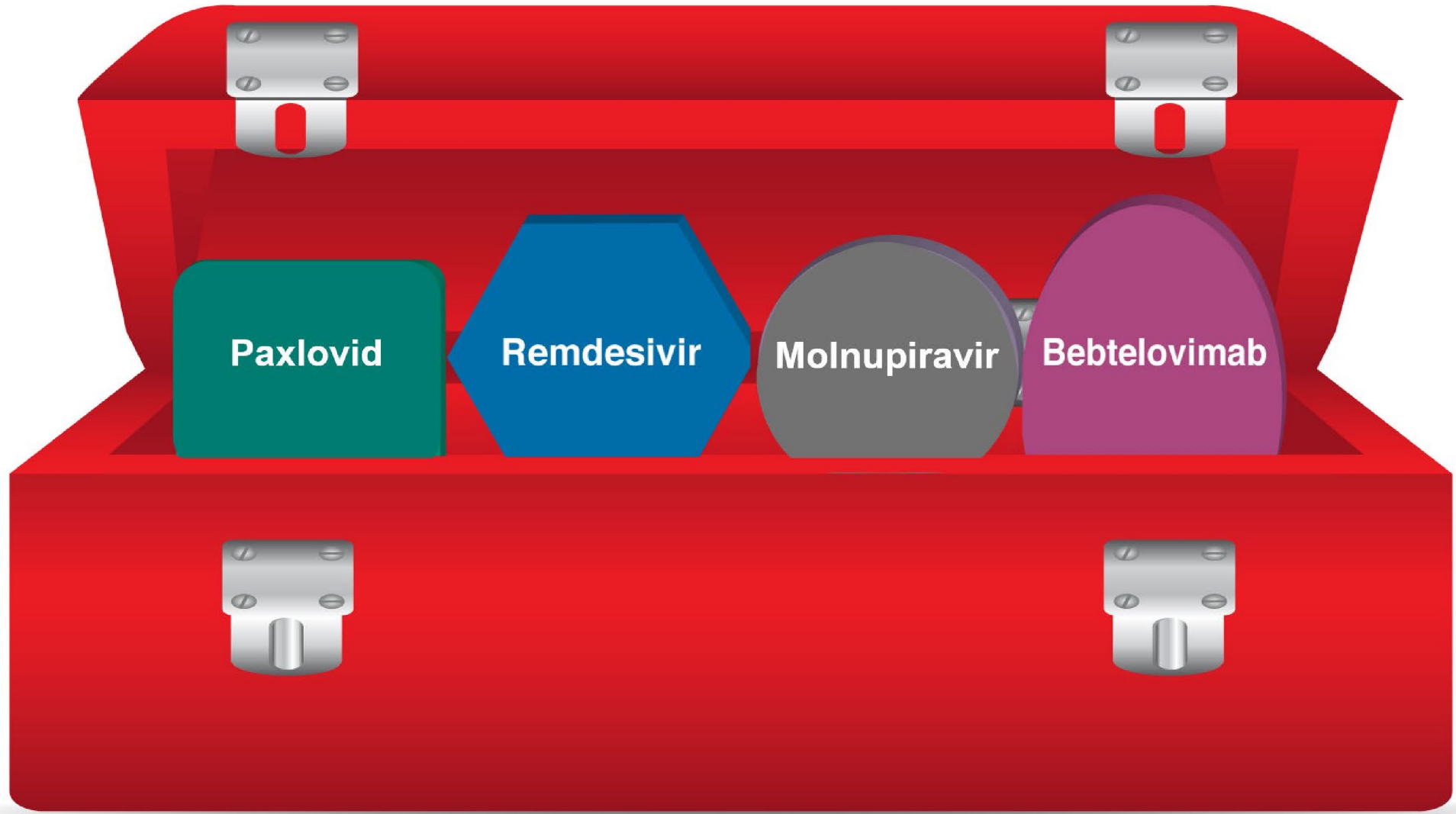
- Remdesivir – FDA approved
- Paxlovid – EUA
- Molnupiravir – EUA
- Anti-SARS-CoV-2 monoclonal antibodies
– Bebtelovimab (EUA)



Moderating host responses

- Dexamethasone – recommended for hospitalized patients on oxygen
- Tocilizumab (EUA) or baricitinib (FDA approved) – recommended for certain patients on dexamethasone
- Other immunomodulators – clinical trials
- Anticoagulants – recommended for certain hospitalized patients

Therapeutic “Toolkit” for Non-Hospitalized Patients with COVID-19 in the Omicron Era





HEALTH AND HUMAN SERVICES

PRESS RELEASE







MARCH 8, 2022

Fact Sheet: Biden Administration Launches Nationwide Test-to-Treat Initiative Ensuring Rapid 'On the Spot' Access to Lifesaving COVID Treatments

■ More info: aspr.hhs.gov/COVID-19/Therapeutics

COVID-19 Vaccines

COVID-19 Vaccines in U.S. Government Development Portfolio

Platform	Immunogen	Developer	Status
Nucleic Acid (mRNA)	S2P		■ BLA (Age 18+)
	S2P		■ BLA (Age 16+); EUA (Age 5-15)
Adenovirus Vector	S2P		■ EUA (Age 18+)
	Wild-type spike		■ EUA/BLA TBD
Recombinant Protein and Adjuvant	S2P		■ EUA request 2/2022
	S2P	 Creating Tomorrow's Vaccines Today	■ EUA request 1/2022

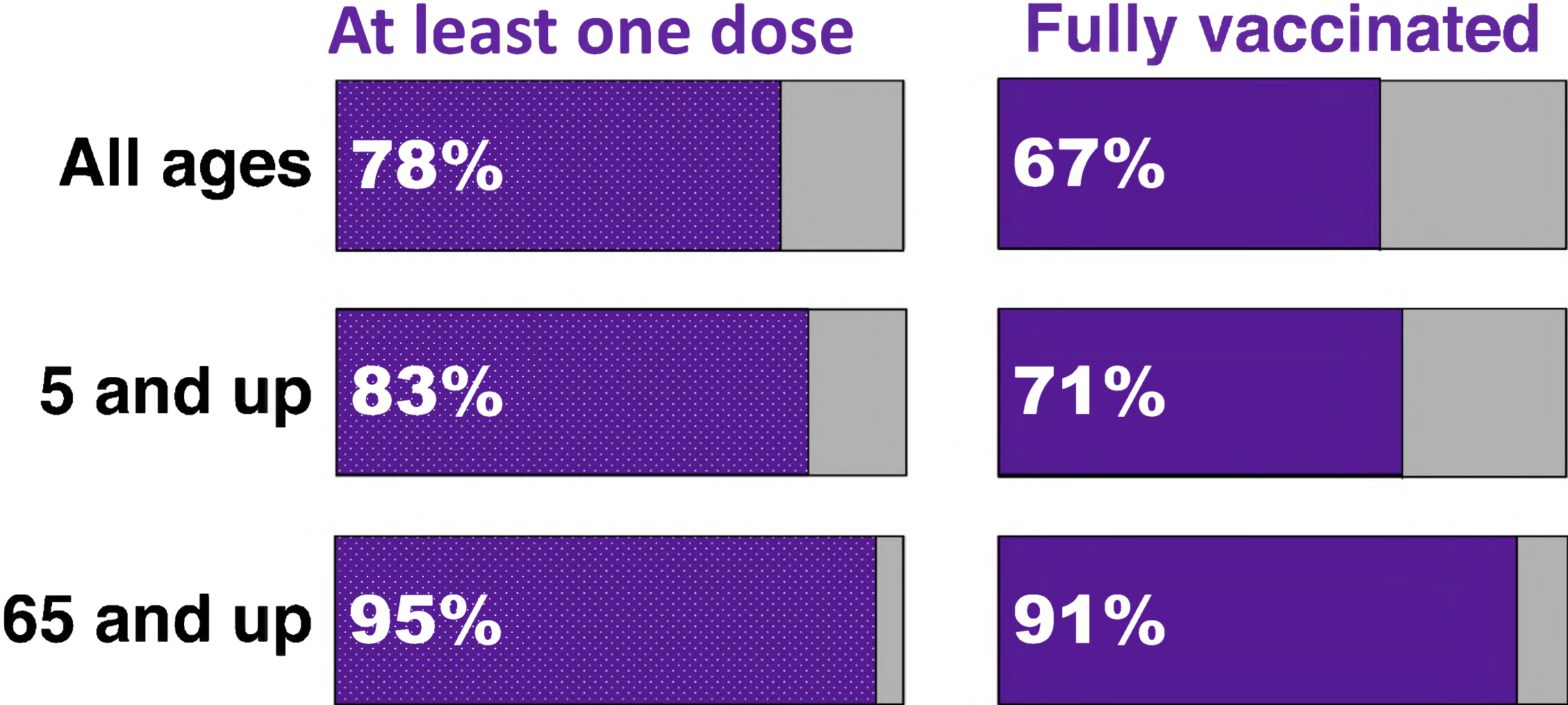


The
Commonwealth
Fund

Estimates of COVID-19-Attributable Deaths, Hospitalizations, Infections, and Health Care Costs Averted by the U.S. Vaccination Program, 12/12/2020 – 3/31/2022

- **Deaths: 2,265,222**
- **Hospitalizations: 17,003,960**
- **Infections: 66,159,093**
- **Health care costs: \$899.4 billion**

Vaccination Profile in the United States

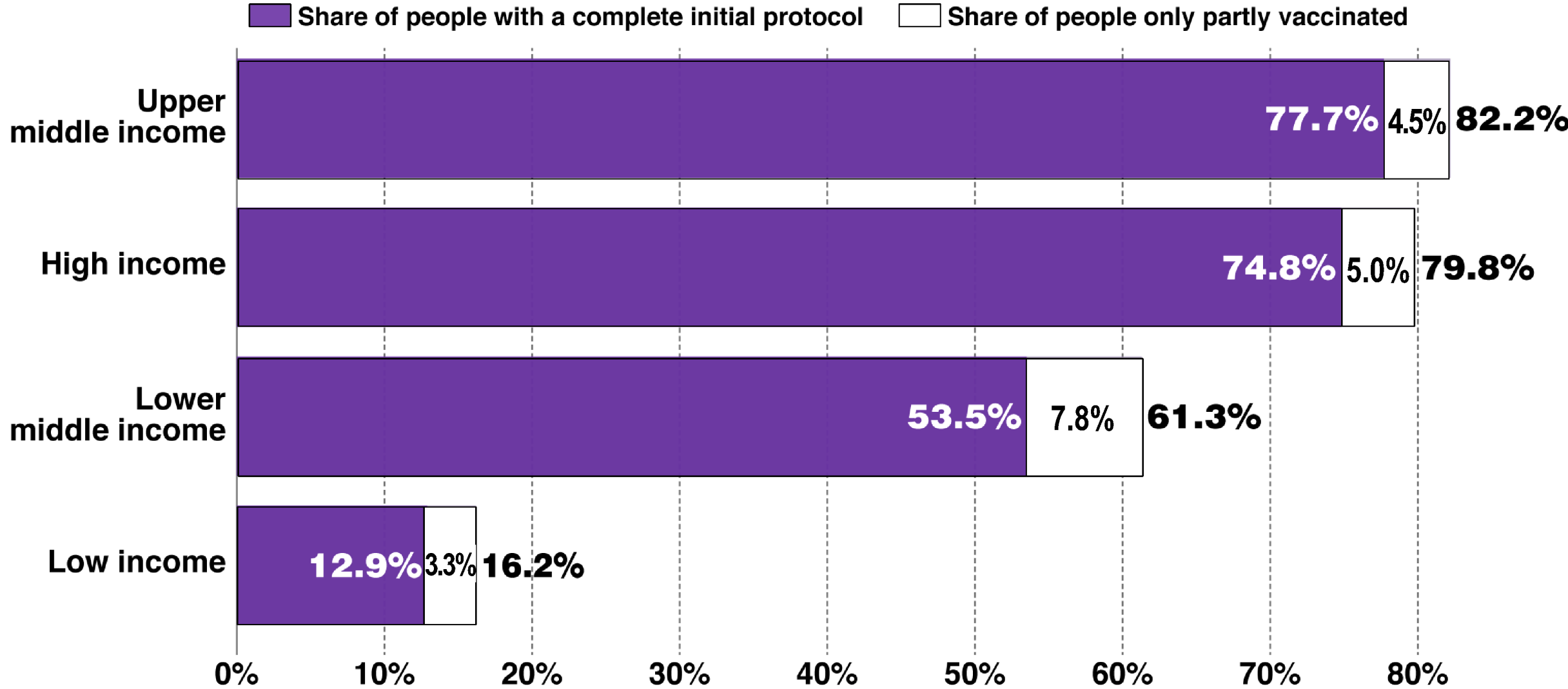


Source: CDC COVID Data tracker, 5/31/2022.

FDA Vaccines and Related Biological Products Advisory Committee (VRBPAC): Upcoming Meetings on COVID-19 Vaccines for Children

- **June 14, 2022** – Discussion of Moderna’s Emergency Use Authorization (EUA) request for children 6 years through 17 years of age
- **June 15, 2022** – Discussion of Moderna’s EUA request for children 6 months through 5 years of age and Pfizer-BioNTech’s EUA request for children 6 months through 4 years of age

Share of People Vaccinated Against COVID-19 as of May 30, 2022

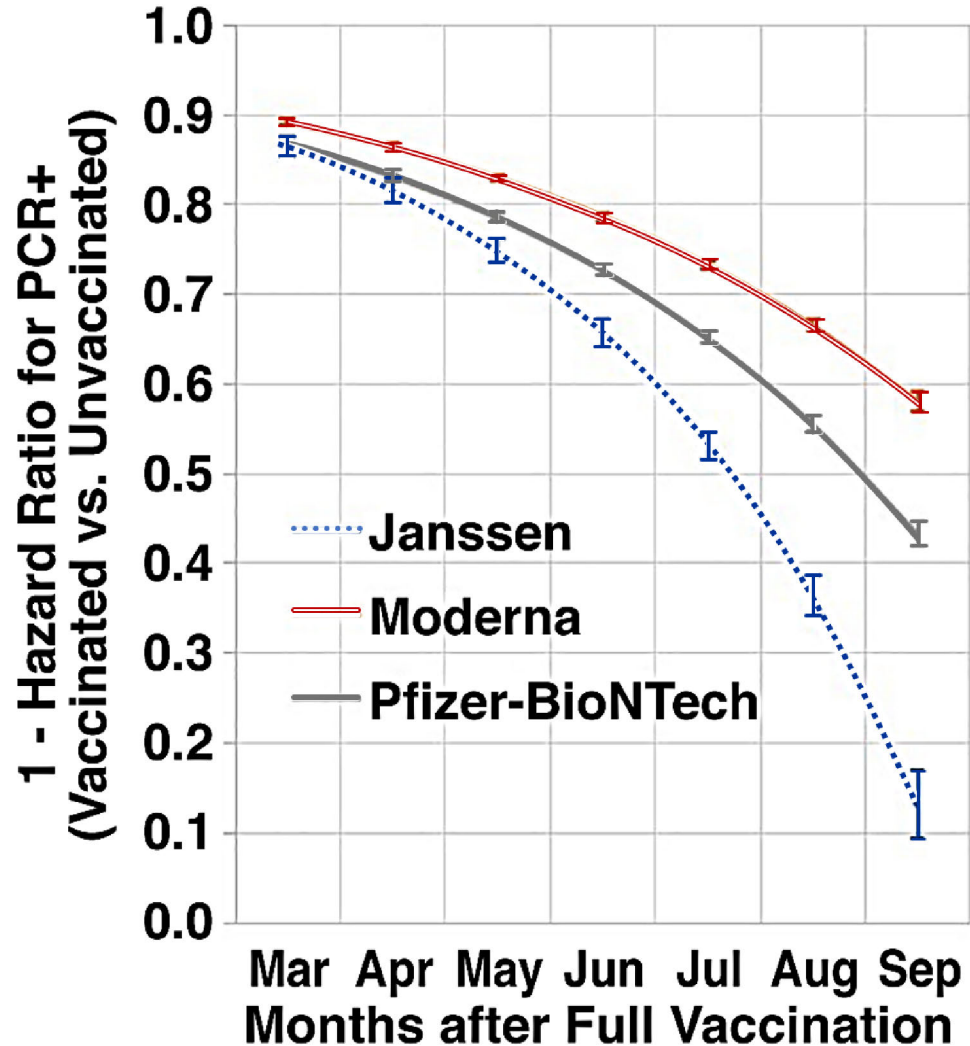


Source: Our World in Data

Booster Shots for SARS-CoV-2 Vaccines

Waning Immunity after COVID-19 Vaccination Among U.S. Veterans, 2021

Waning immunity against infection

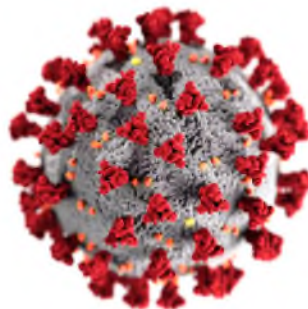


■ Vaccine effectiveness (VE) against SARS-CoV-2 infection declined from 87.9% to 48.1% from Feb. to Oct., 2021

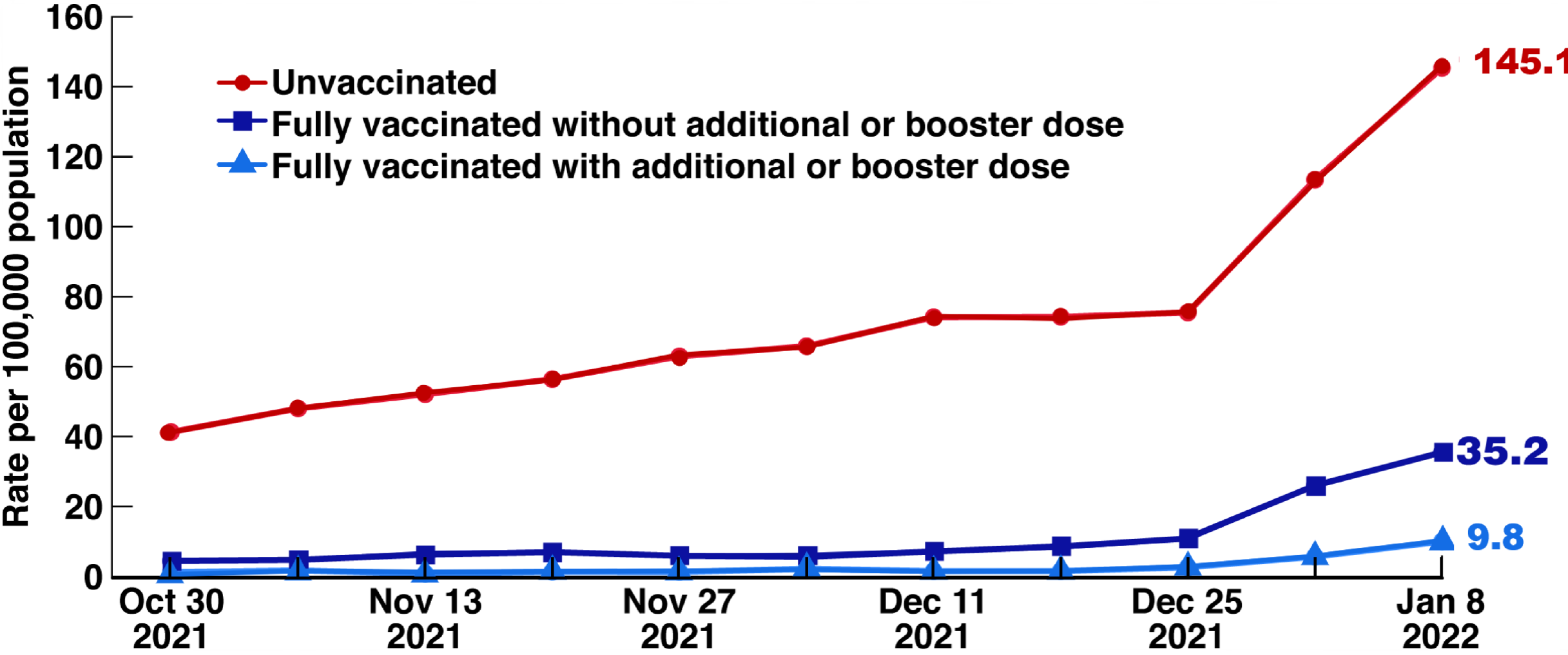
■ From July to October 2021 (Delta predominant period), VE against COVID-19 death:

- age <65 years: 73.0% for Janssen, 81.5% for Moderna, 84.3% for Pfizer-BioNTech
- age ≥65 years: 52.2% for Janssen, 75.5% for Moderna, 70.1% for Pfizer-BioNTech

- **Numerous studies of the real-world effectiveness COVID-19 vaccines show that booster doses reconstitute waning immune protection for at least several months**
- **The effect of booster doses is most pronounced against severe disease, hospitalization and death**



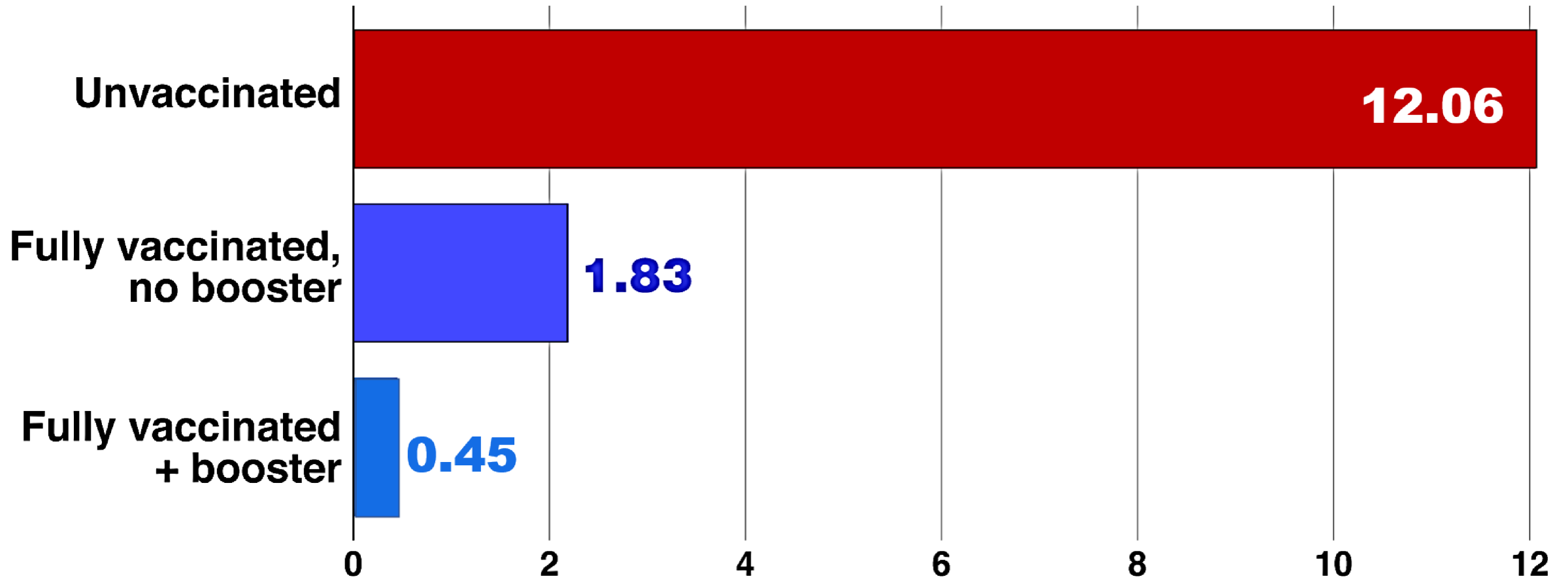
Age-Adjusted Rates of COVID-19-Associated Hospitalizations by Vaccination Status in Adults Ages ≥ 18 Years, October 2021–January 2022



Source: CDC

COVID-19 Vaccination and Boosters Work!

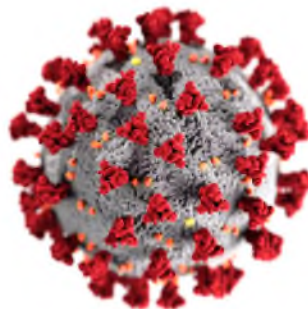
COVID-19 weekly death rate/100,000 population
by vaccination status, USA, 1/2022



Impact of COVID-19 Booster Doses in the United States

In March 2022 (Omicron variant predominant):

- **Unvaccinated people aged 18+ years had a 5x increased risk of COVID-19-associated hospitalization compared to people vaccinated with a primary series and a booster dose**
- **Unvaccinated people aged 12+ years had a 17x increased risk of dying from COVID-19 compared to people vaccinated with a primary series and a booster dose**



**FDA Expands Eligibility for
Pfizer-BioNTech COVID-19
Vaccine Booster Dose to
Children 5 through 11 Years**

**Considerations for a
Second COVID-19
Booster Shot**

Waning Effectiveness of 1st COVID-19 Vaccine Booster Restored by 2nd Booster Dose

- **First booster doses restore the waning vaccine effectiveness of a primary vaccination series, including against severe disease and hospitalization associated with the Omicron variant**
- **However, the effectiveness of a first booster dose wanes over time**
- **Growing evidence indicates that a second COVID-19 vaccine booster dose can restore vaccine effectiveness for certain populations, at least in short term**



The
New England
Journal of Medicine

Established in 1812 as THE NEW ENGLAND JOURNAL OF MEDICINE AND SURGERY

Volume 386

May 5, 2022

Number 18

Protection by a Fourth Dose of BNT162b2 against Omicron in Israel

YM Bar-On, R Milo et al.

- **>1.2 million people aged 60+ years and eligible for fourth dose, Israeli Ministry of Health database**
- **An additional booster dose of Pfizer/BioNTech vaccine at 4 months after a 1st booster resulted in a 3.5-fold lower rate of severe illness**
- **Protection against severe illness did not wane during 6 weeks of follow up**



The
New England
Journal of Medicine

Established in 1812 as THE NEW ENGLAND JOURNAL OF MEDICINE AND SURGERY

Volume 386

April 28, 2022

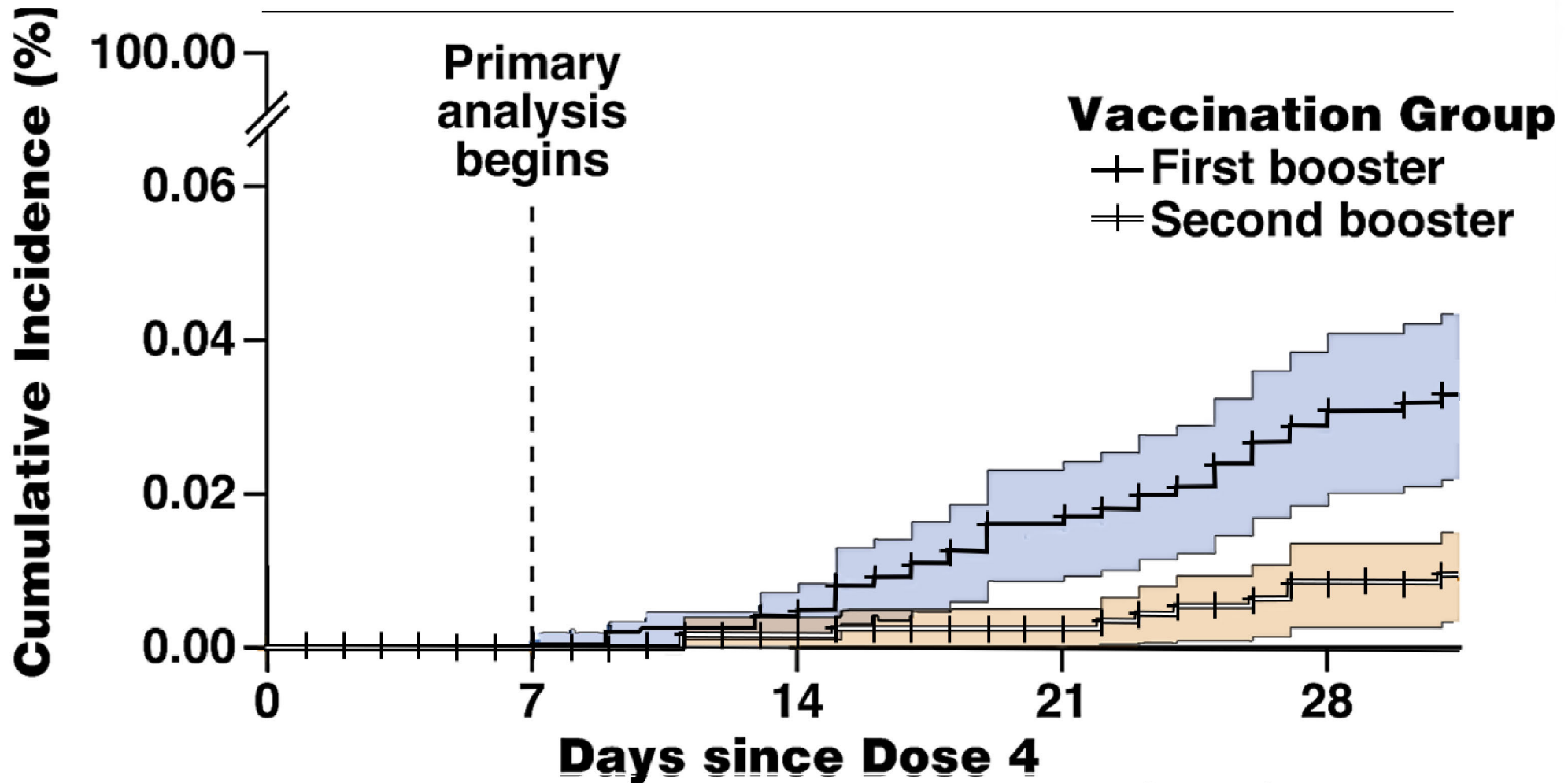
Number 17

Fourth Dose of BNT162b2 mRNA COVID-19 Vaccine in a Nationwide Setting

O Magen, N Dagan et al.

- **365,000 members of Clalit Health Services aged 60+ years**
- **Relative effectiveness of a 4th vaccine dose after 14-30 days compared to a 3rd third dose given at least 4 months earlier**
 - + **61% vs. symptomatic COVID-19**
 - + **72% vs. COVID-19–related hospitalization**
 - + **64% vs. severe COVID-19**
 - + **76% vs. COVID-19–related death**

Cumulative COVID-19 Mortality Rates in Israeli Adults 60+ Years Receiving 1 or 2 Booster Doses of BNT162b2 Vaccine





Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

CDC Newsroom

For Immediate Release

March 29, 2022

CDC Recommends Additional Boosters for Certain Individuals



Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

CDC Newsroom

For Immediate Release

May 19, 2022

CDC Strengthens Recommendations and Expands Eligibility for COVID-19 Booster Shots

COVID-19 mRNA Vaccine Dose Eligibility, Age

		0-4	5-11	12-17	18-49	50+
Number of doses	First dose	X	✓	✓	✓	✓
	Second dose	X	✓	✓	✓	✓
	Third dose/ booster	X	✓	✓	✓	✓
	Fourth dose/ booster	X	X	✓*	✓*	✓



News Release

NIH Begins Clinical Trial Evaluating Second COVID-19 Booster Shots in Adults

Study Includes Multiple Variant Vaccines

- **COVID-19 Variant Immunologic Landscape (COVAIL) trial**
- **Assessing different 4th dose vaccine regimens—
prototype and variant vaccines alone and in
combinations—to see if they broaden immunity in adults
who have already had one booster dose**



The Future



The
New England
Journal of Medicine

Established in 1812 as THE NEW ENGLAND JOURNAL OF MEDICINE AND SURGERY

Published online December 15, 2021

Perspective

Universal Coronavirus Vaccines — An Urgent Need

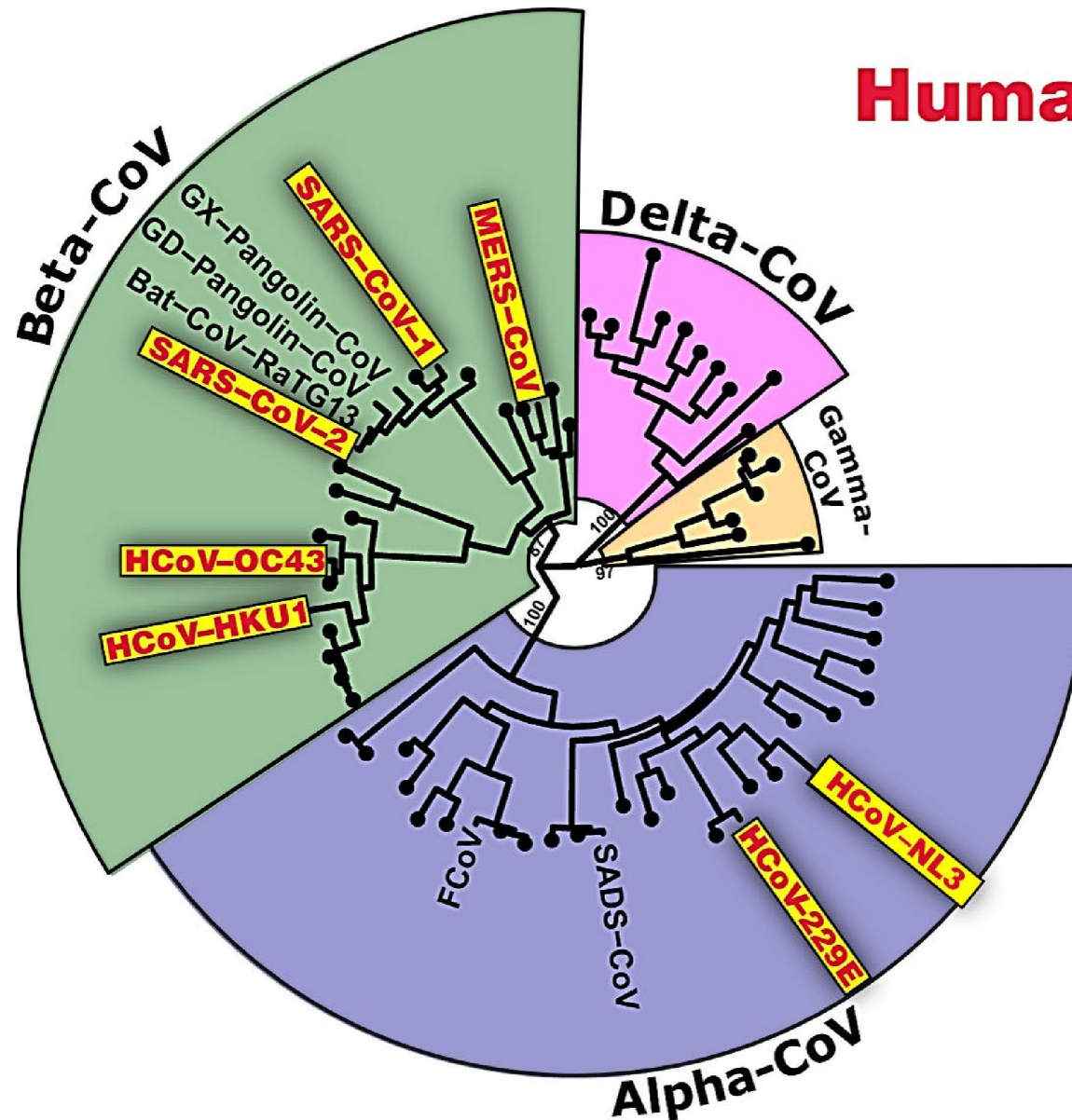
**David M. Morens, M.D., Jeffery K. Taubenberger, M.D., Ph.D., and
Anthony S. Fauci, M.D.**

- In the past 20 years, three coronaviruses have caused major disease outbreaks – **SARS, MERS, COVID-19**
- Since September 2020, five SARS-CoV-2 **Variants of Concern** have emerged – alpha, beta, gamma, delta, omicron
- Innovative approaches are needed to induce broad and durable protection against coronaviruses, known and unknown



Pan-Coronavirus Vaccines

Coronavirus Phylogenetic Tree



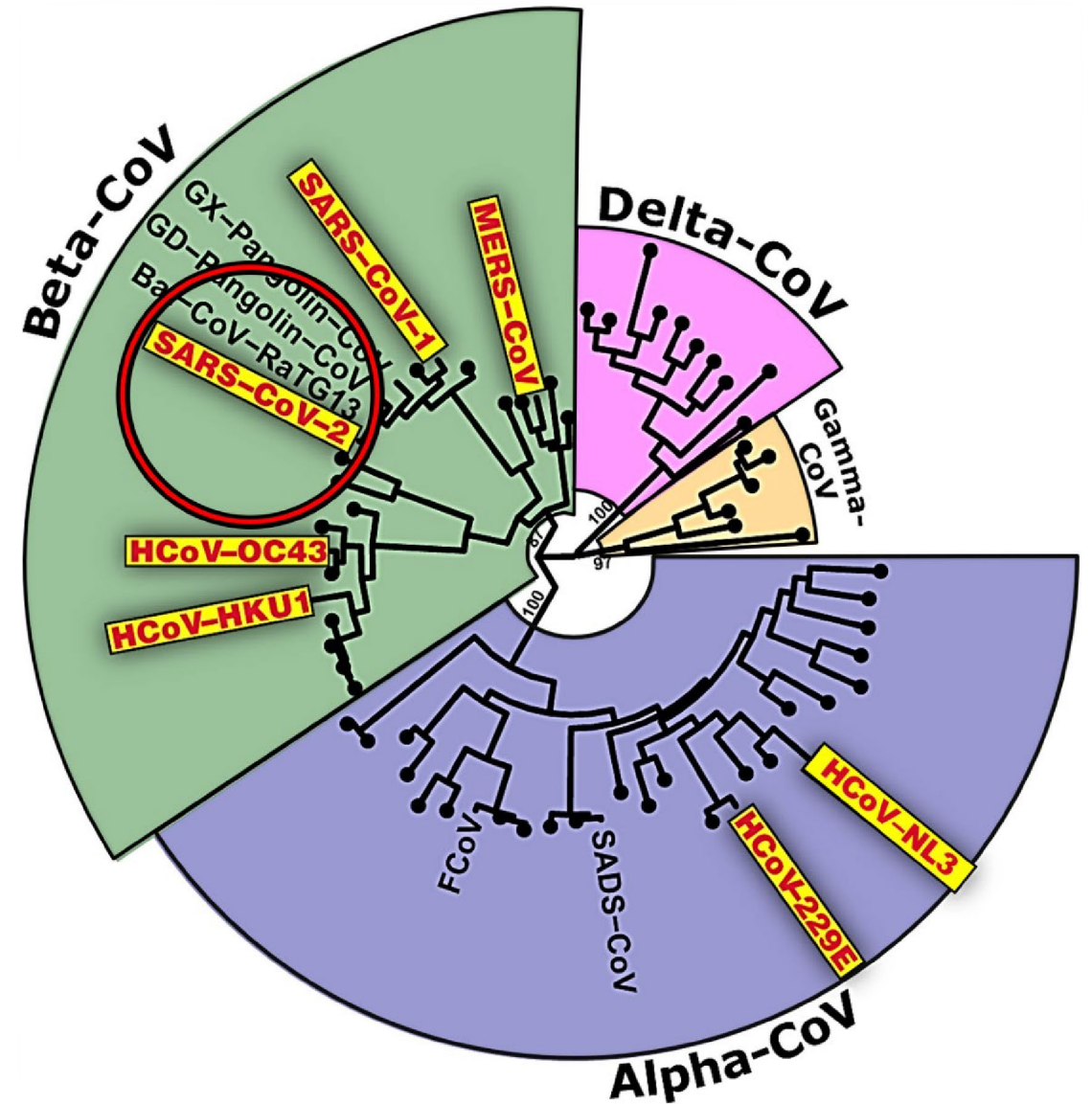
Human coronaviruses

Source: SM Gygli, PhD, NIAID. Based on 440 bp nucleotide sequences of RNA-dependent RNA polymerase.

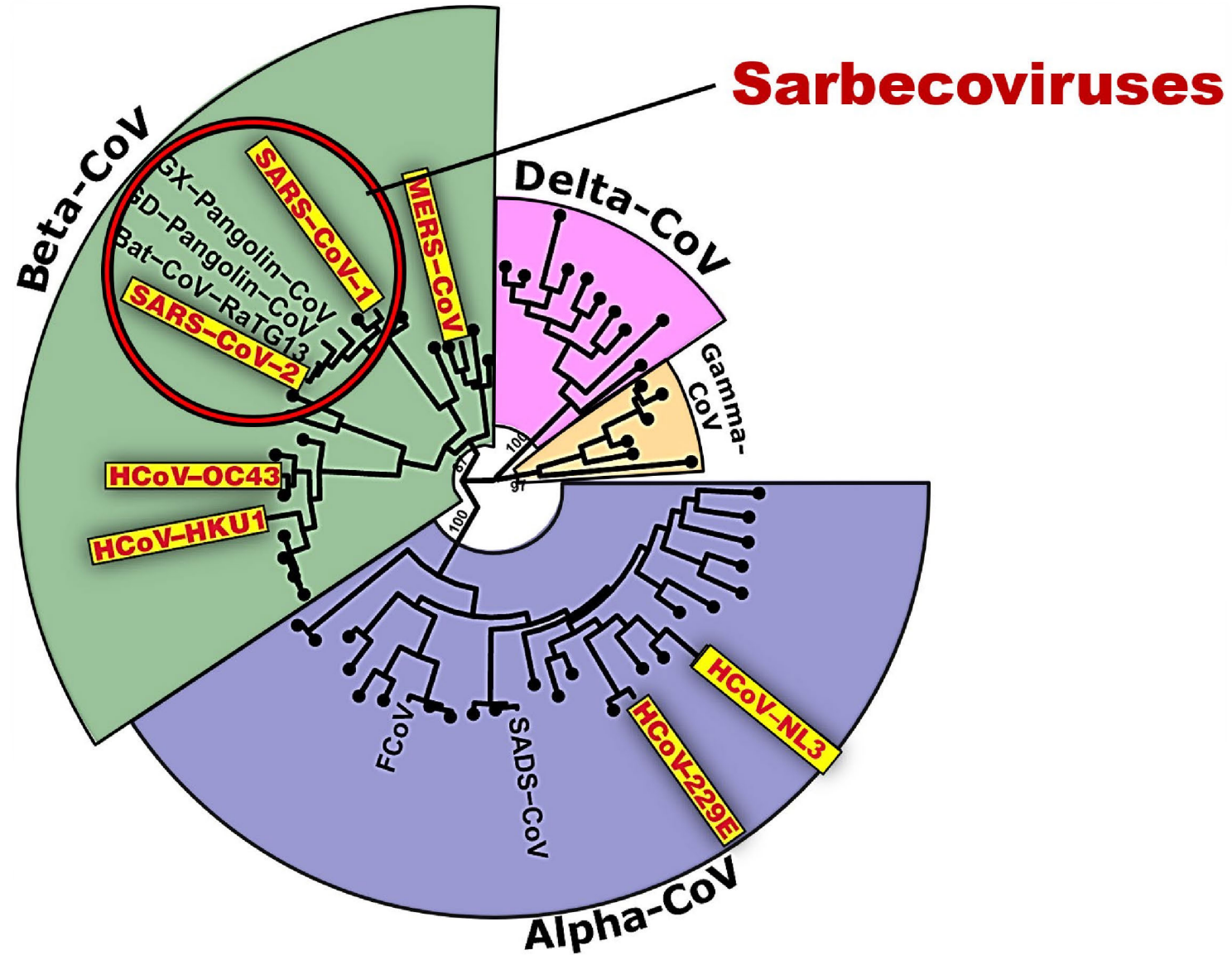
Pan-SARS-CoV-2 Vaccine

WHO Variants of Concern:

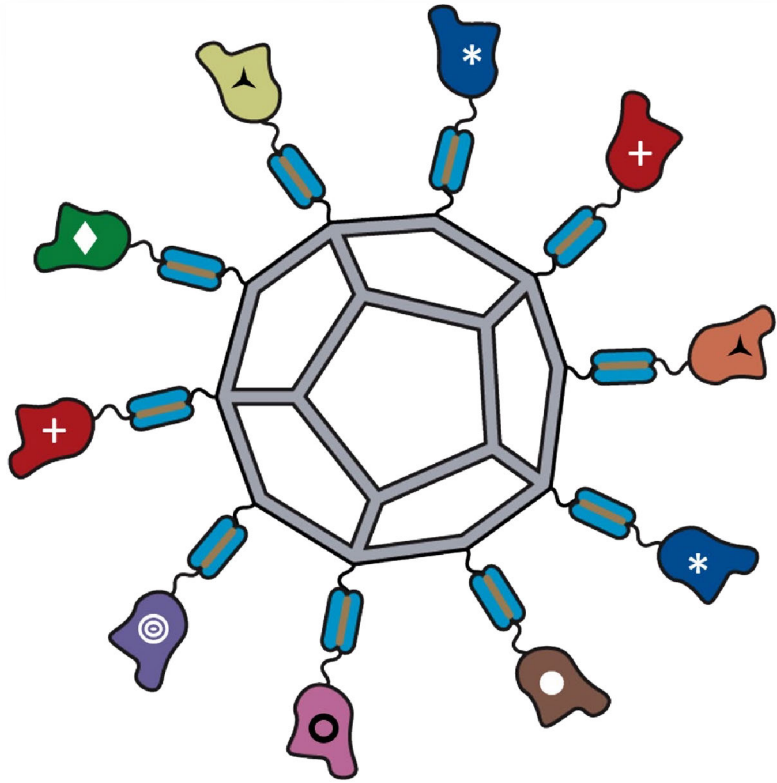
- Alpha
- Beta
- Gamma
- Delta
- Omicron



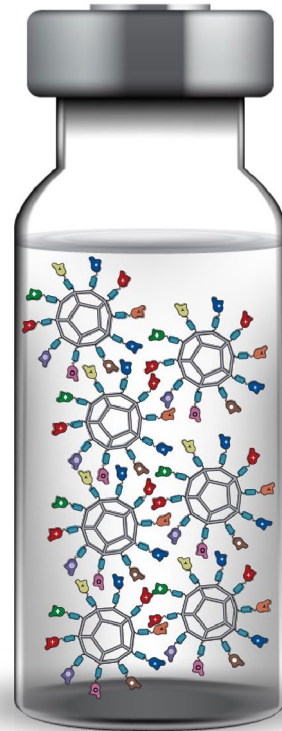
Pan-Sarbecovirus Vaccine



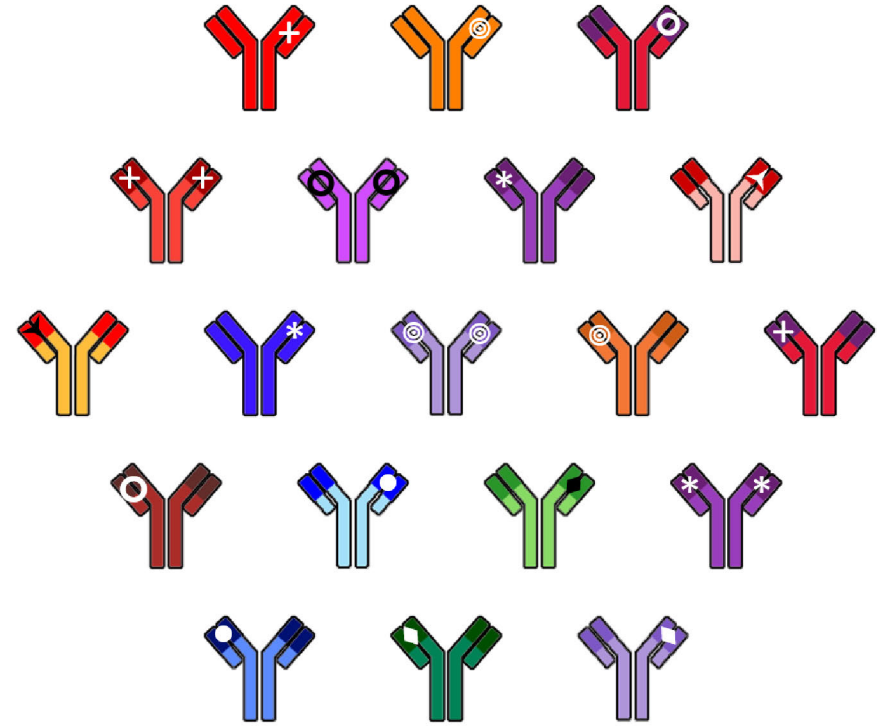
Example of a Pan-Coronavirus Vaccine Concept



Nanoparticle with different spike protein fragments

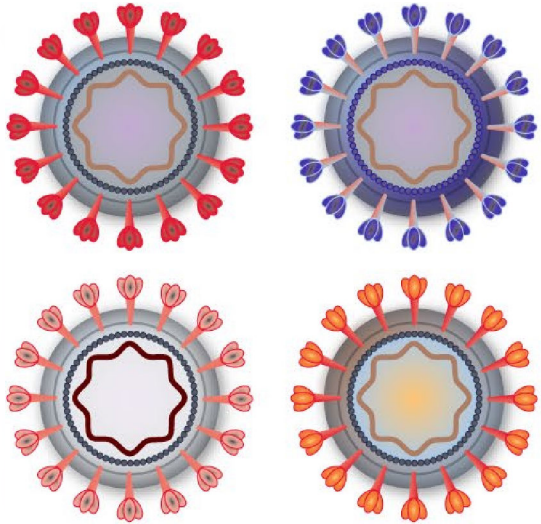


Vaccine



Diverse antibody response

Example of a Universal Beta-Coronavirus Vaccine Concept



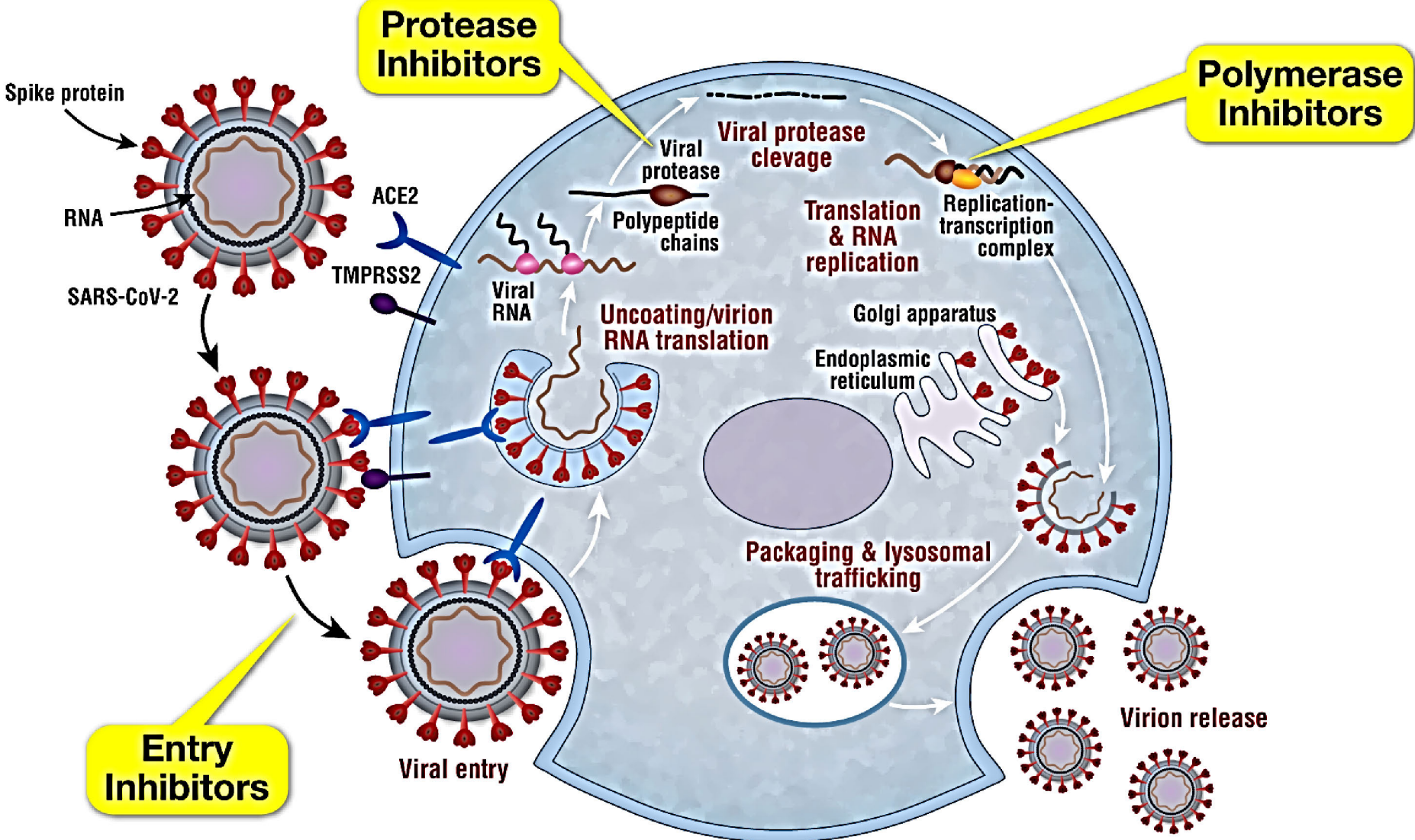
**Broad protection
against human
and animal
beta-coronaviruses**

**Inactivated, whole virus
vaccine consisting of
SARS-CoV-2 and
several different
coronaviruses delivered
by intranasal mist**



The Antiviral Program for Pandemics (APP) aims to catalyze the development of new medicines to combat COVID-19 and prepare for other pandemic threats

Bolstering COVID-19 Therapeutic Armamentarium: New Targets for Antivirals



COVID-19



The End Game for 2022 and Beyond

Pandemic Phase



Deceleration of New Cases



Control

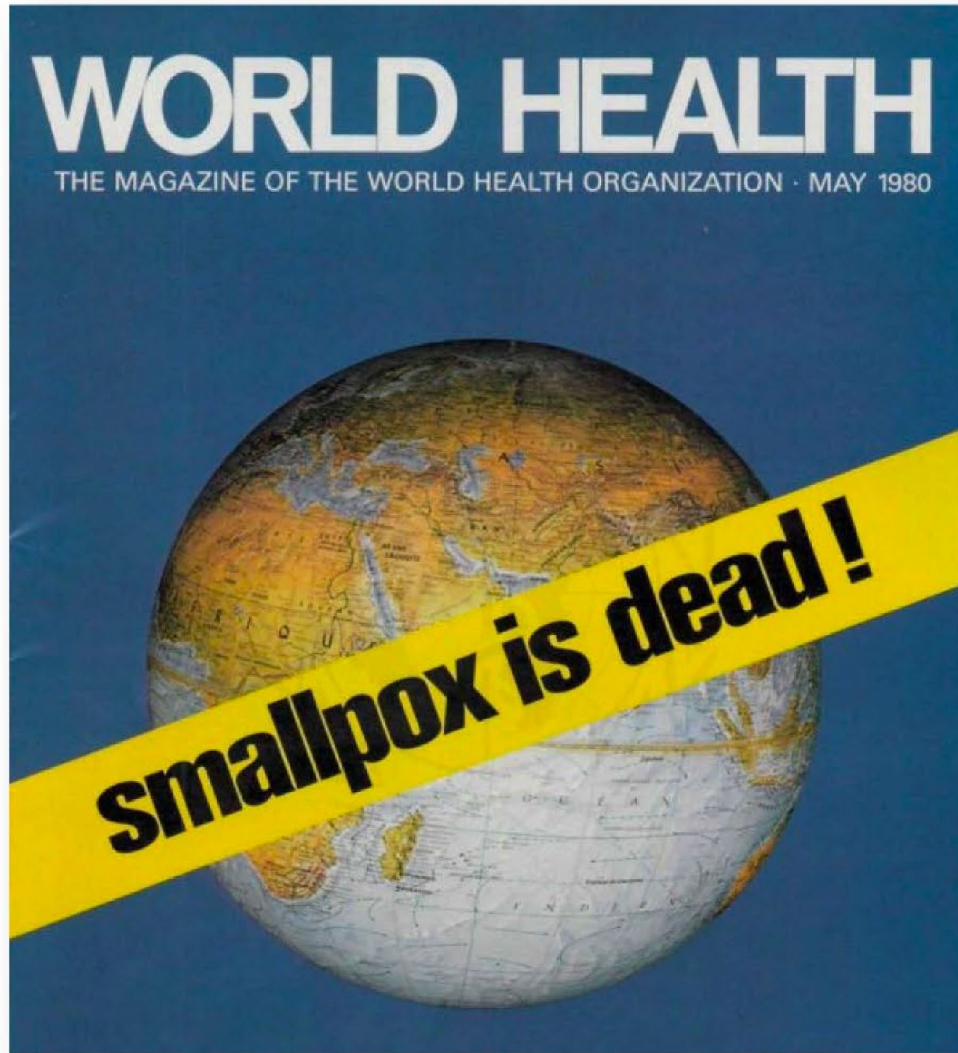


Elimination



Eradication

Smallpox Eradication



- **Lack of animal reservoir**
- **Phenotypically stable virus**
- **Widely accepted global vaccination campaign**
- **Durability of vaccine- and infection-induced immunity**

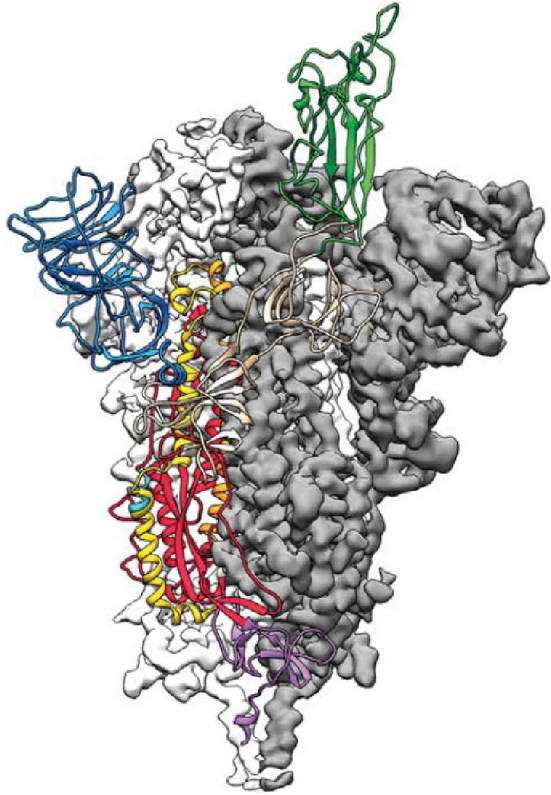
Elimination of Polio and Measles in the United States

Polio elimination: 1979



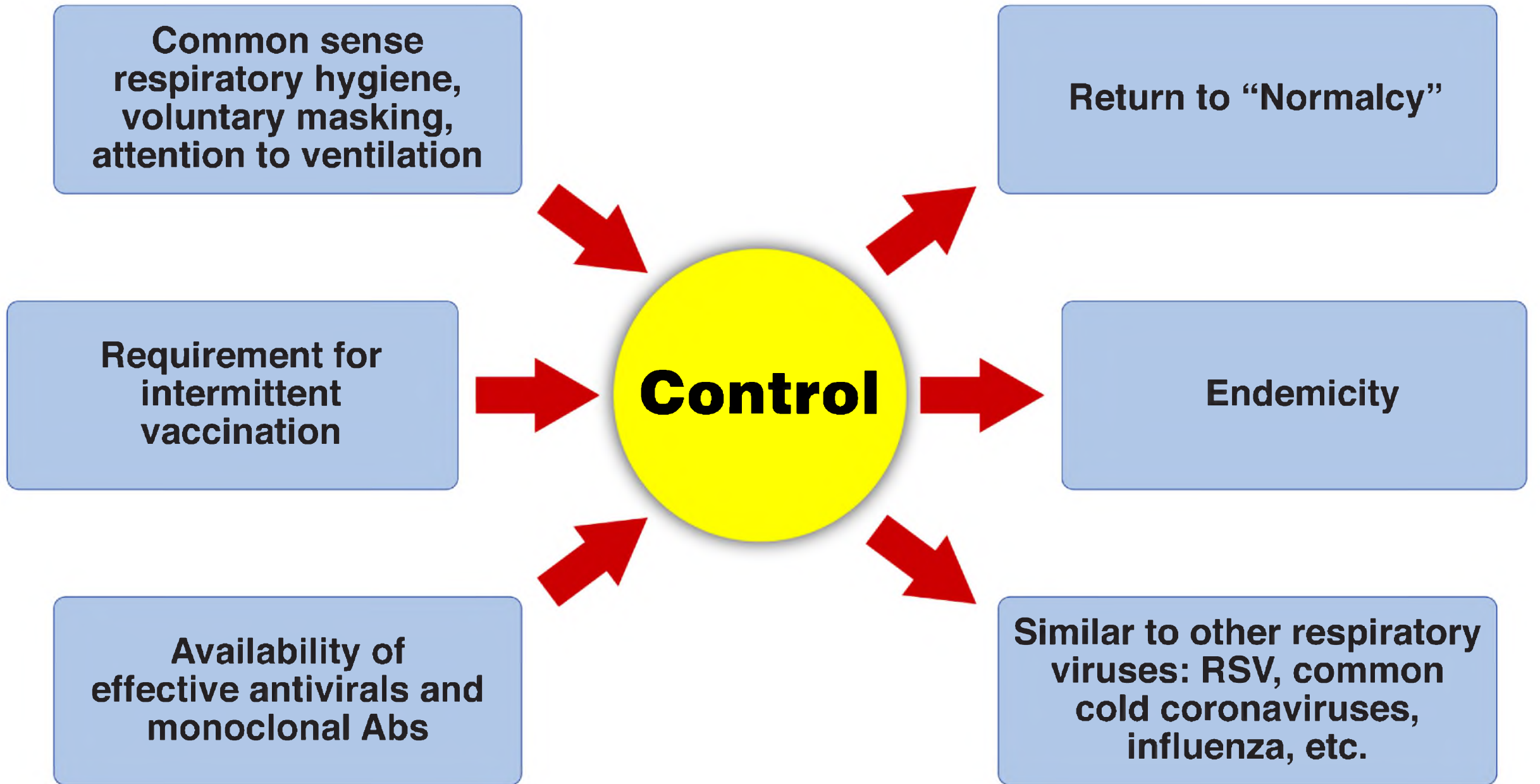
**Measles
elimination:
2000**

- **Lack of animal reservoir**
- **Phenotypically stable virus**
- **Widely accepted national vaccination campaign**
- **Durability of vaccine- and infection-induced immunity**



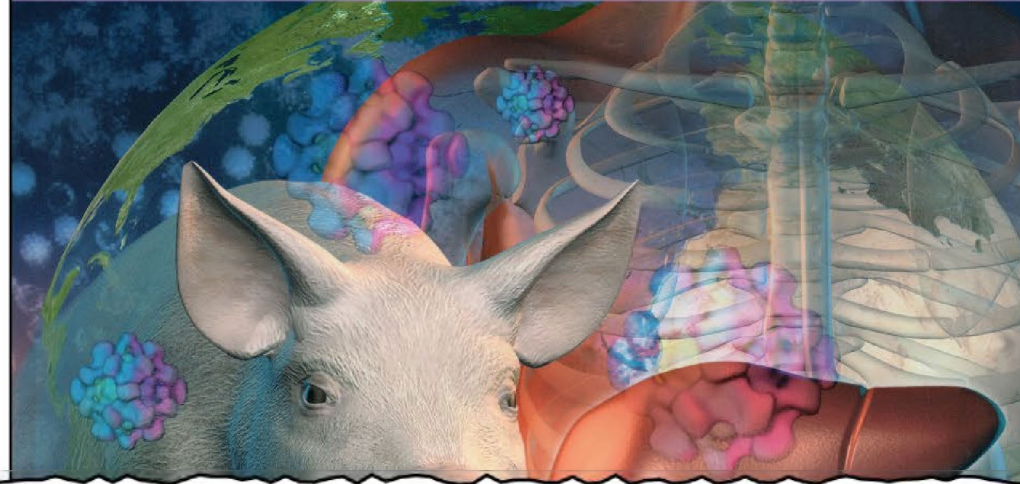
SARS-CoV-2 (Spike Protein)

- **Established animal reservoirs**
- **Evolution of genotypically and phenotypically diverse variants**
- **Lack of a wide acceptance of safe and effective vaccines**
- **Waning of vaccine- and infection-induced immunity**



THE LANCET Infectious Diseases

Volume 8 • Issue 11 • November 2008



Emerging Infections: A Perpetual Challenge

DM Morens, GK Folkers, and AS Fauci

Review

Intervening in HIV immunopathogenesis
See page 675

Review

People, pigs, and hepatitis E
See page 698

Historical review

Emerging infections: from ancient
Greece to AIDS
See page 710