Vaccines and Related Biological Products Advisory Committee Meeting

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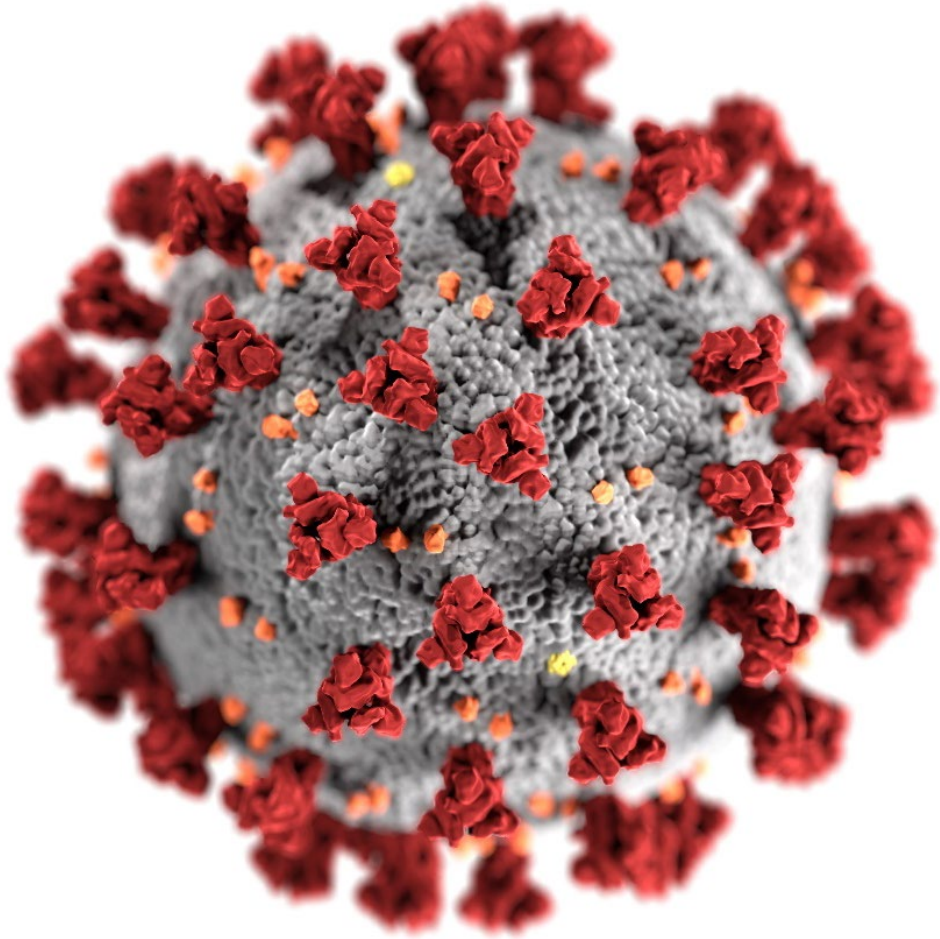
Update on the Epidemiology of SARS-CoV-2 Strains

CDR Heather Scobie, PhD, MPH
COVID-19 Epidemiology Task Force
Centers for Disease Control and Prevention

April 6, 2022



cdc.gov/coronavirus

SARS-CoV-2 Variants

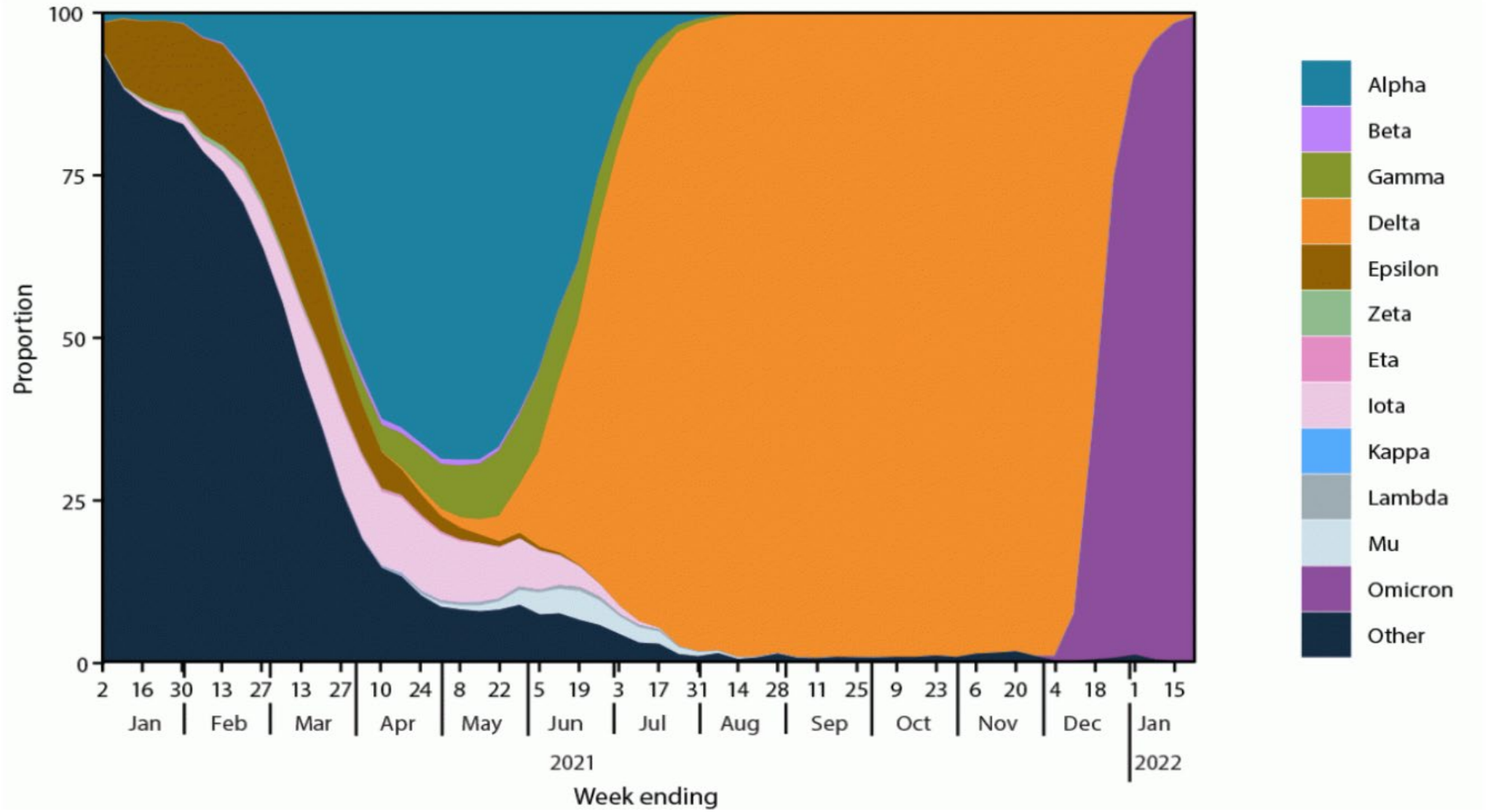
Genomic Surveillance in the United States

- Multifaceted genomic surveillance system for analyzing SARS-CoV-2 variants circulating in the United States
  - National SARS-CoV-2 Strain Surveillance
  - CDC-supported contracts with several commercial diagnostic laboratories
  - Partners deposit and tag randomly sampled viral sequence in public repositories (GISAID and NCBI)
- CDC estimates that if a variant is circulating at 0.1% frequency, there is a >99% chance that it will be detected in national genomic surveillance
- During Omicron, temporarily enhanced genomic surveillance strategies:
  - Rapid screening of PCR-based diagnostic tests for S-gene Target Failure (SGTF) for confirmation
  - Expanded voluntary airport-based genomic surveillance programs in four U.S. cities

https://www.cdc.gov/mmwr/volumes/70/wr/mm7050e1.htm?s_cid=mm7050e1_w
https://www.cdc.gov/coronavirus/2019-ncov/variants/omicron-variant.html

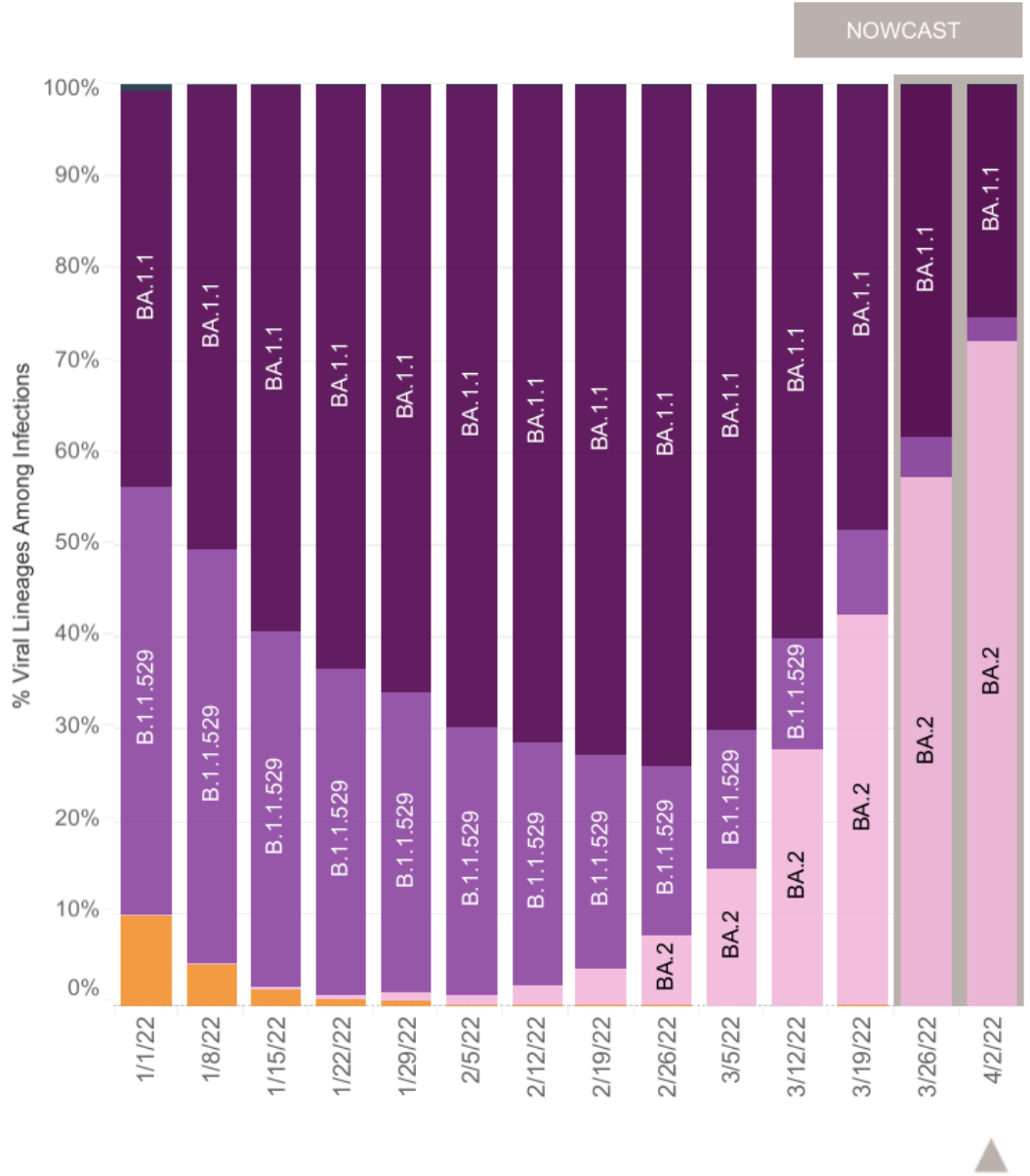
Changing Landscape of Circulating Variants

FIGURE 1. National weekly proportion estimates* of SARS-CoV-2 variants† — United States, January 2, 2021–January 22, 2022



Lambrou et al. Genomic Surveillance for SARS-CoV-2 Variants: Predominance of the Delta (B.1.617.2) and Omicron (B.1.1.529) Variants — United States, June 2021–January 2022 https://www.cdc.gov/mmwr/volumes/71/wr/mm7106a4.htm

Recent Trends in Weighted Variant Proportion Estimates & Nowcast



USA

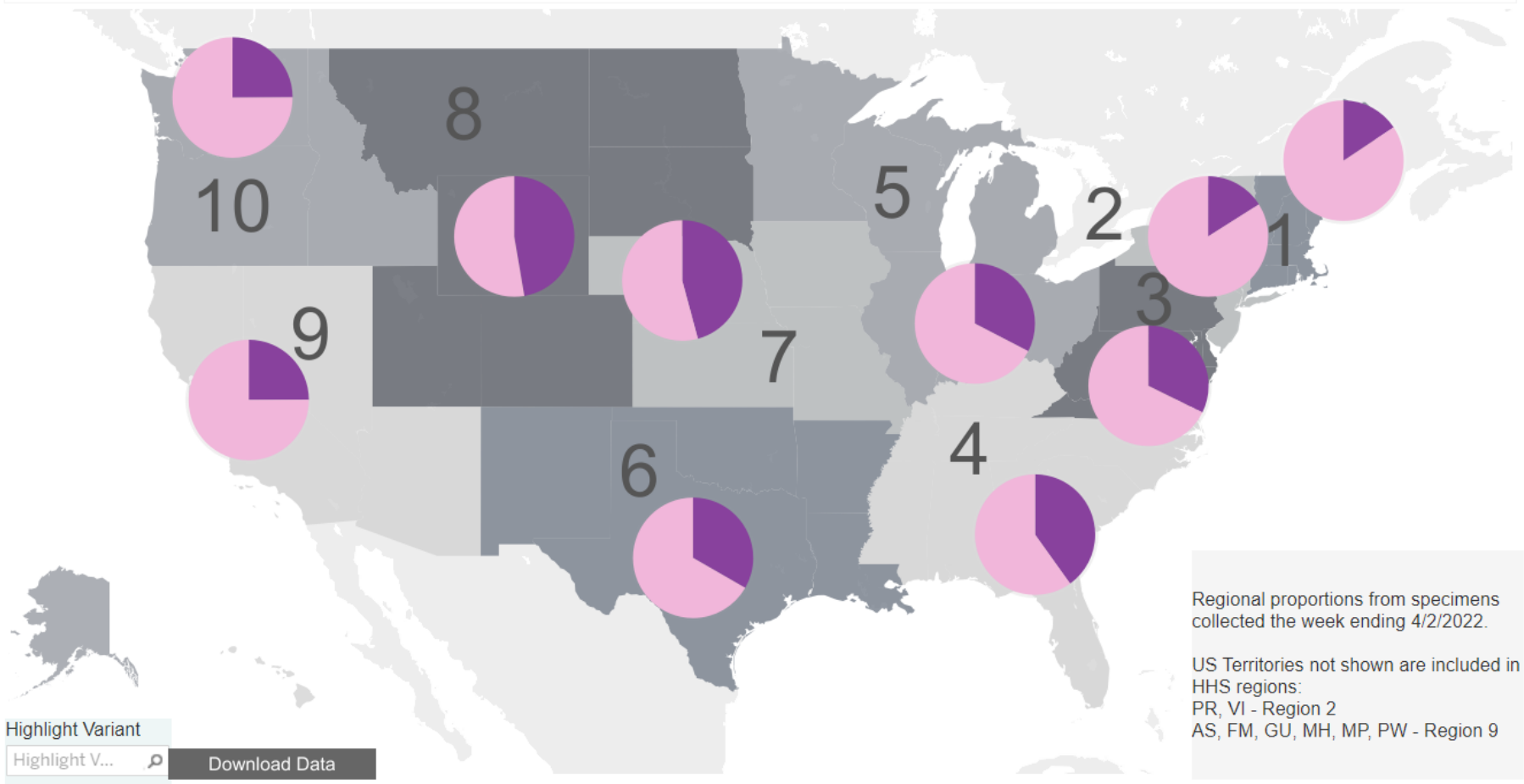
WHO label	Lineage #	US Class	%Total	95%PI
Omicron	BA.2	VOC	72.2%	68.1-75.9%
	BA.1.1	VOC	25.3%	21.9-29.1%
	B.1.1.529	VOC	2.5%	2.0-3.2%
Delta	B.1.617.2	VOC	0.0%	0.0-0.0%
Other	Other*		0.0%	0.0-0.0%

* Enumerated lineages are US VOC and lineages circulating above 1% nationally in at least one week period. "Other" represents the aggregation of lineages which are circulating <1% nationally during all weeks displayed.
** These data include Nowcast estimates, which are modeled projections that may differ from weighted estimates generated at later dates
# AY.1-AY.133 and their sublineages are aggregated with B.1.617.2. BA.1 and BA.3 are aggregated with B.1.1.529. For regional data, BA.1.1 is also aggregated with B.1.1.529, as it currently cannot be reliably called in each region.

https://covid.cdc.gov/covid-data-tracker/#variant-proportions Accessed April 4, 2022

Nowcast Estimates of Variant Proportions by HHS Region

March 27-April 2, 2022



Omicron Lineage

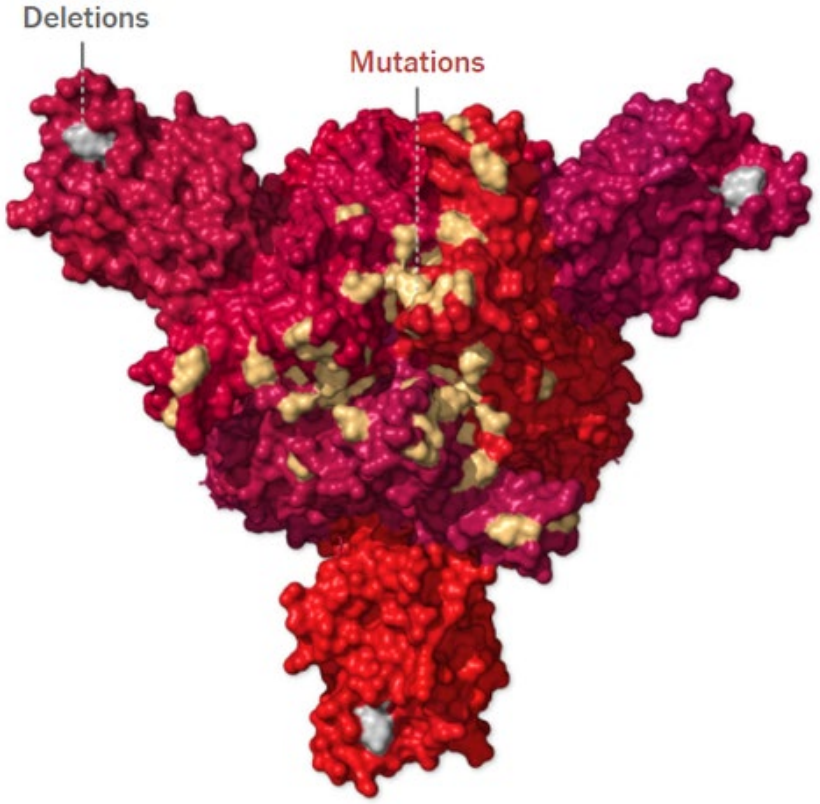
- BA.2
- B.1.1.529

HHS=Health and Human Services

https://covid.cdc.gov/covid-data-tracker/#variant-proportions Accessed April 4, 2022

Characteristics of SARS-CoV-2 Omicron variant

- Increased transmissibility
- Decreased disease severity
- 30 mutations in spike gene (S-gene)
  - 15 in receptor binding domain
- Reduction in efficacy of some monoclonal antibody treatments
- Reduction in neutralization by sera from vaccinated or convalescent individuals



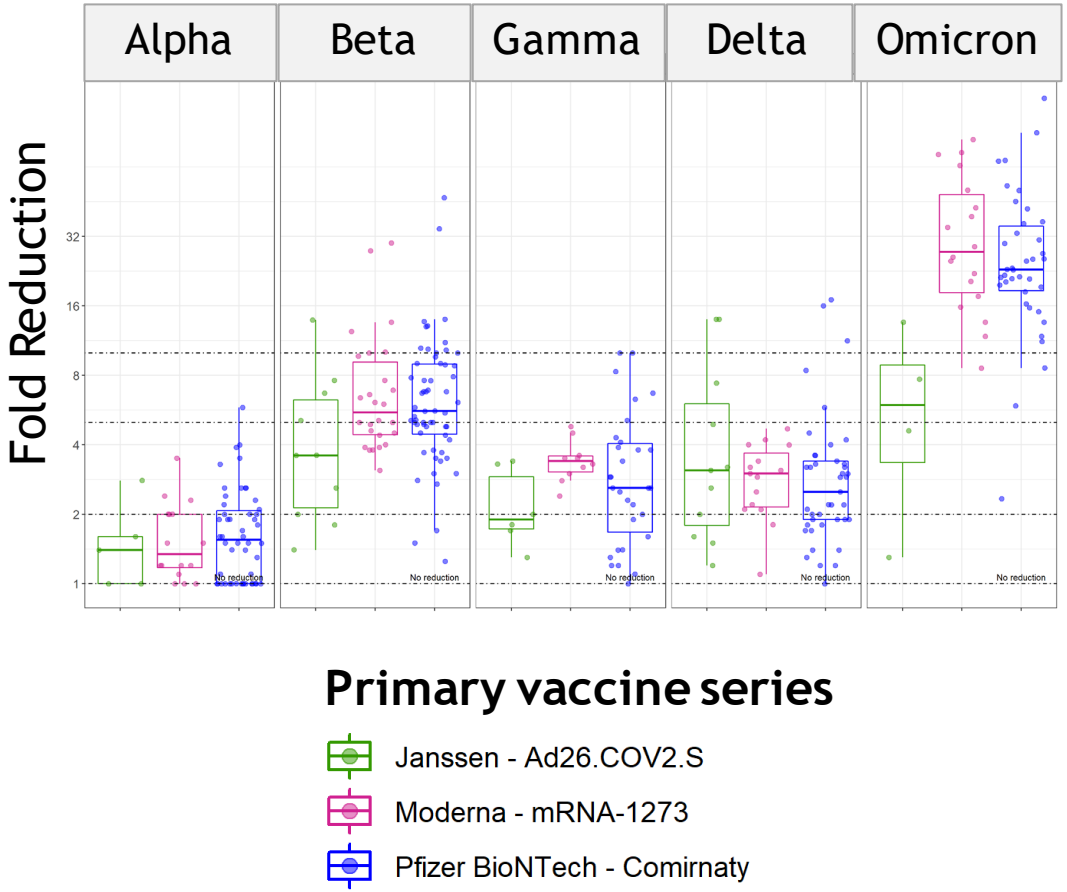
Key mutations (yellow) in the Omicron spike protein (top view)
Source: New York Times

https://www.cdc.gov/coronavirus/2019-ncov/variants/omicron-variant.html
https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/scientific-brief-omicron-variant.html

Neutralization of Omicron Variant by Sera from Vaccinees

Studies (n=42) of U.S. vaccines using both pseudoviruses & live viruses

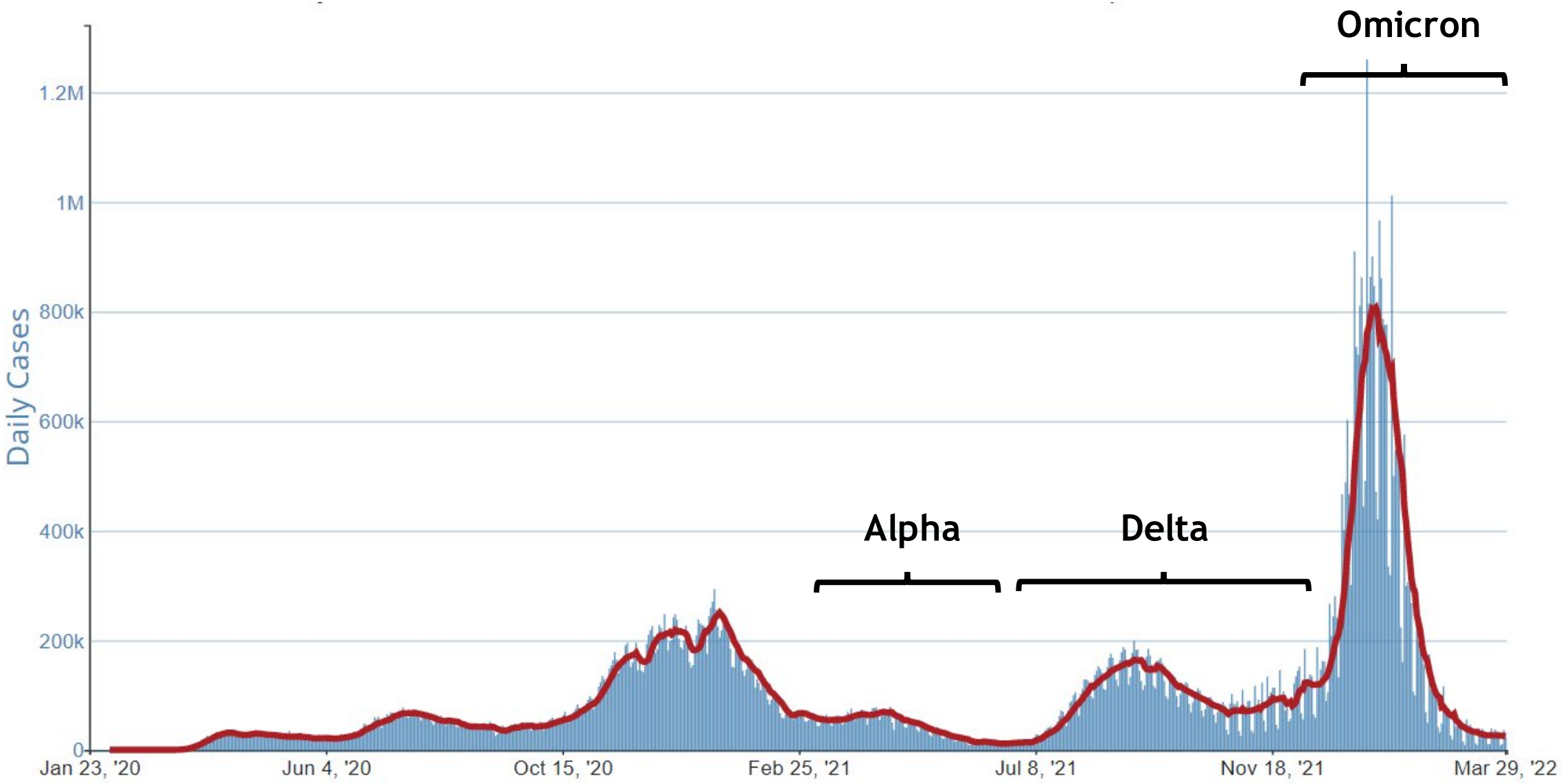
- Reduction compared with wild-type:
  - 25-fold for mRNA vaccine without booster dose
  - 6-fold for mRNA vaccine with booster dose
- Neutralization of Omicron below limit of detection for many individuals receiving two mRNA doses or one Janssen dose
  - Above limit of detection in many vaccinated people receiving booster or who were also previously infected
- Given detection limits of assays, difficult to evaluate whether people have levels of antibodies needed to protect against severe disease



Source: Data Summary and Neutralization Plots at ViewHub by IVAC https://view-hub.org/resources, Accessed March 28, 2022
https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-12-16/06-covid-scobie-508.pdf

COVID-19 Disease Trends

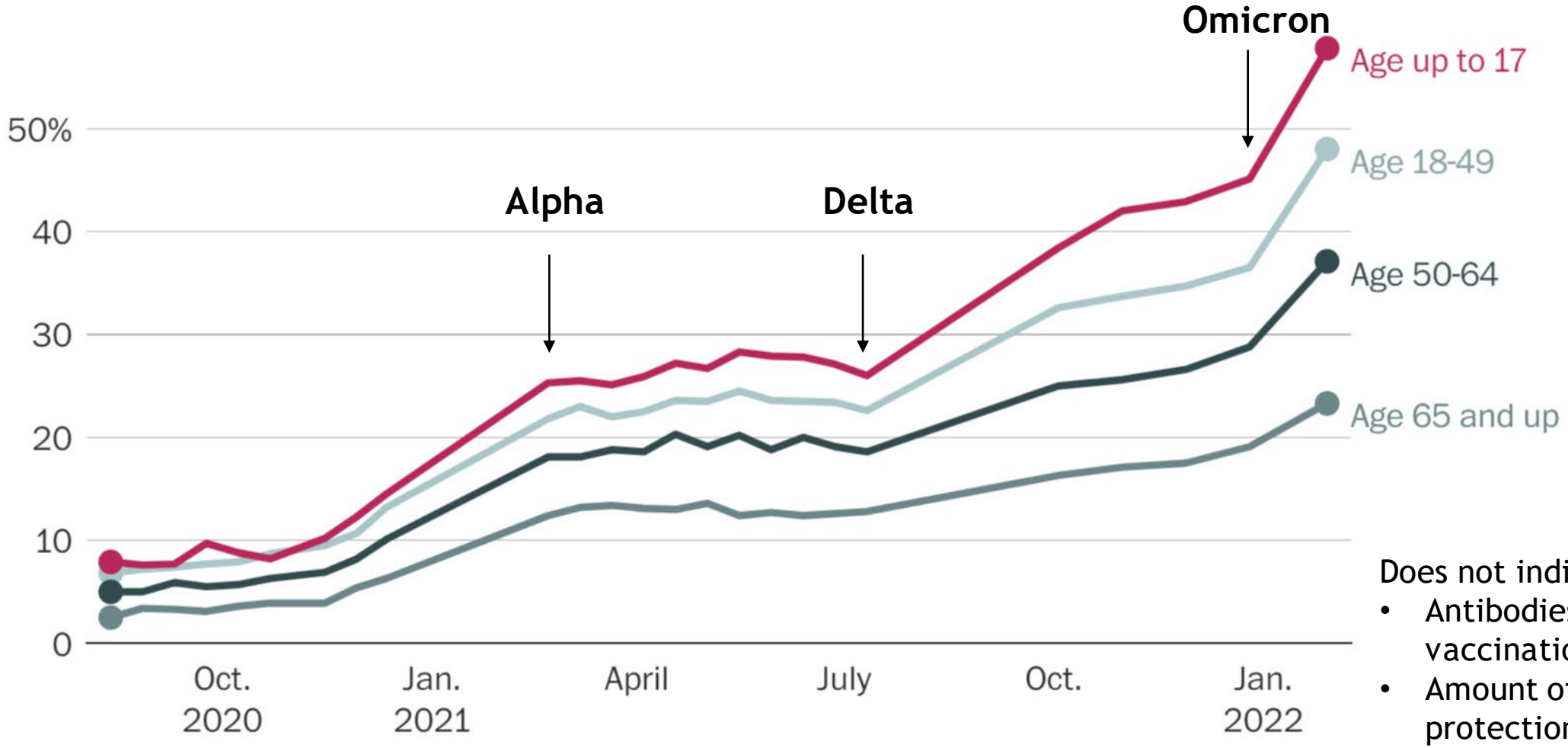
Daily Trends in Number of COVID-19 Cases, United States



CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#trends_dailycases Accessed March 31, 2022

Percentage of People with Antibodies (Anti-Nucleocapsid) Indicating Resolving or Past Infection with SARS-CoV-2, United States

August 30, 2020 – January 29, 2022



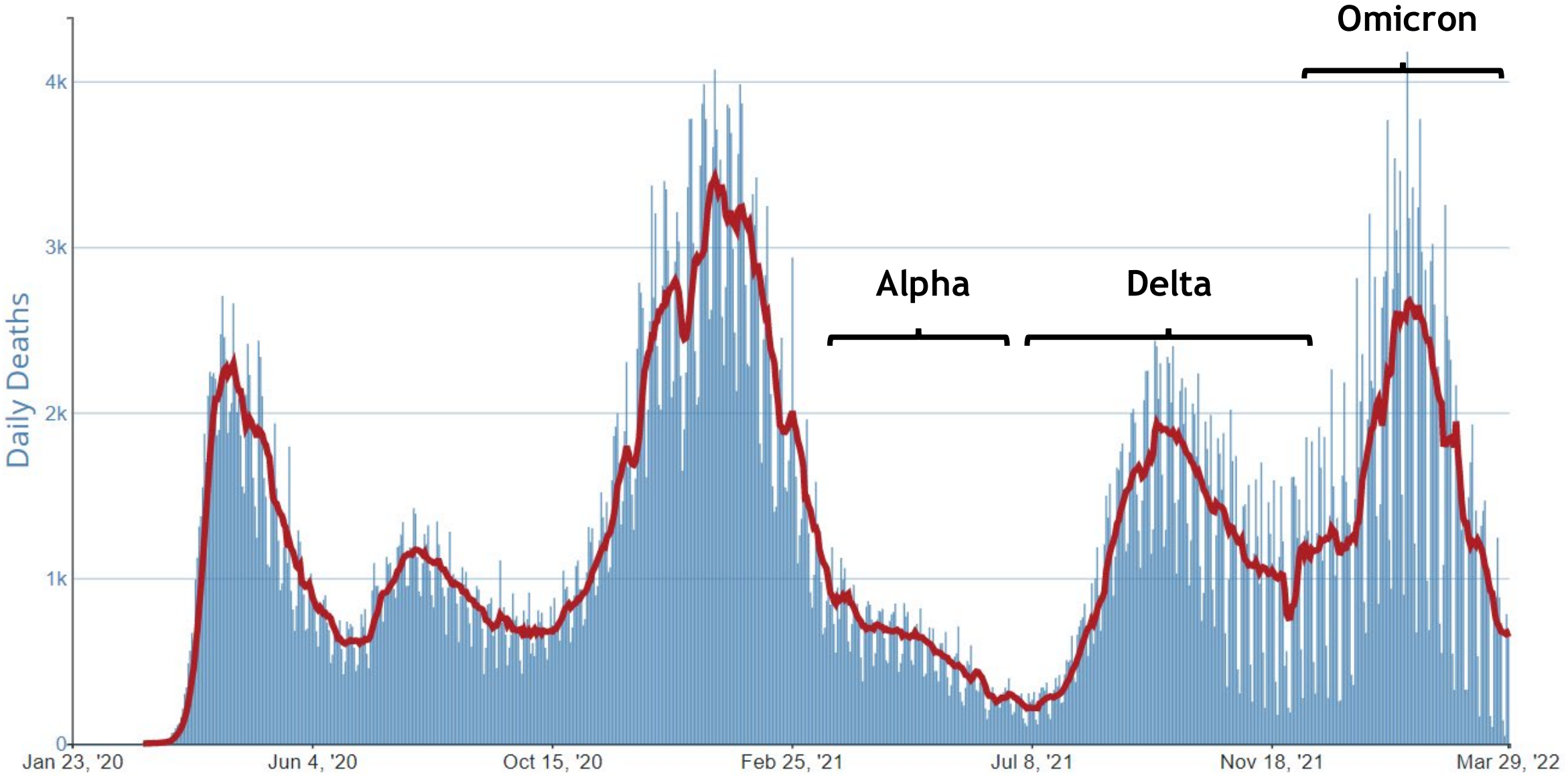
Does not indicate:

- Antibodies from vaccination (anti-spike)
- Amount of antibodies or protection from reinfection

Data Source: CDC COVID Data Tracker: https://covid.cdc.gov/covid-data-tracker/#national-lab

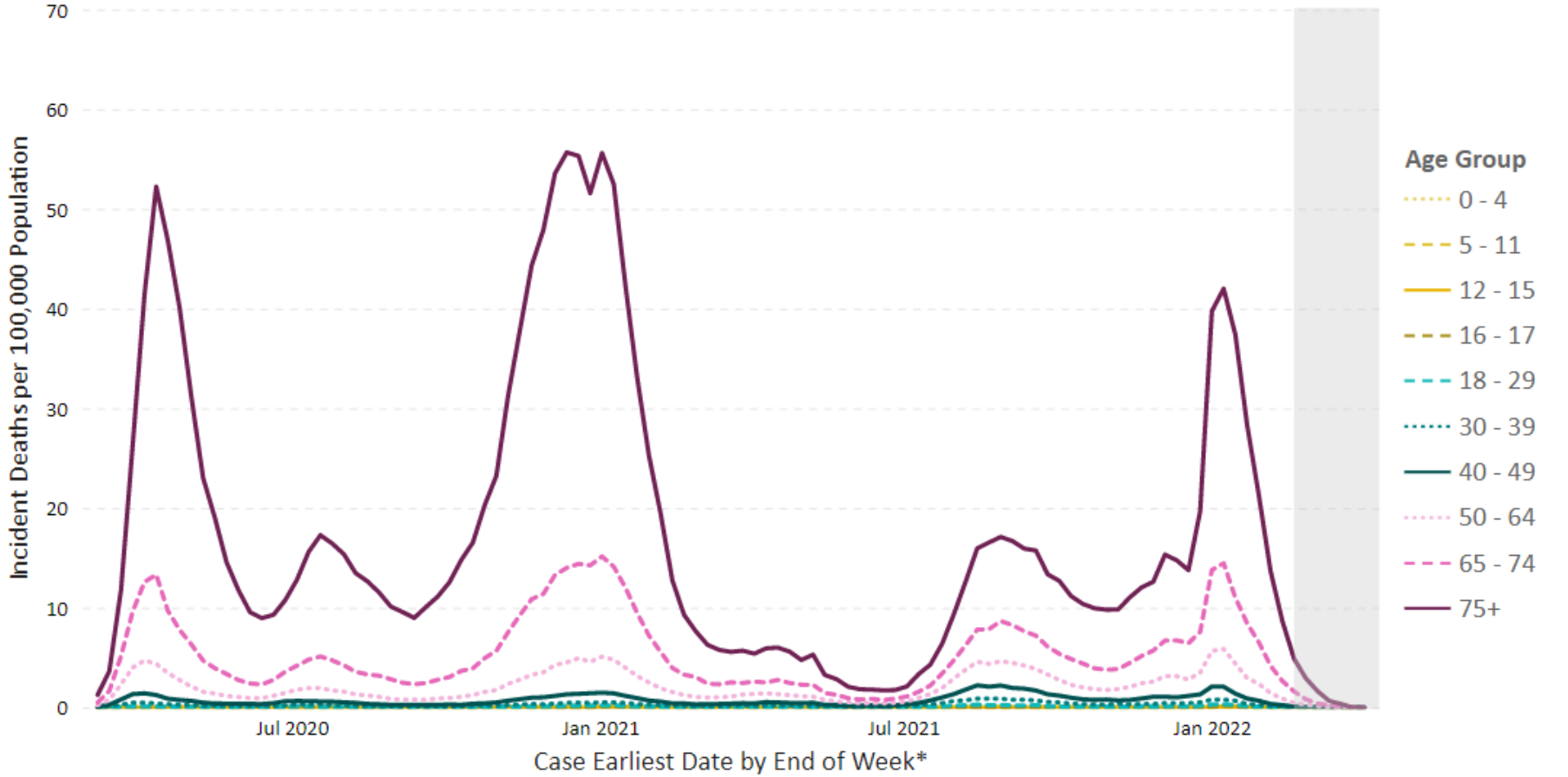
Data Visualization: Dan Keating, Washington Post: https://www.washingtonpost.com/health/2022/02/28/covid-cases-nationwide/

Daily Trends in Number of COVID-19 Deaths, United States



CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#trends_dailydeaths Accessed March 31, 2022

Weekly Trends in COVID-19 Mortality Rates by Age Group, United States, March 1, 2020 – April 2, 2022

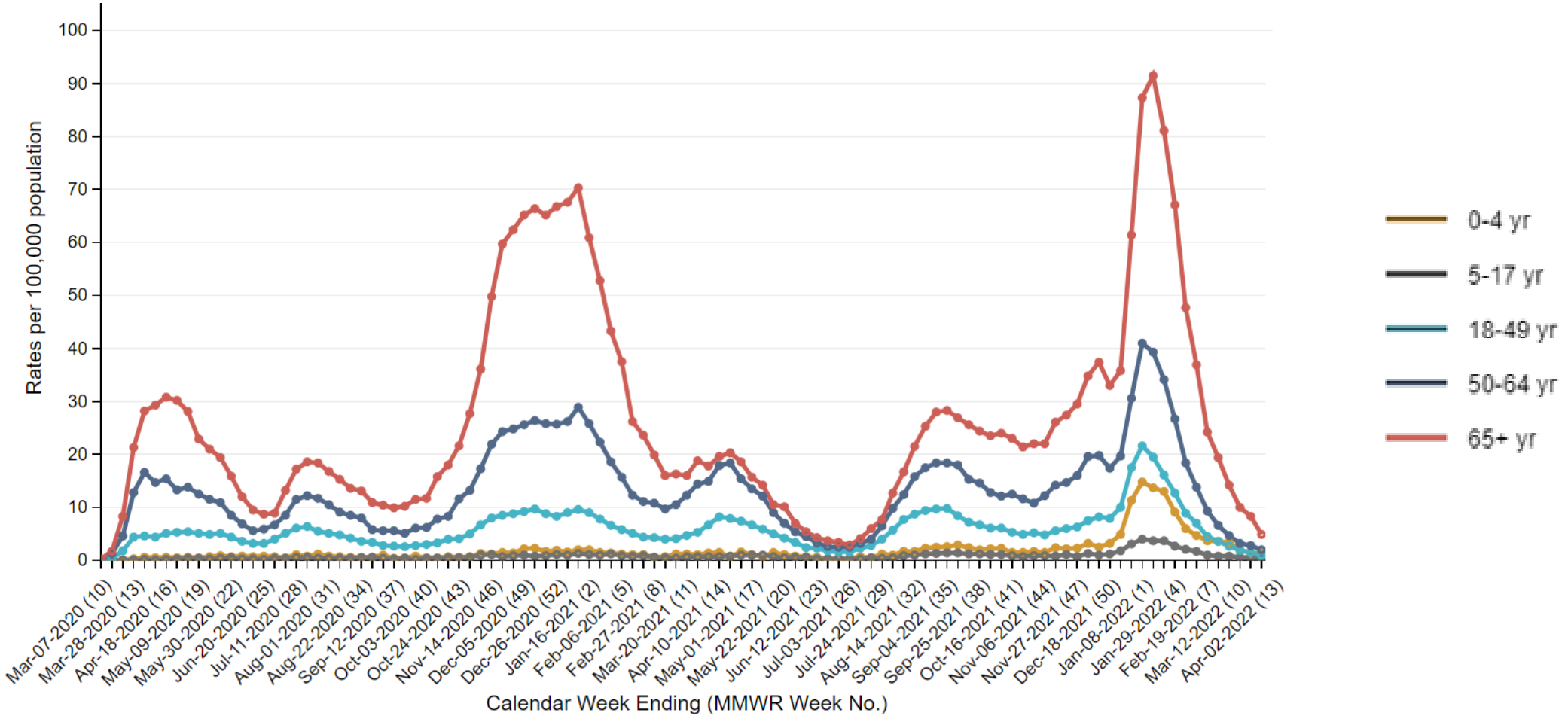


US: The most recent case record was reported during the week ending on Apr 02, 2022. Percentage of deaths among reported cases - 1.14%. Percentage of deaths reporting age by date - 99.90%.
US territories are included in case and death counts but not in population counts. Potential six-week delay in case reporting to CDC denoted by gray bars. Weekly data with five or less deaths have been suppressed.
*Case Earliest Date is the earliest of the clinical date (related to illness or specimen collection and chosen by a defined hierarchy) and the Date Received by CDC. The date for the current week extends through Saturday.

Source: CDC COVID-19 Case Line-Level Data, 2019 US Census, HHS Protect; Visualization: Data, Analytics & Visualization Task Force and CDC CPR DEO Situational Awareness Public Health Science Team

https://covid.cdc.gov/covid-data-tracker/#demographicsovertime Accessed March 31, 2022

Weekly Trends in COVID-19-Associated Hospitalization Rates by Age Group, United States, March 7, 2020 – March 26, 2022



A population-based surveillance system (COVID-NET) collected data on laboratory-confirmed COVID-19-associated hospitalizations among adults through a network of over 250 acute-care hospitals in 14 states.

CDC COVID-NET. https://gis.cdc.gov/grasp/covidnet/covid19_3.html Accessed March 31, 2022

COVID-19 Trends by Vaccination Status

COVID-19 Vaccinations in the United States

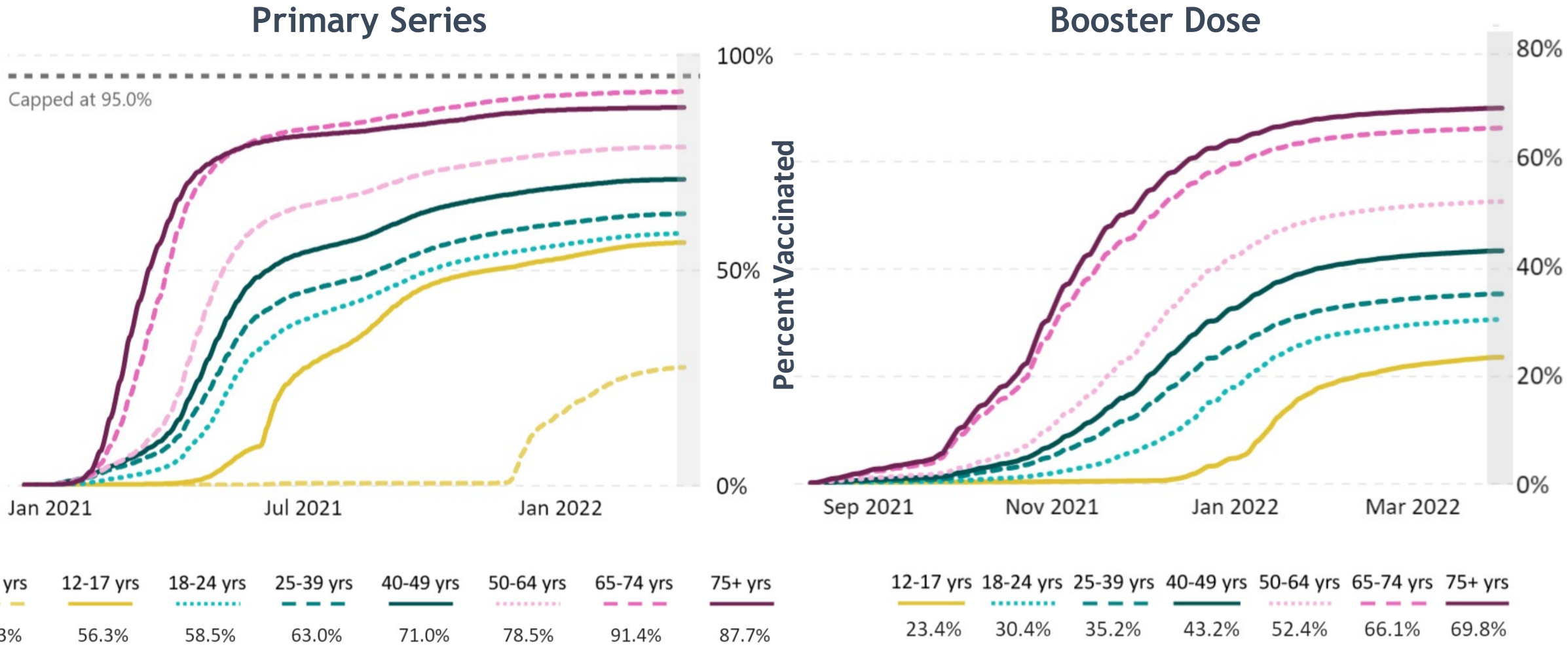
As of March 30, 2022

217.6M **People fully vaccinated**	70% Population ≥5 Years of Age
97.5M **People received a booster dose***	50% Population ≥12 Years of Age

***This includes people who received booster doses and people who received additional doses.**

https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total Accessed March 31, 2022

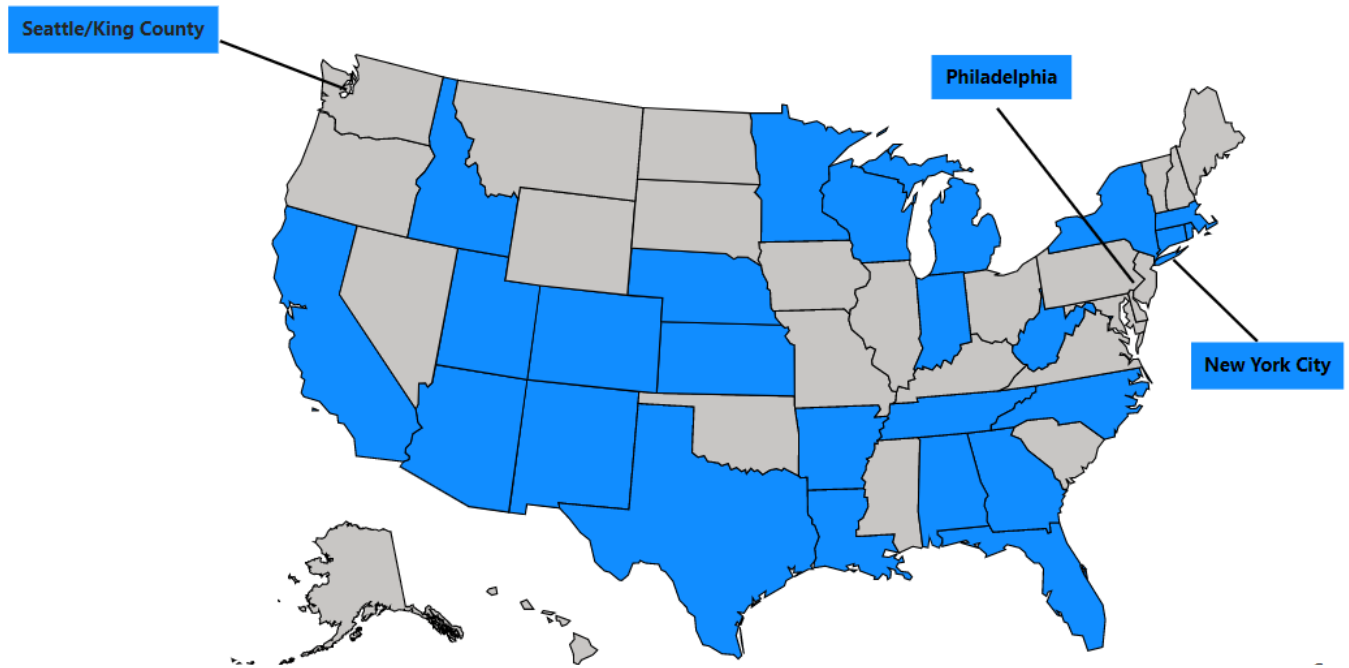
Percentage of People Vaccinated with at Least a Primary Series or Booster Dose by Age Group and Date Administered, United States



CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#vaccination-demographics-trends Accessed March 31, 2022

Monitoring Rates of Cases and Deaths by Vaccination Status

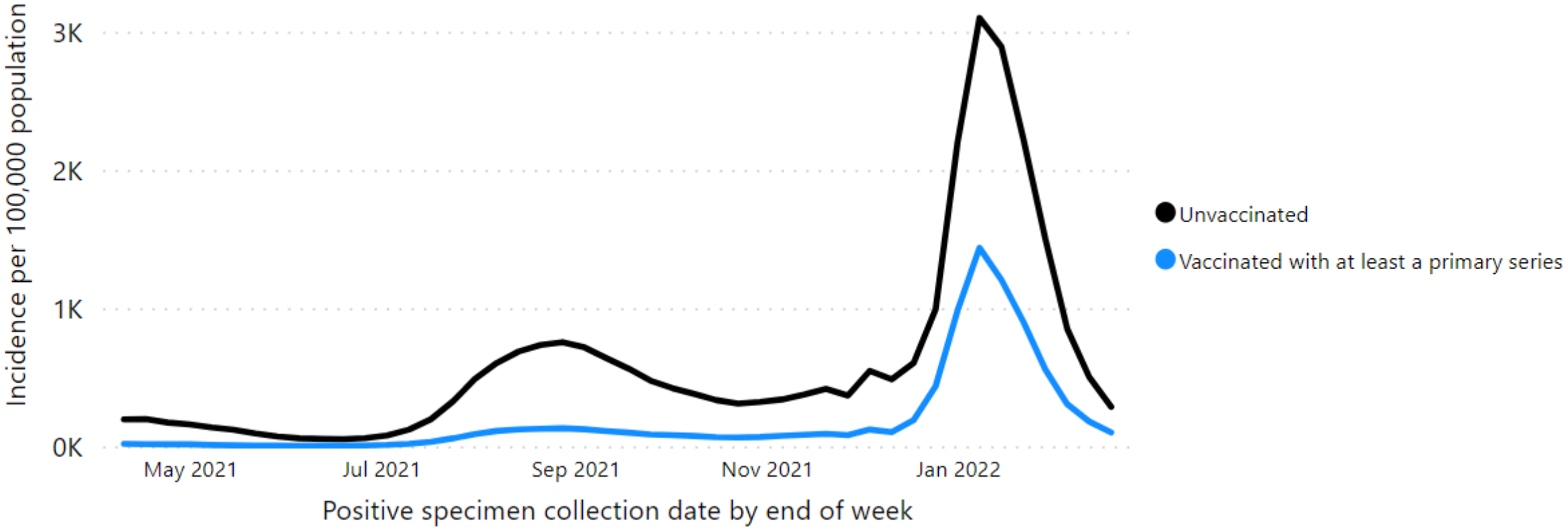
- 29 jurisdictions that routinely link surveillance and immunization data*
  - 67% of total U.S. population
- Report COVID-19 cases and COVID-associated deaths by vaccination status
- Weekly rates and incidence rate ratios
  - Unvaccinated vs. fully vaccinated (overall, with or without a booster dose)



* AL, AR, AZ, CA, CO, CT, DC, FL, GA, ID, IN, KS, LA, MA, MI, MN, NC, NE, NM, NY, NY City, RI, Seattle/King County, TN, TX, UT, WI, WV

Age-Adjusted Rates of COVID-19 Cases by Vaccination Status

April 04 – February 19, 2022 (29 U.S. Jurisdictions)



Unvaccinated people aged 5 years and older had:

2.8X

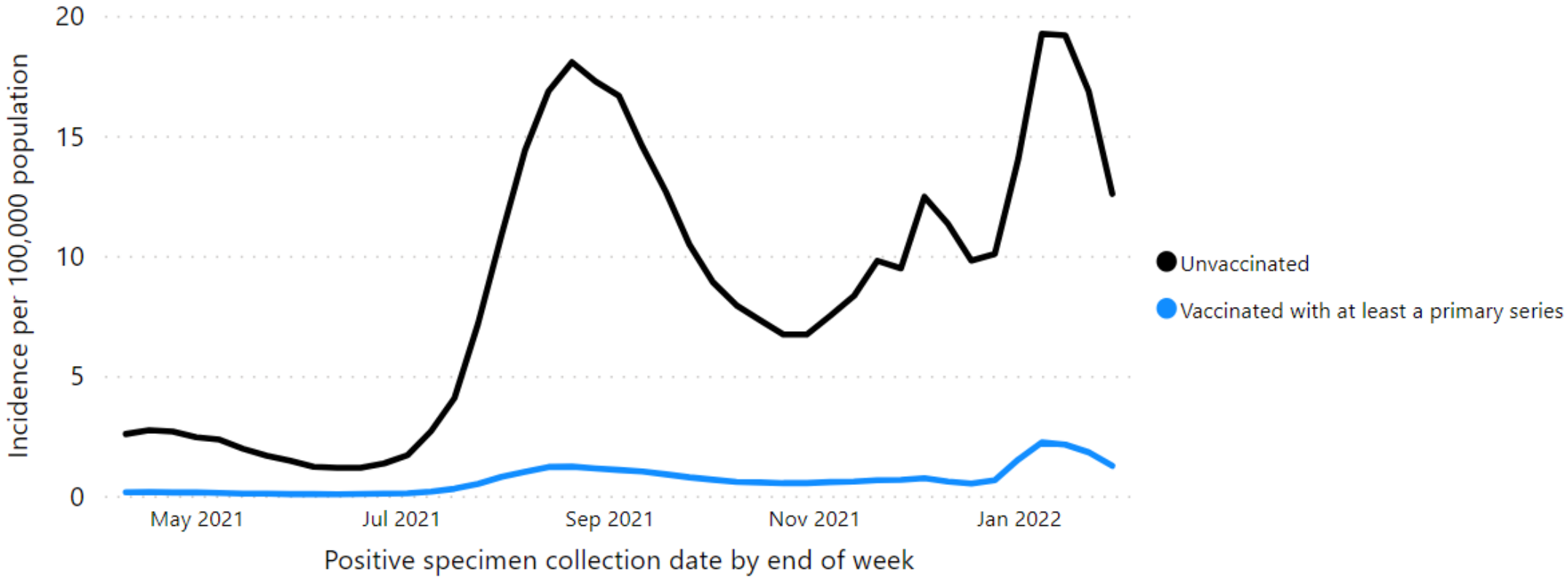
Risk of Testing Positive for COVID-19

in February, compared to people vaccinated with at least a primary series.

CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status Accessed March 17, 2022

Age-Adjusted Rates of COVID-19 Deaths by Vaccination Status

April 04 – February 19, 2022 (29 U.S. Jurisdictions)



Unvaccinated people aged 5 years and older had:

9X

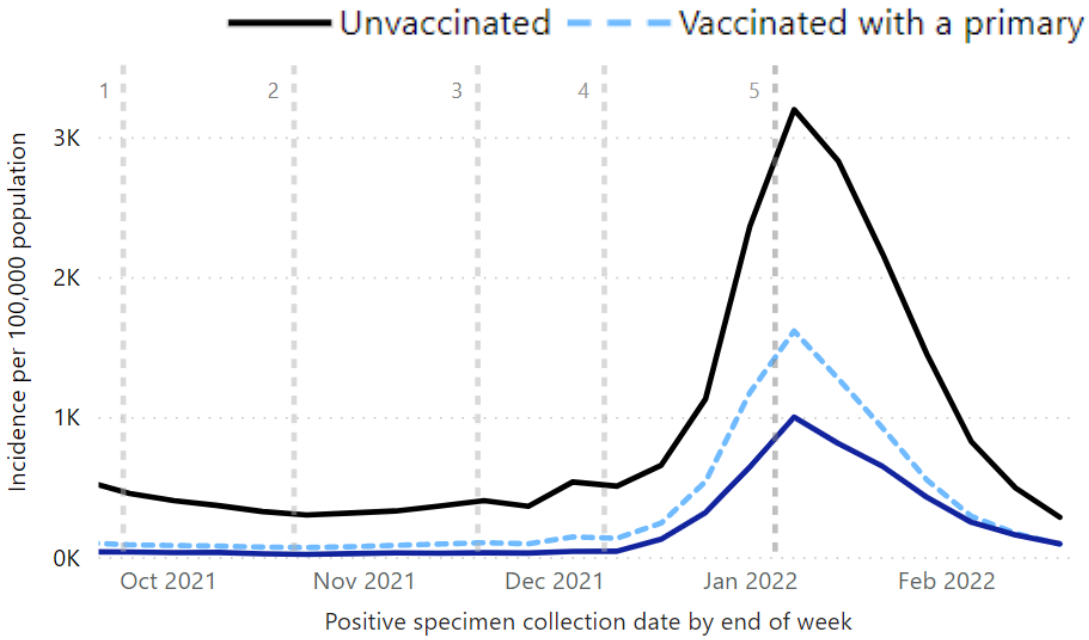
Risk of Dying from COVID-19

in January, compared to people vaccinated with at least a primary series.

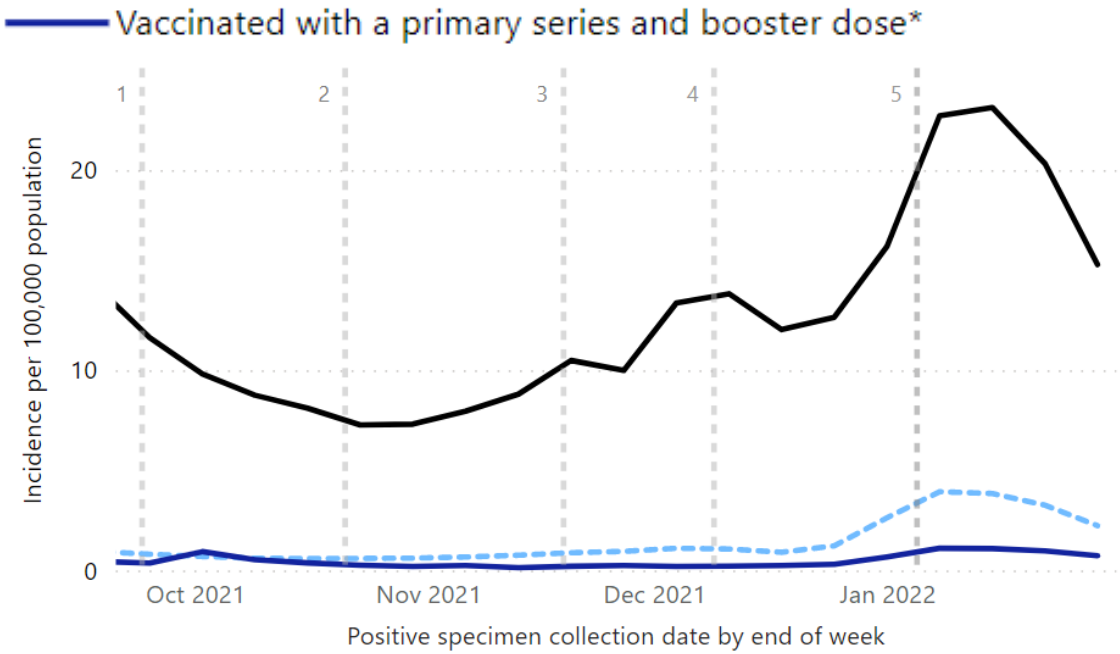
CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status Accessed March 17, 2022

Age-Adjusted Rates of COVID-19 Cases & Deaths by Vaccination Status and Receipt of Booster Dose,* September 19 – January 29, 2022 (26 U.S. Jurisdictions)

Cases



Deaths



Unvaccinated people aged 12 years and older had:

3.5X *Risk of Testing Positive for COVID-19* **AND** **21X** *Risk of Dying from COVID-19* **in January, and**

3.2X *Risk of Testing Positive for COVID-19* **in February, compared to people vaccinated with a primary series and a booster dose.***

*This includes people who received booster doses and people who received additional doses.

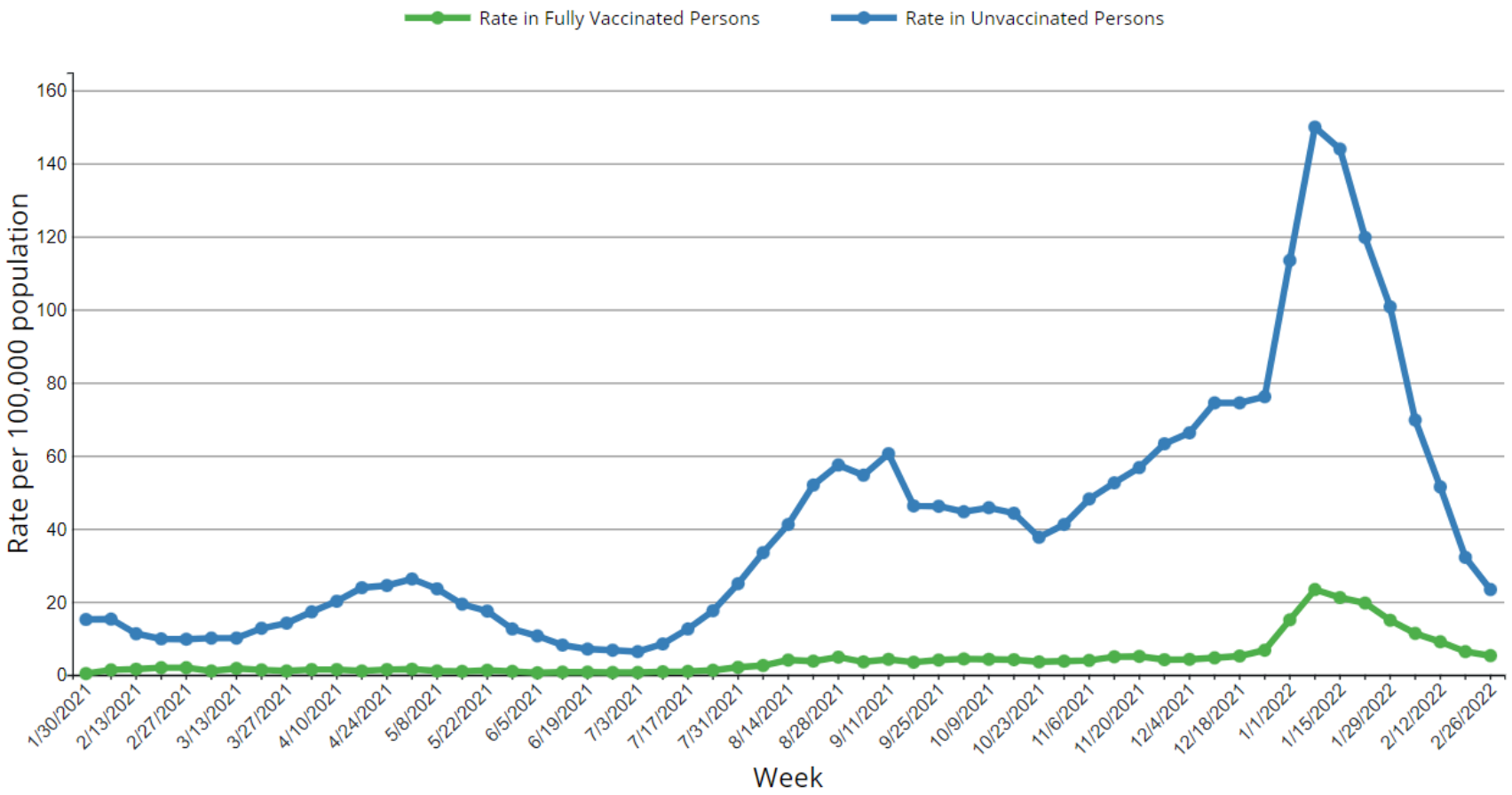
CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status Accessed March 28, 2022

COVID-19-Associated Hospitalization Surveillance Network (COVID-NET)

- **Population-based** surveillance **for laboratory-confirmed** COVID-19-associated **hospitalizations**
- Catchment area: >250 acute care hospitals in 99 counties in 14 states, representing 10% of U.S. population
- **Case definition**: Resident of the surveillance area and positive SARS-CoV-2 test within 14 days prior to or during hospitalization
- **Rates by vaccination status***
  - Linkage to immunization information systems
  - Representative sample of hospitalized cases (>37,000 to date)

*California, Colorado, Connecticut, Georgia, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah are included in these analyses

Age-adjusted rates of COVID-19-associated hospitalizations by vaccination status in adults ages ≥18 years, January 2021 - February 2022

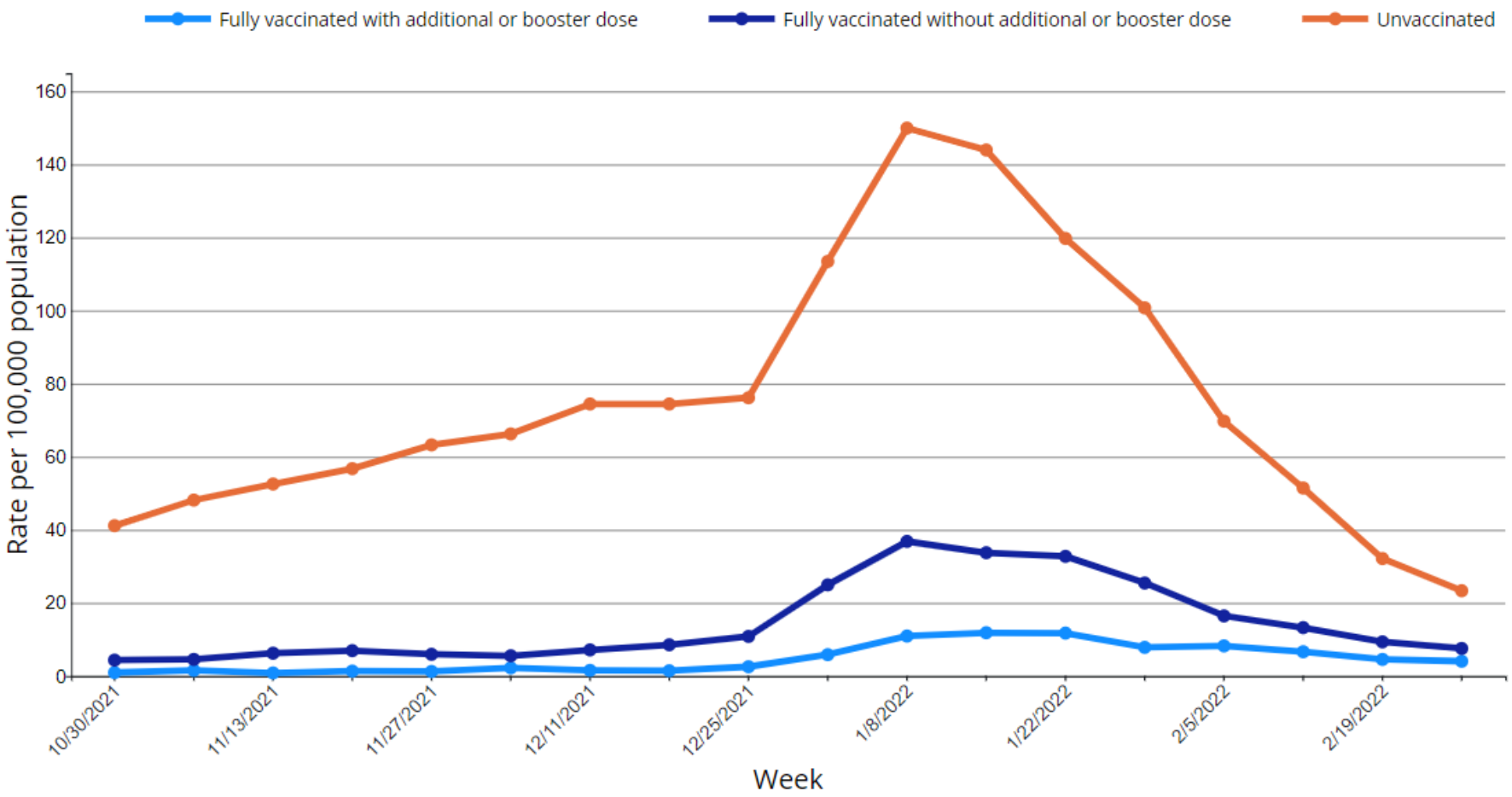


In February, compared to fully vaccinated adults ages ≥18 years, monthly rates of COVID-19-associated hospitalizations were **5X** higher in unvaccinated adults

A population-based surveillance system (COVID-NET) collected data on laboratory-confirmed COVID-19-associated hospitalizations among adults through a network of over 250 acute-care hospitals in 14 states.

CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#covidnet-hospitalizations-vaccination Accessed March 17, 2022

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



In February, compared to fully vaccinated adults ages ≥18 years with additional or booster doses, monthly rates of COVID-19-associated hospitalizations were **7X** higher in unvaccinated adults

CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#covidnet-hospitalizations-vaccination Accessed March 17, 2022

COVID-19-associated Hospitalizations Among Vaccinated Adults ≥18 Years with COVID-19 as Primary Reason for Admission — COVID-NET

January 1, 2021–January 31, 2022

- Fully vaccinated cases more likely to be:
  - Older
  - Long-term care facility resident
  - DNR/DNI/CMO code
- More underlying medical conditions

Category	Unvaccinated weighted % N=8,013	Fully vaccinated weighted % N=1,768
Age group (median, IQR)	58 (46-70)	70 (59-80)
18-49 years	31	11
50-64 years	33	16
≥65 years	37	72
LTCF residence	4	12
DNR/DNI/CMO	6	14
Underlying medical conditions*		
Chronic lung disease	28	42
Cardiovascular disease	33	56
Neurologic disease	15	29
Renal disease	14	30
Immunosuppressive condition	11	24
≥3 Underlying medical conditions	50	76

* Conditions significantly different in multivariable model of factors associated with hospitalization

DNI = do not intubate; DNR = do not resuscitate; CMO=comfort measure only

Unpublished data, as described at: https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html

Summary

- In 2021, the US experienced a dynamic landscape of SARS-CoV-2 variants, including Delta- and Omicron-driven resurgences of SARS-CoV-2 transmission
- CDC continues to monitor emerging variants, including BA.2 sublineage of Omicron, including prevalence and impact on disease incidence and severity over time
- Monitoring trends in rates of cases, hospitalizations, and deaths by vaccination status has been helpful for monitoring the impact of variants
- Currently authorized vaccines offer protection against severe disease — important to stay up to date with vaccination, including boosters in eligible populations

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- Ruth Link-Gelles
- Sara Oliver
- Aron Hall
- Adam MacNeil
- Rebecca Kondor
- Phillip Shirk
- Clint Paden
- Dave Wentworth
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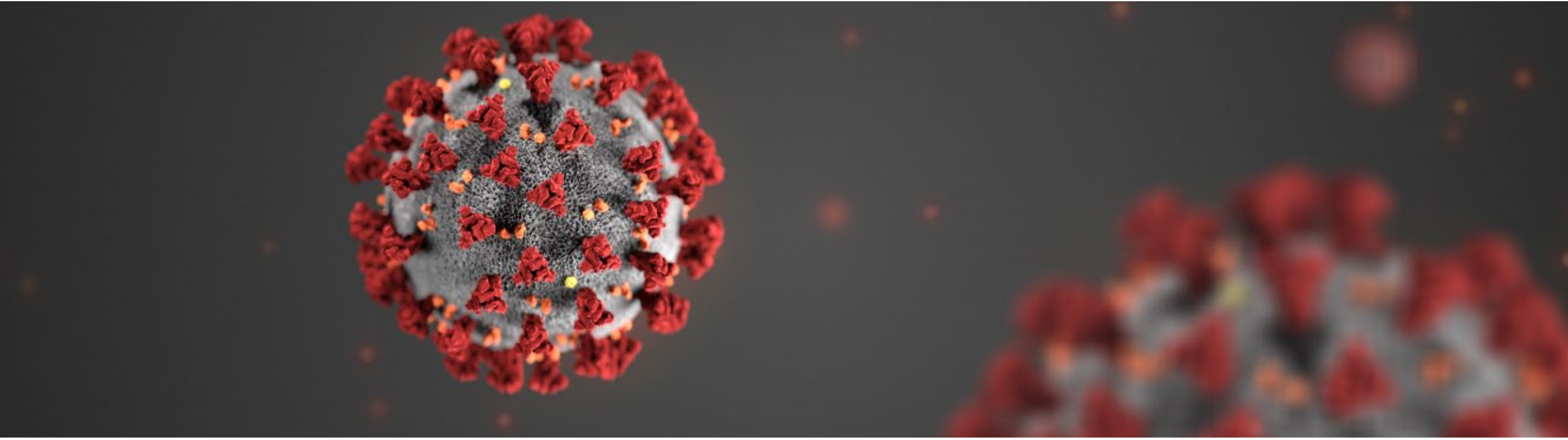


For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

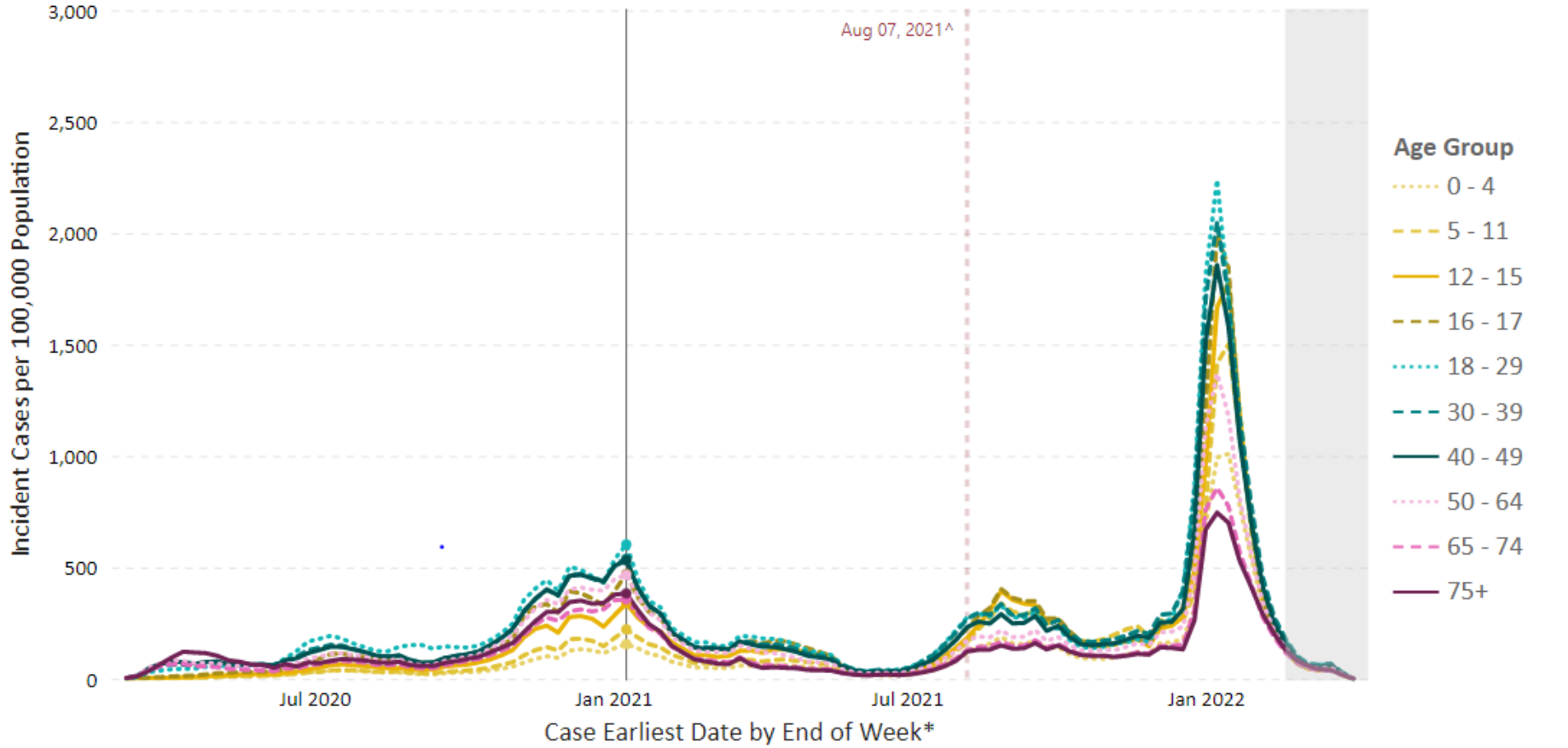
Extra Slides

SARS-CoV-2 variant classifications and definitions

Classification	Definition	Variants
Variant of Concern (VOC)	A variant for which there is evidence of: • increase in transmissibility • more severe disease • significant reduction in antibody neutralization • reduced effectiveness of treatments or vaccines • diagnostic detection failures	• **Delta** (B.1.617.2 & AY lineages) • **Omicron** (B.1.1.529 & BA lineages)
Variants Being Monitored (VBM)	Variants with data indicating a potential or clear: • impact on approved or authorized medical countermeasures, or association with more severe disease or increased transmission, but • no longer detected or circulating at very low levels • not posing imminent risk to public health in U.S.	• Alpha (B.1.1.7 & Q lineages) • Beta (B.1.351, sub-lineages) • Gamma (P.1, sub-lineages) • Epsilon (B.1.427/B.1.429) • Eta (B.1.525) • Iota (B.1.526) • Kappa (B.1.617.1) • B.1.617.3 • Zeta (P.2) • Mu (B.1.621, B.1.621.1)

https://www.cdc.gov/coronavirus/2019-ncov/variants/variant-info.html

Weekly Trends in COVID-19 Case Rates by Age Group, United States, March 1, 2020 - April 2, 2022



US: The most recent case record was reported during the week ending on Apr 02, 2022. Percentage of cases reporting age by date - 99.90%.

US territories are included in case and death counts but not in population counts. Potential six-week delay in case reporting to CDC denoted by gray bars. Weekly data with five or less cases have been suppressed.

*Case Earliest Date is the earliest of the clinical date (related to illness or specimen collection and chosen by a defined hierarchy) and the Date Received by CDC. The date for the current week extends through Saturday.

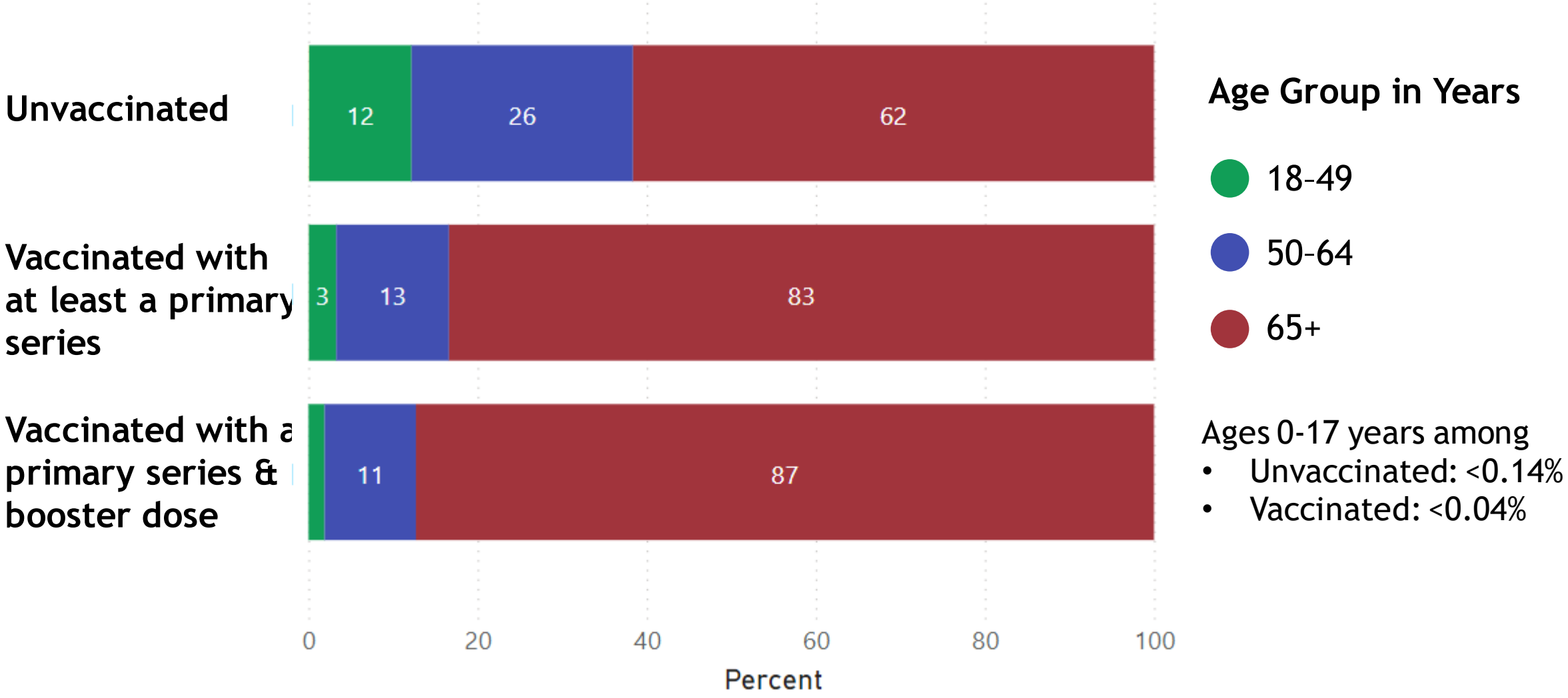
^Case rates during the week ending Aug 07, 2021 are reflective of a data reporting artifact from South Dakota. Surveillance data are provisional, and as additional clinical date data becomes available, the case rates over time are subject to change.

Source: CDC COVID-19 Case Line-Level Data, 2019 US Census, HHS Protect; Visualization: Data, Analytics & Visualization Task Force and CDC CPR DEO Situational Awareness Public Health Science Team

https://covid.cdc.gov/covid-data-tracker/#demographicsovertime Accessed March 31, 2022

Percentage of Deaths by Vaccination Status and Age Group

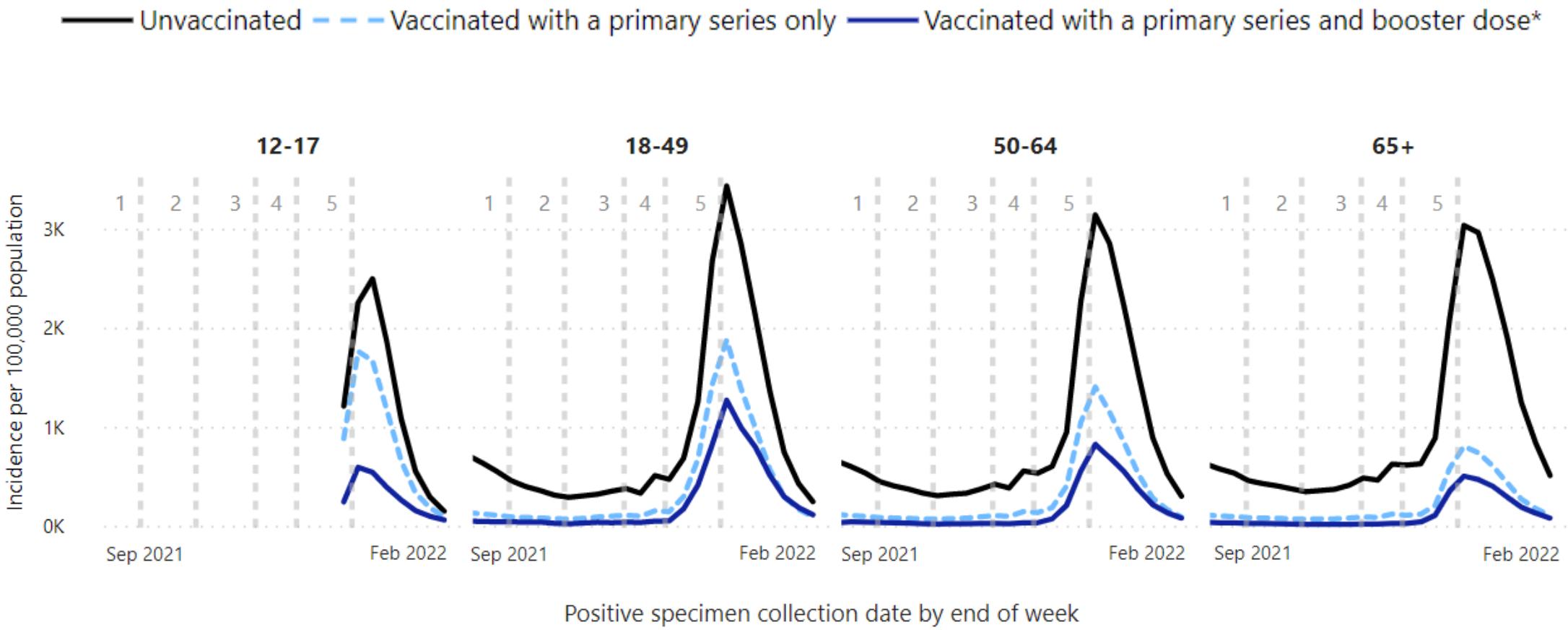
September 26, 2021 – January 29, 2022 (26 Jurisdictions)



Ages 0-17 years among
- Unvaccinated: <0.14%
- Vaccinated: <0.04%

Data Source: CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status Accessed March 28, 2022

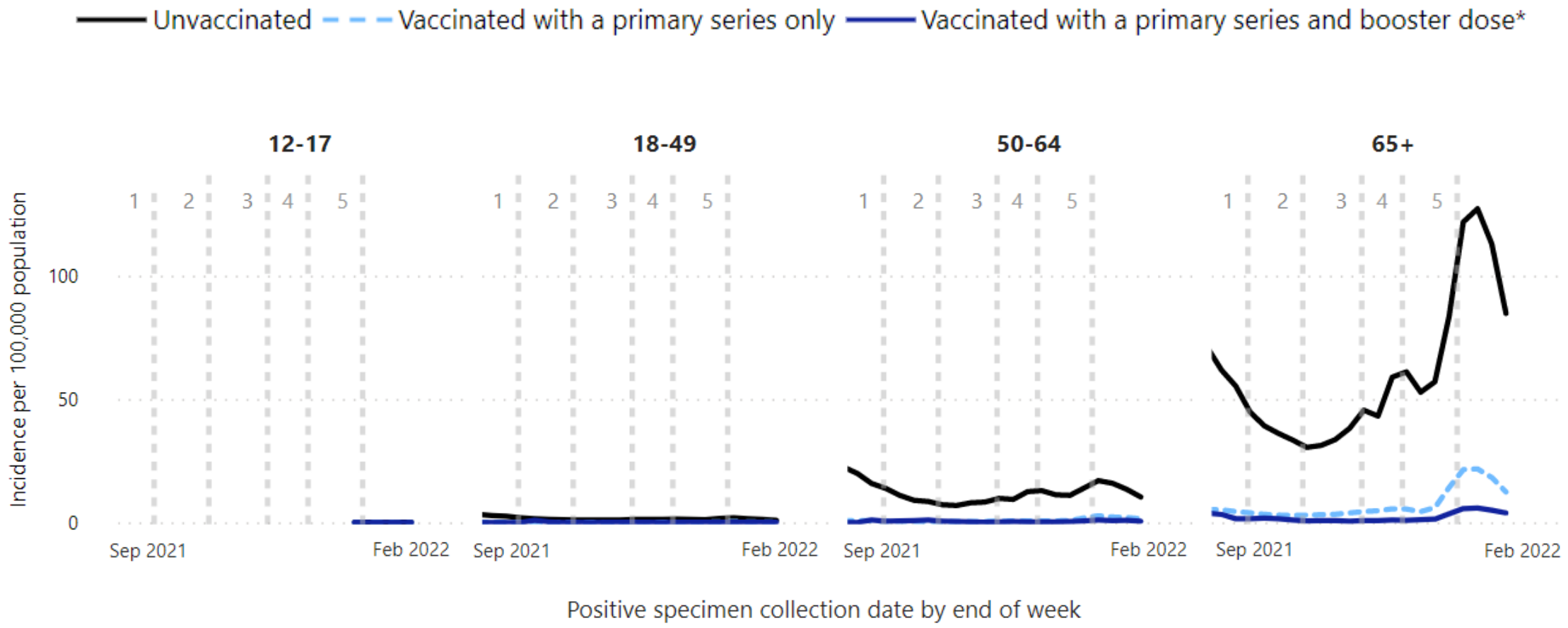
Rates of COVID-19 Cases by Vaccination Status, Receipt of Booster Dose,* and Age Group, September 19 – January 29, 2022 (26 U.S. Jurisdictions)



*This includes people who received booster doses and people who received additional doses.

CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status Accessed March 28, 2022

Rates of COVID-19 Cases by Vaccination Status, Receipt of Booster Dose,* and Age Group, September 19 – January 29, 2022 (26 U.S. Jurisdictions)



*This includes people who received booster doses and people who received additional doses.

CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status Accessed March 28, 2022