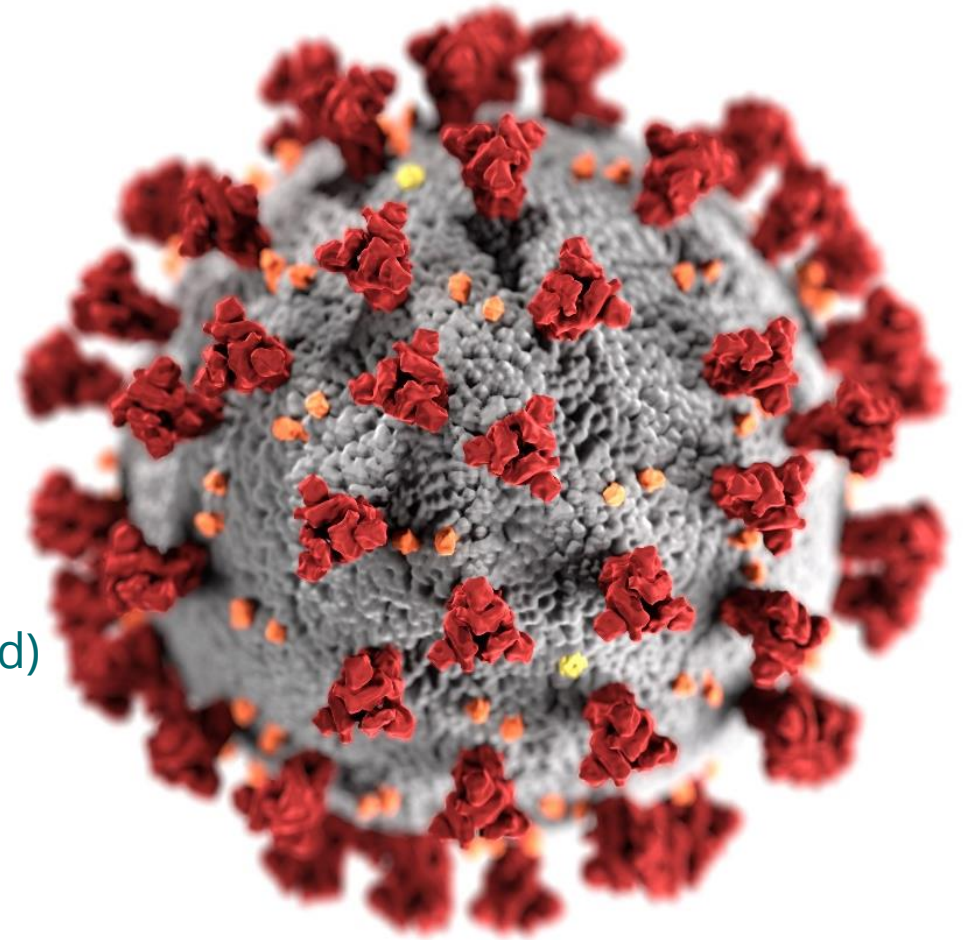


Update on SARS-CoV-2 Variants and the Epidemiology of COVID-19

CDR Heather Scobie, PhD, MPH

Coronavirus and Other Respiratory Viruses Division (Proposed)
Centers for Disease Control and Prevention

September 1, 2022



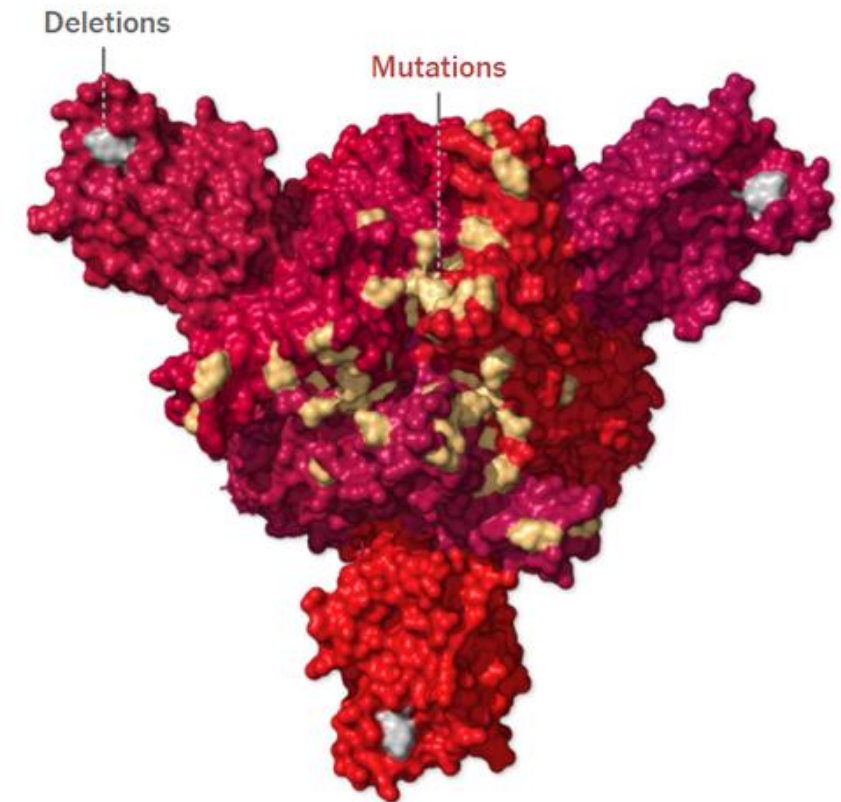
cdc.gov/coronavirus

SARS-CoV-2 Variants



SARS-CoV-2 Omicron (B.1.1.529) variant

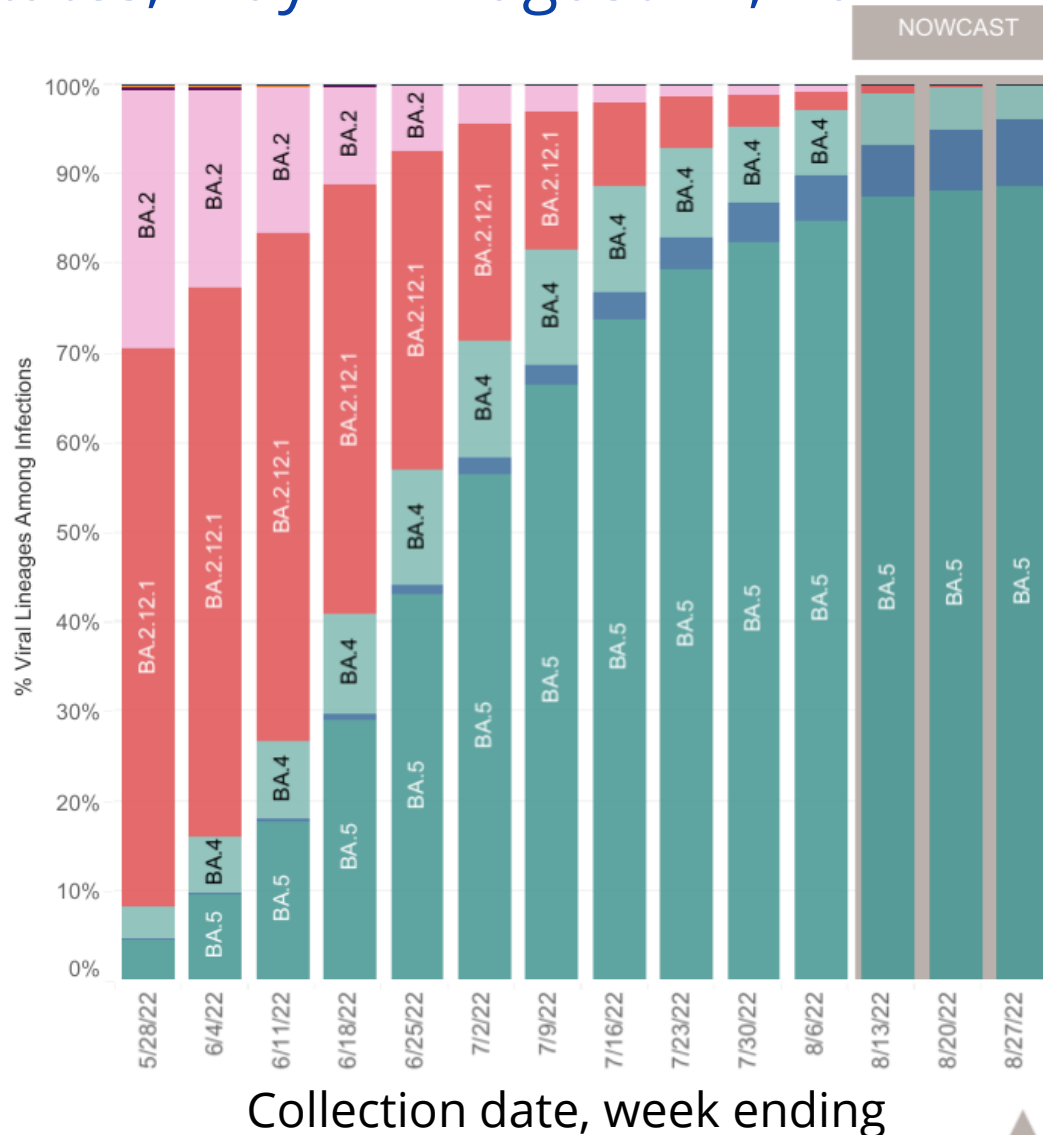
- Five main sub-lineages: BA.1 through BA.5
- Increased transmissibility and immune evasion, but decreased disease severity
- 30+ mutations in spike gene (S-gene)
 - 15 in receptor binding domain
- Lower vaccine effectiveness
 - Reduced neutralization by sera from vaccinated or convalescent individuals
- Reduction in efficacy of some monoclonal antibody treatments



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

Trends in Weighted Variant Proportion Estimates & Nowcast

United States, May 22–August 27, 2022



USA

WHO label	Lineage #	US Class	%Total	95%PI
Omicron	BA.5	VOC	88.7%	87.3-89.8%
	BA.4.6	VOC	7.5%	6.4-8.8%
	BA.4	VOC	3.6%	3.3-3.8%
	BA.2.12.1	VOC	0.2%	0.2-0.3%
	BA.2	VOC	0.0%	0.0-0.0%
	B.1.1.529	VOC	0.0%	0.0-0.0%
	BA.1.1	VOC	0.0%	0.0-0.0%
Delta	B.1.617.2	VBM	0.0%	0.0-0.0%
Other	Other*		0.0%	0.0-0.0%

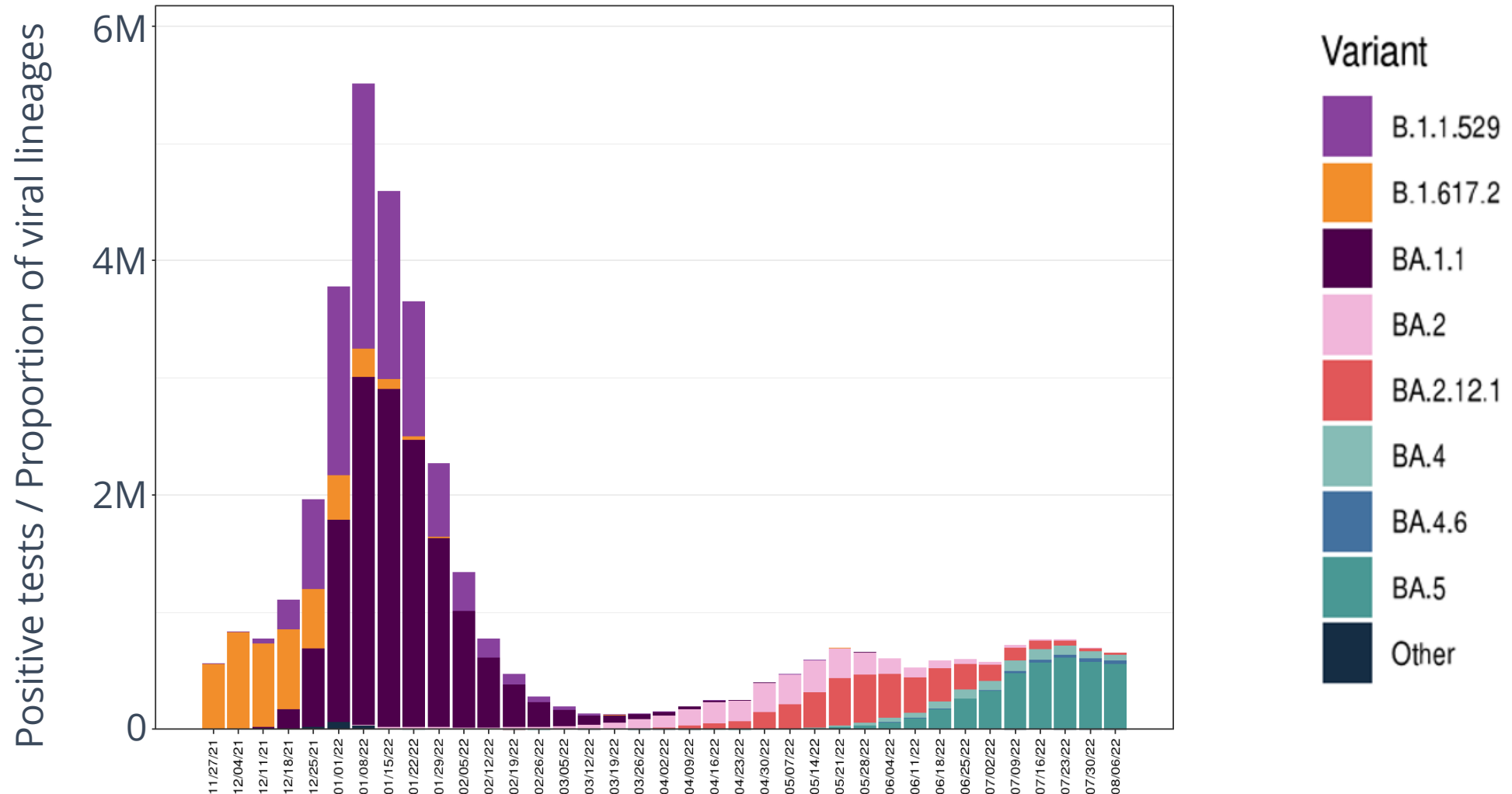
* Enumerated lineages are US VOC and lineages circulating above 1% nationally in at least one week period. "Other" represents the aggregation of lineages which are circulating <1% nationally during all weeks displayed.

** 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, BA.3 and their sublineages (except BA.1.1 and its sublineages) are aggregated with B.1.1.529. For regional data, BA.1.1 and its sublineages are also aggregated with B.1.1.529, as they currently cannot be reliably called in each region. Except BA.2.12.1, BA.2 sublineages are aggregated with BA.2. Except BA.4.6, sublineages of BA.4 are aggregated to BA.4. Sublineages of BA.5 are aggregated to BA.5.

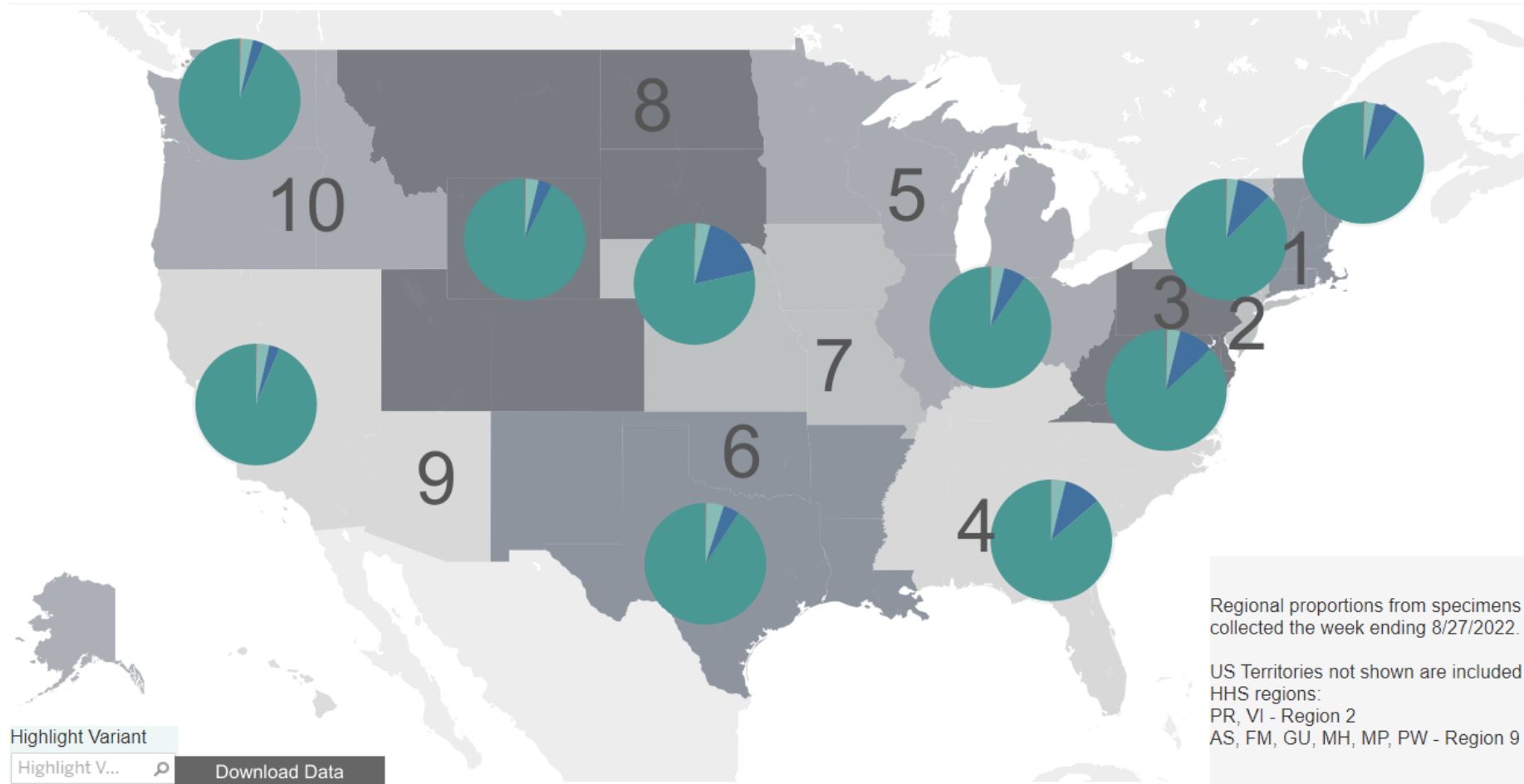
Estimated Number of Reported COVID-19 Cases by Variant

Variant Proportions Scaled by Positive Nucleic Acid Amplification Test (NAAT) Counts

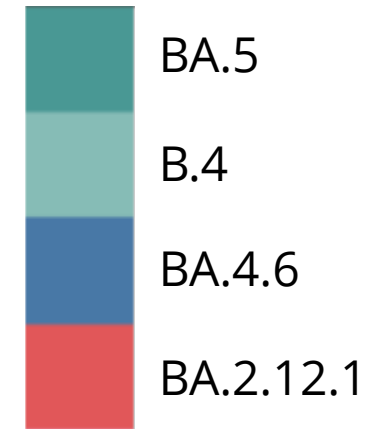


Nowcast Estimates of Variant Proportions by HHS Region

United States, August 21–27, 2022



Omicron Sub-lineage



Regional proportions from specimens collected the week ending 8/27/2022.

US Territories not shown are included in HHS regions:
 PR, VI - Region 2
 AS, FM, GU, MH, MP, PW - Region 9

Highlight Variant
 Highlight V... Download Data

Lineages called using pangolin v4.1.2, pangolin-data v1.13 and usher v.0.5.4.
 Lineage BA.1.1 and its sublineages are aggregated with B.1.1.529 at the regional level as they currently cannot be reliably called in each region.

Updated August 26, 2022

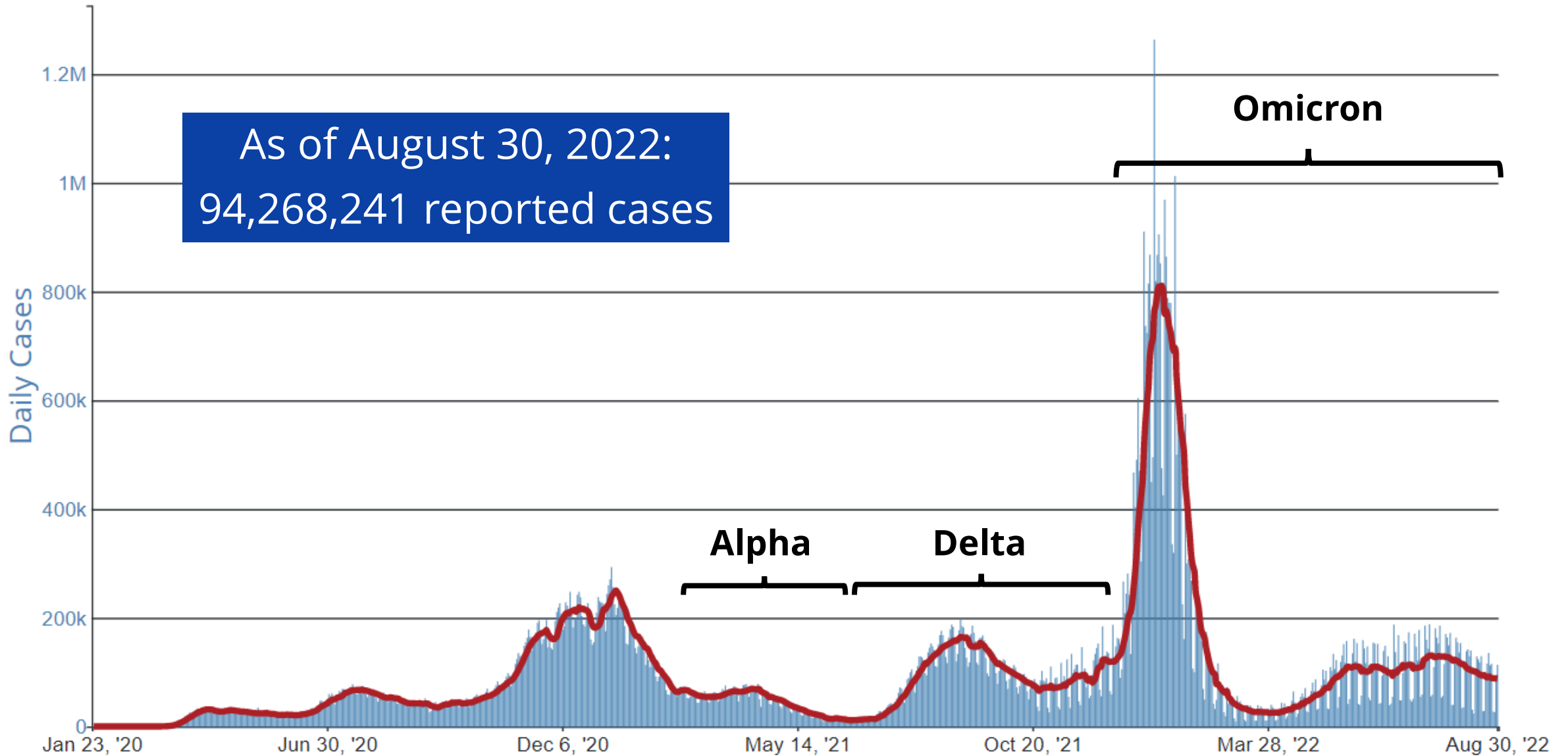
HHS=Health and Human Services

<https://covid.cdc.gov/covid-data-tracker/#variant-proportions> Accessed August 26, 2022

COVID-19 Trends

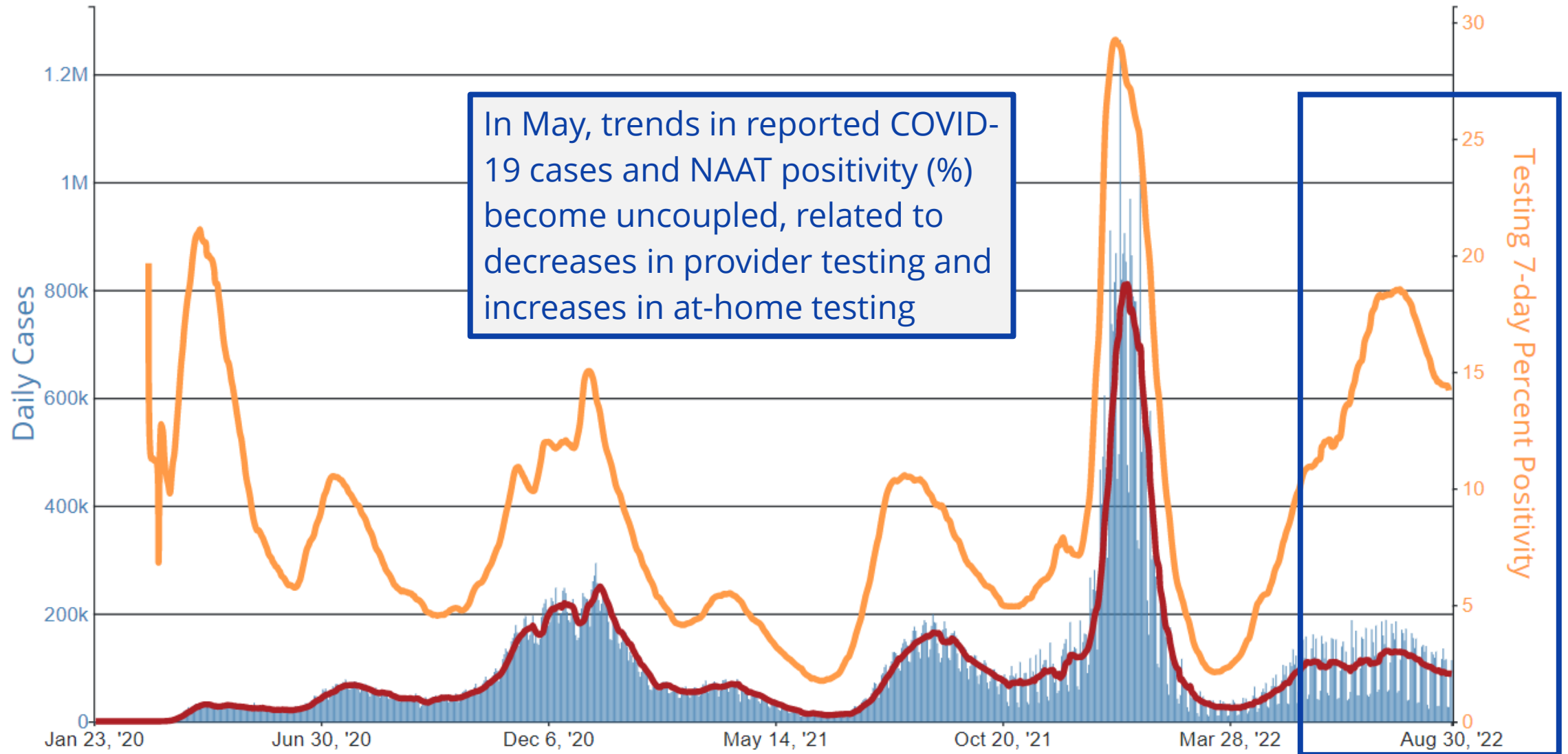


Daily Trends in Reported COVID-19 Cases, United States

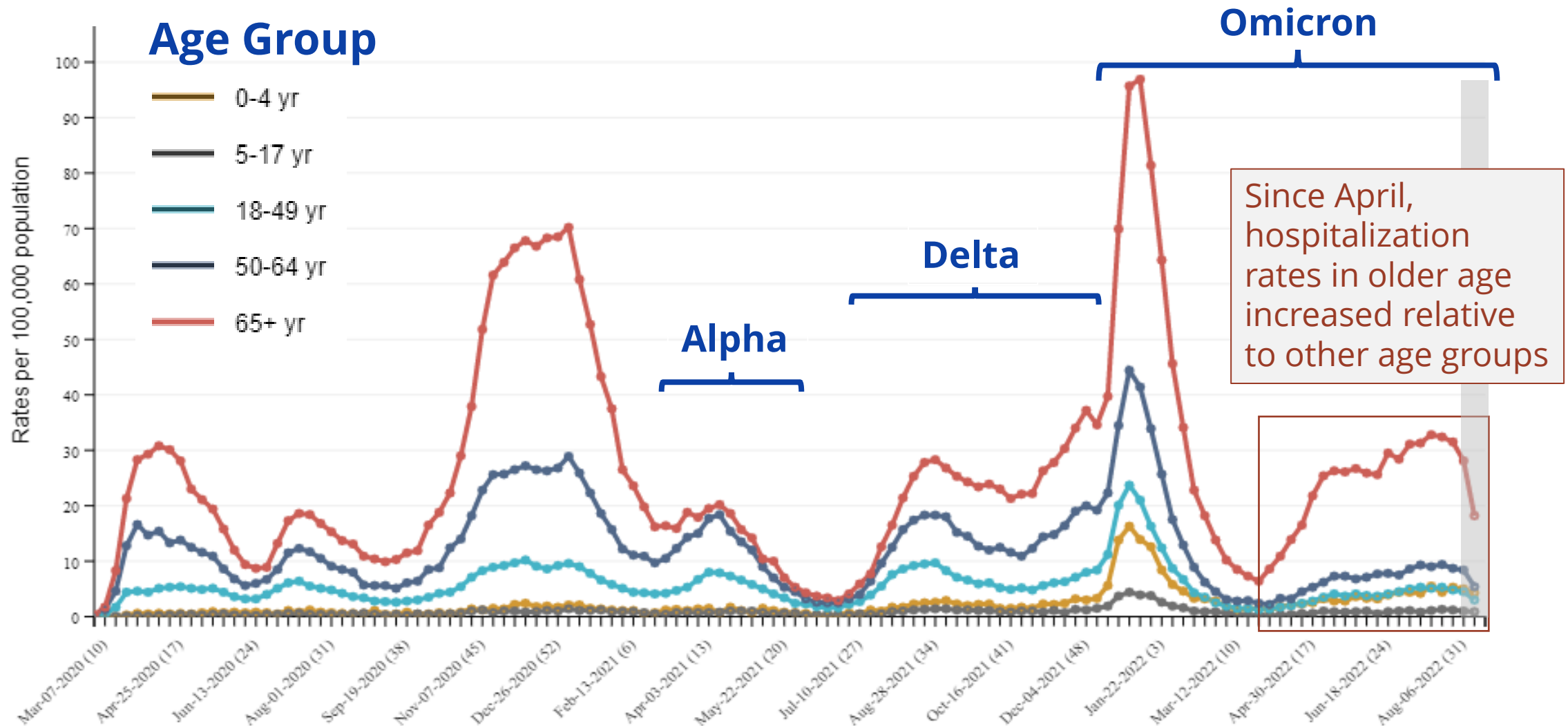


CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#trends_dailycases Accessed August 31, 2022

Daily Trends in Reported COVID-19 Cases and NAAT Percent Positivity (7-day Moving Average), United States



Weekly Trends in COVID-19-Associated Hospitalization Rates by Age Group — COVID-NET, March 2020 – August 20, 2022

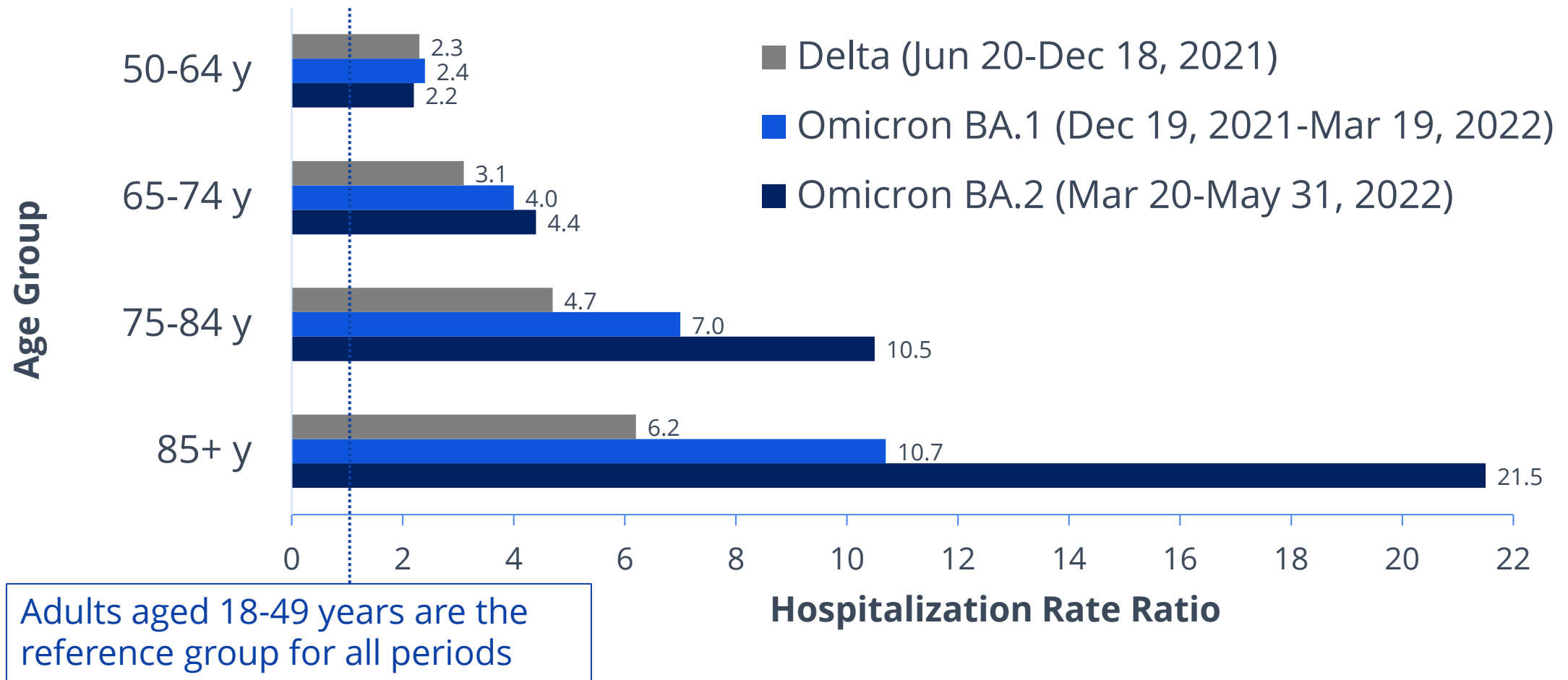


Grey shaded area denotes the most recent 2 weeks where reporting is <95% complete.

Source: COVID-NET; https://gis.cdc.gov/grasp/COVIDNet/COVID19_3.html Accessed August 26, 2022

Hospitalization Rate Ratios by Age Group

COVID-NET, June 2021 – May 31, 2022



Characteristics of hospitalized adults ≥18 years

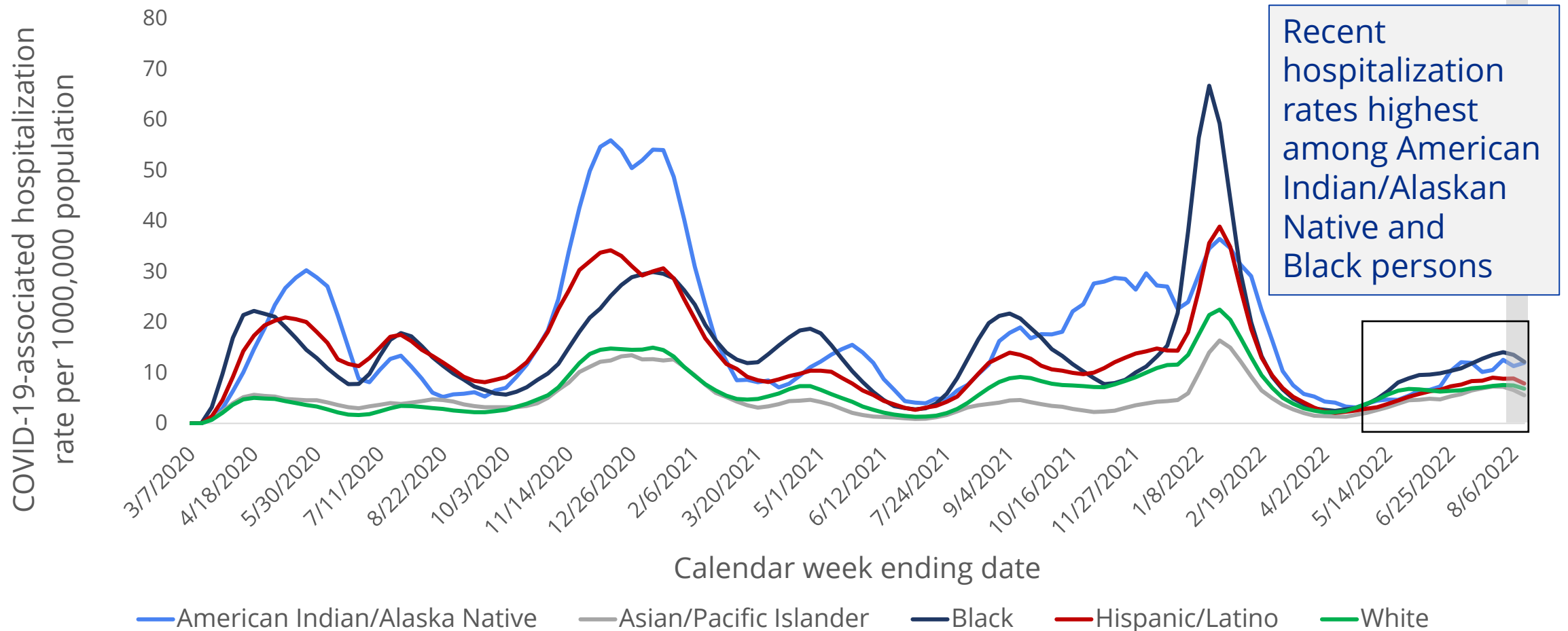
COVID-NET, June 20, 2021 – May 31, 2022

Characteristic	% of Total Hospitalizations			Trends during BA.1 & BA.2
	Delta Jun 20, 2021– Dec 18, 2021 (n=5,234)	Omicron BA.1 Dec 19, 2021– Mar 19, 2022 (n=1,804)	Omicron BA.2 Mar 20, 2021– May 31, 2022 (n=1,228)	
Age Median (years)	59.9	63.8	70.5	<ul style="list-style-type: none"> Median age increased
Likely COVID-19-related*	95.5	87.8	85.4	
Risk Factors				<ul style="list-style-type: none"> Underlying conditions more prevalent
Any underlying medical condition	89.3	91.7	95.1	
Immunosuppressive condition	11.0	16.0	19.2	
Long-term care facility	5.7	9.0	14.2	
Outcomes				<ul style="list-style-type: none"> Clinical outcomes less severe
Length of stay (days, median)	4.8	3.9	3.3	
ICU admission	24.3	17.9	13.2	
Mechanical ventilation	13.5	7.6	5.7	
In-hospital death	12.4	7.5	5.1	

* COVID-19-related illness as a likely reason for admission is indicated by COVID-19 diagnosis or symptoms consistent with COVID-19 as the chief complaint or reason for admission in the history of present illness. Non-COVID-19 reasons for admission included planned inpatient surgery or procedures, psychiatric admission needing acute medical care, trauma, other, and unknown. Havers et al. MMWR 2022; 71(34);1085–1091. https://www.cdc.gov/mmwr/volumes/71/wr/mm7134a3.htm?s_cid=mm7134a3_w

Age-Adjusted Rates of COVID-19-Associated Hospitalizations Among Persons of All Ages by Race/Ethnicity

COVID-NET, March 7, 2020 – August 13, 2022 (3-Week Moving Average)

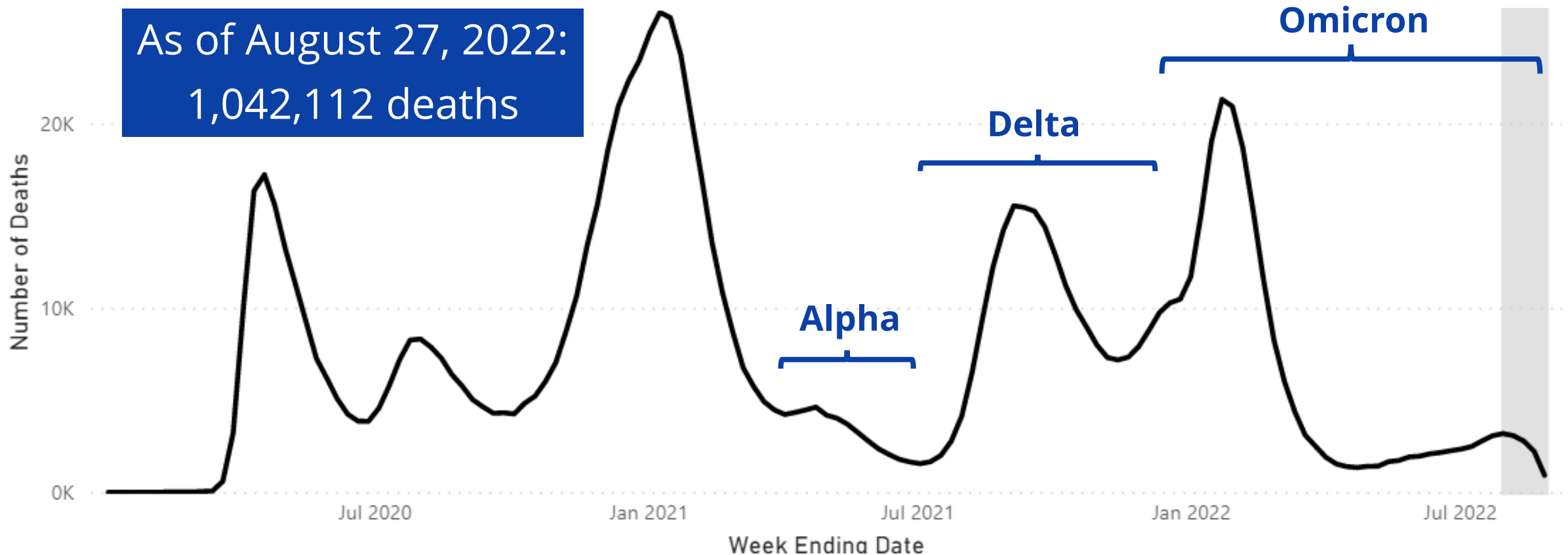


Grey shaded area denotes the most recent 2 weeks where reporting is <95% complete.

COVID-19-Associated Hospitalization Surveillance Network (COVID-NET): <https://covid.cdc.gov/covid-data-tracker/#covidnet-hospitalization-network>. Accessed August 23, 2022

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

Provisional Death Certificate Data, National Vital Statistics System

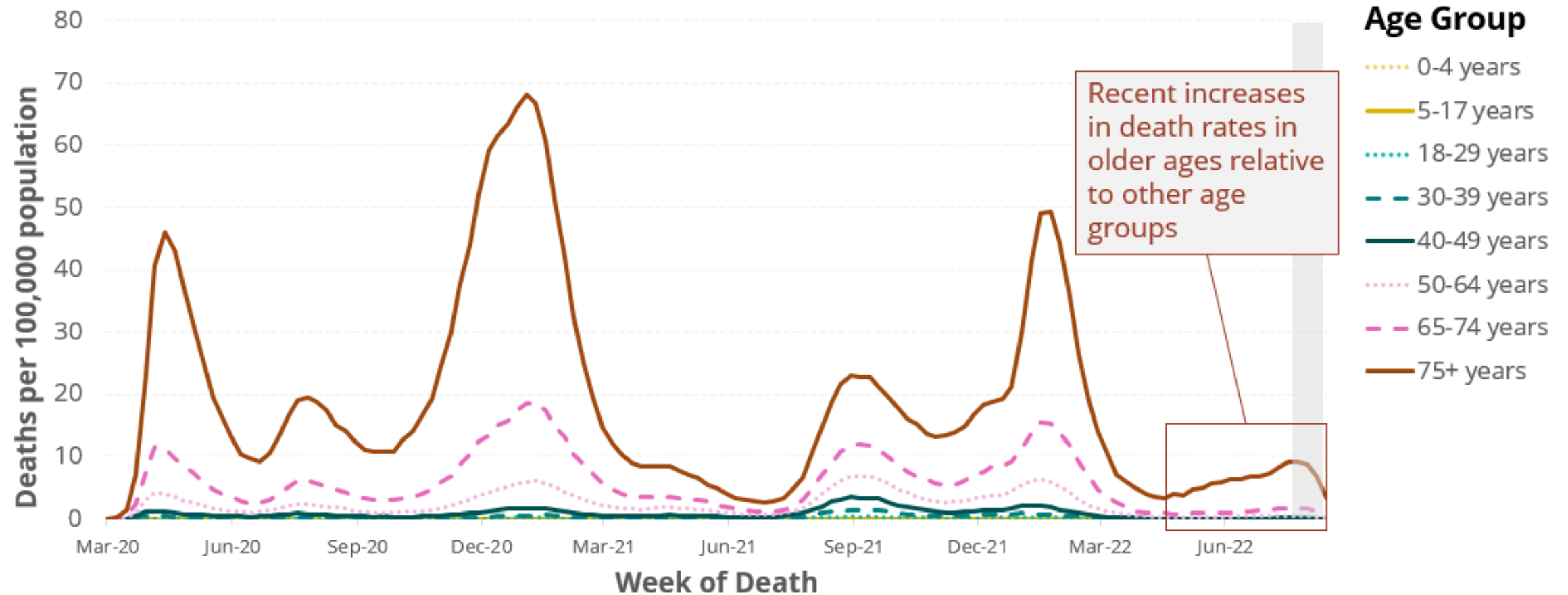


NOTE: Provisional death counts are based on death certificate data received and coded by NCHS as of the date of analysis and do not represent all deaths that occurred in that period. Data for the most recent 5 weeks (shown in the gray shaded area) are typically less than 90% complete, with lower levels of completeness in more recent weeks. Death counts are updated as additional deaths are received and coded.

SOURCE: NCHS, National Vital Statistics System. Estimates are based on provisional data.
https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm Accessed August 31, 2022

Weekly Trends in COVID-19 Mortality Rates by Age Group, United States, March 1, 2020 – August 20, 2022

Provisional Death Certificate Data, National Vital Statistics System

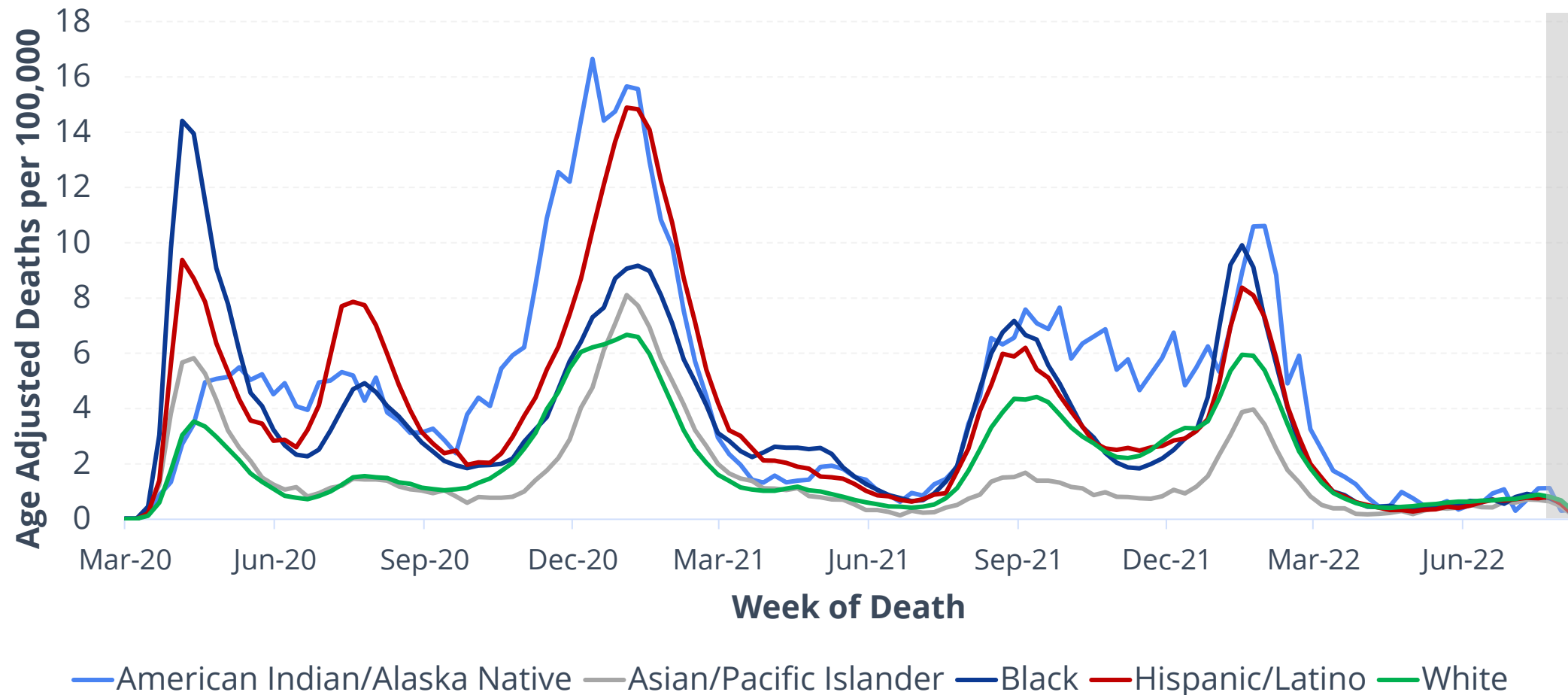


Source: National Center for Health Statistics, National Vital Statistics System. Data accessed on August 25, 2022. Date provided for "Week of Death" references week-end date. The gray box over the most recent two weeks indicates total death data for these weeks are less than 60% complete overall and should be interpreted with caution.

Source: <https://data.cdc.gov/NCHS/Provisional-Weekly-Deaths-by-Region-Race-Age/tpcp-uiv5>

Weekly Trends in Age-Adjusted COVID-19 Mortality Rates by Race/Ethnicity, United States, March 1, 2020 – August 20, 2022

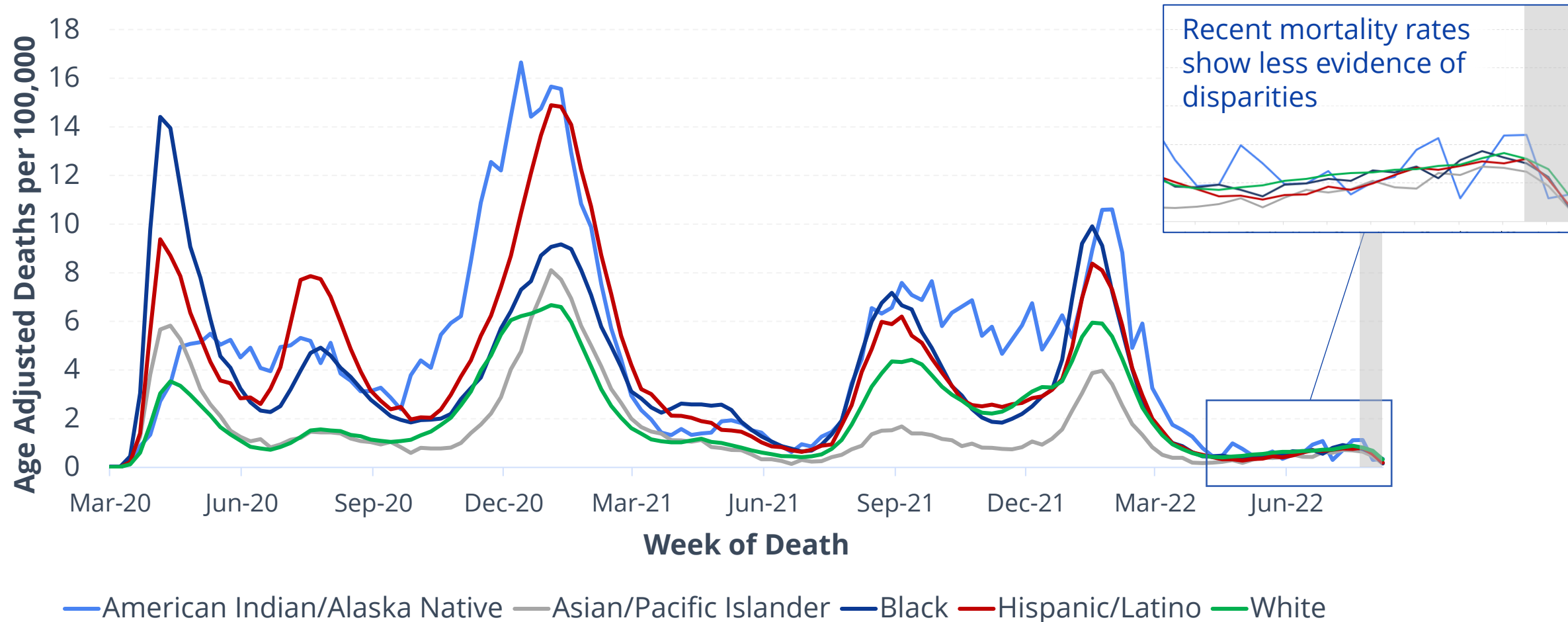
Provisional Death Certificate Data, National Vital Statistics System



Source: National Center for Health Statistics, National Vital Statistics System. Data accessed on August 25, 2022. Date provided for "Week of Death" references week-end date. The gray box over the most recent two weeks indicates total death data for these weeks are less than 60% complete overall and should be interpreted with caution. <https://data.cdc.gov/NCHS/Provisional-Weekly-Deaths-by-Region-Race-Age/tpcp-uv5> (National Vital Statistics System provisional death certificate data)

Weekly Trends in Age-Adjusted COVID-19 Mortality Rates by Race/Ethnicity, United States, March 1, 2020 – August 20, 2022

Provisional Death Certificate Data, National Vital Statistics System



Source: National Center for Health Statistics, National Vital Statistics System. Data accessed on August 25, 2022. Date provided for "Week of Death" references week-end date. The gray box over the most recent two weeks indicates total death data for these weeks are less than 60% complete overall and should be interpreted with caution.
<https://data.cdc.gov/NCHS/Provisional-Weekly-Deaths-by-Region-Race-Age/tpcp-uv5> (National Vital Statistics System provisional death certificate data)

Trends in COVID-19 by Vaccination Status



COVID-19 Vaccinations in the United States

As of August 24, 2022

223.9M
People vaccinated
with a primary series

72% Population
≥5 Years of Age

108.5M
People received a
first booster dose*

49% Population
≥5 Years of Age

23.1M
People received a
second booster dose*

34% Population
≥50 Years of Age

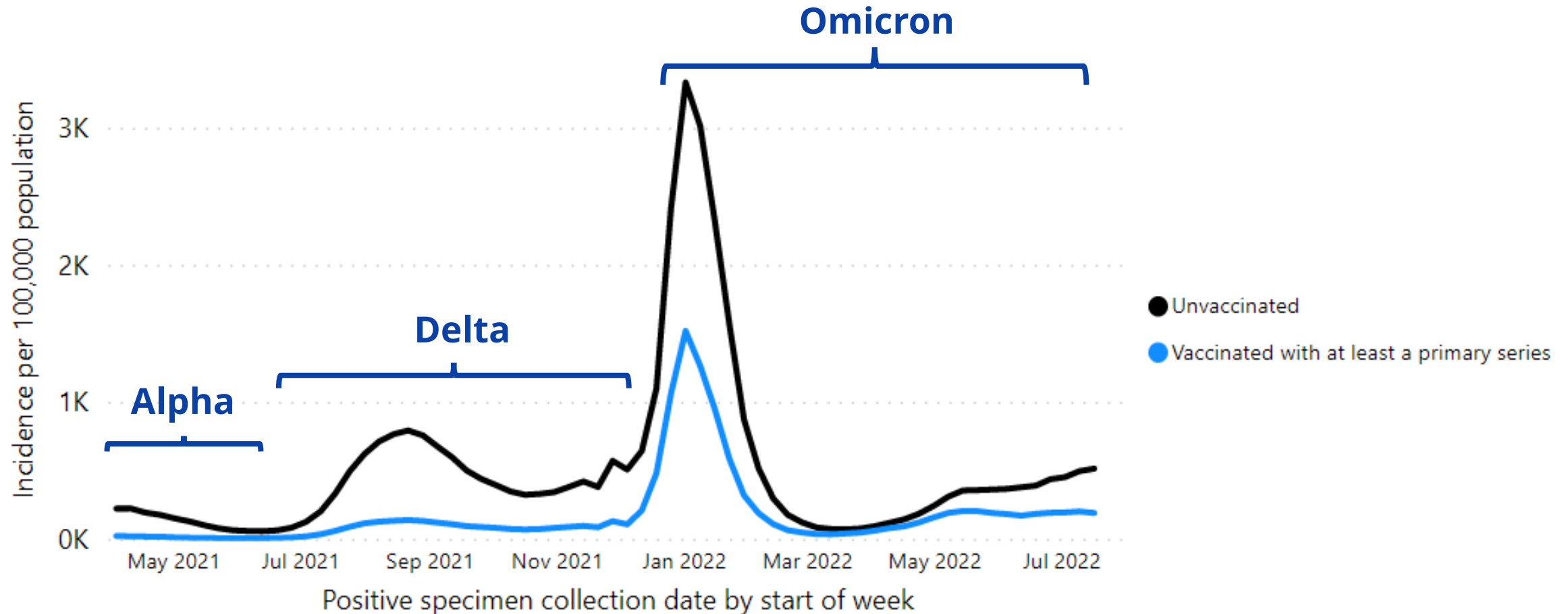
Differences in vaccination coverage by:

- Age, with lower primary series coverage in children
- Race/ethnicity, with lower booster coverage in most minority groups
- Disability status

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

https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total Accessed August 24, 2022

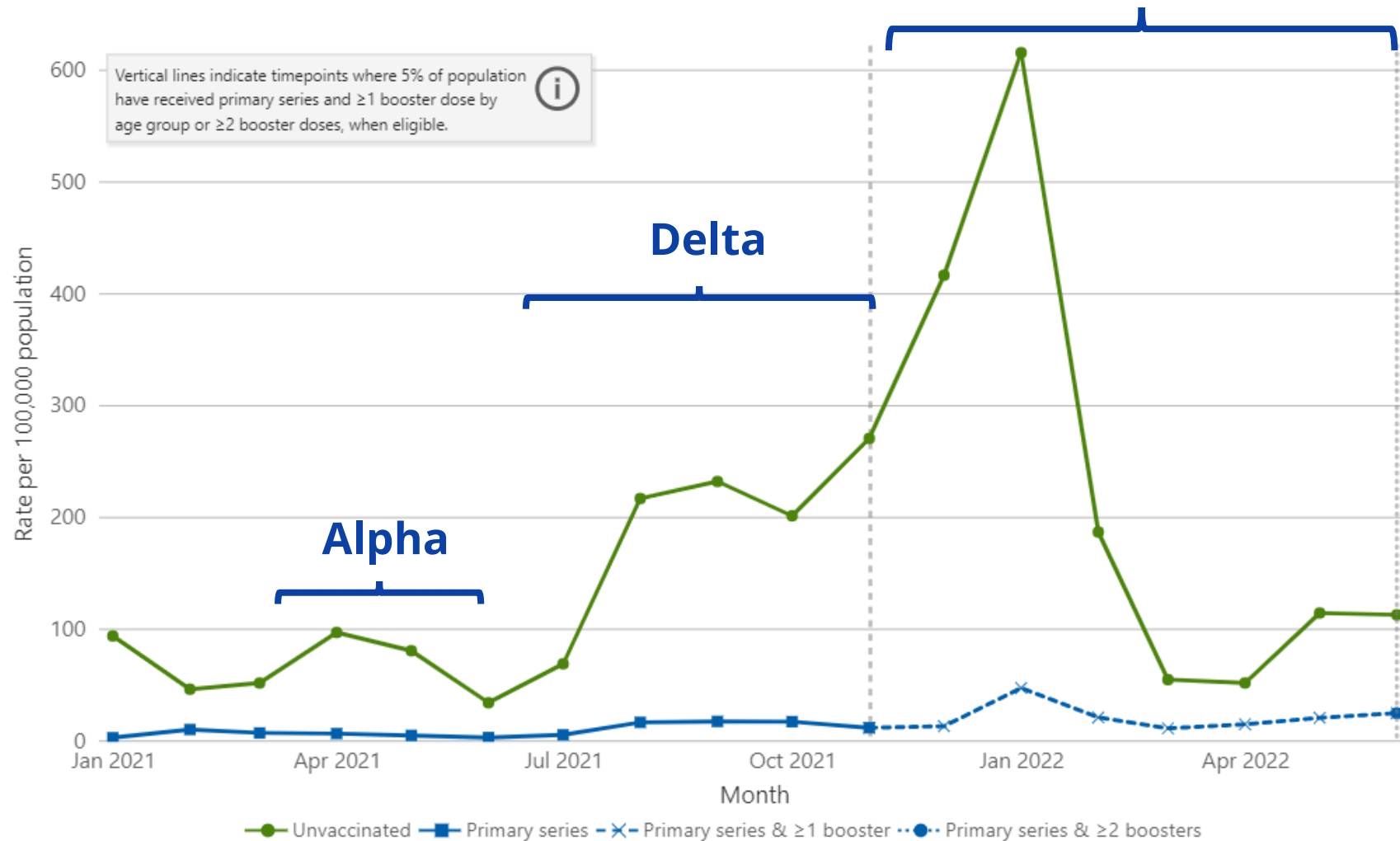
Age-Adjusted Rates of COVID-19 Cases by Vaccination Status Among Ages ≥ 5 years April 4, 2021 – July 23, 2022 (31 U.S. Jurisdictions)



In July 2022, **unvaccinated** people ages ≥ 5 years had **2.4X higher** risk of testing positive for COVID-19, compared to those with at least a **primary series**

Age-Adjusted Rates of COVID-19-Associated Hospitalization by Vaccination Status and Receipt of Booster Dose in Adults Ages ≥ 18 Years

COVID-NET, January 2021–June 2022

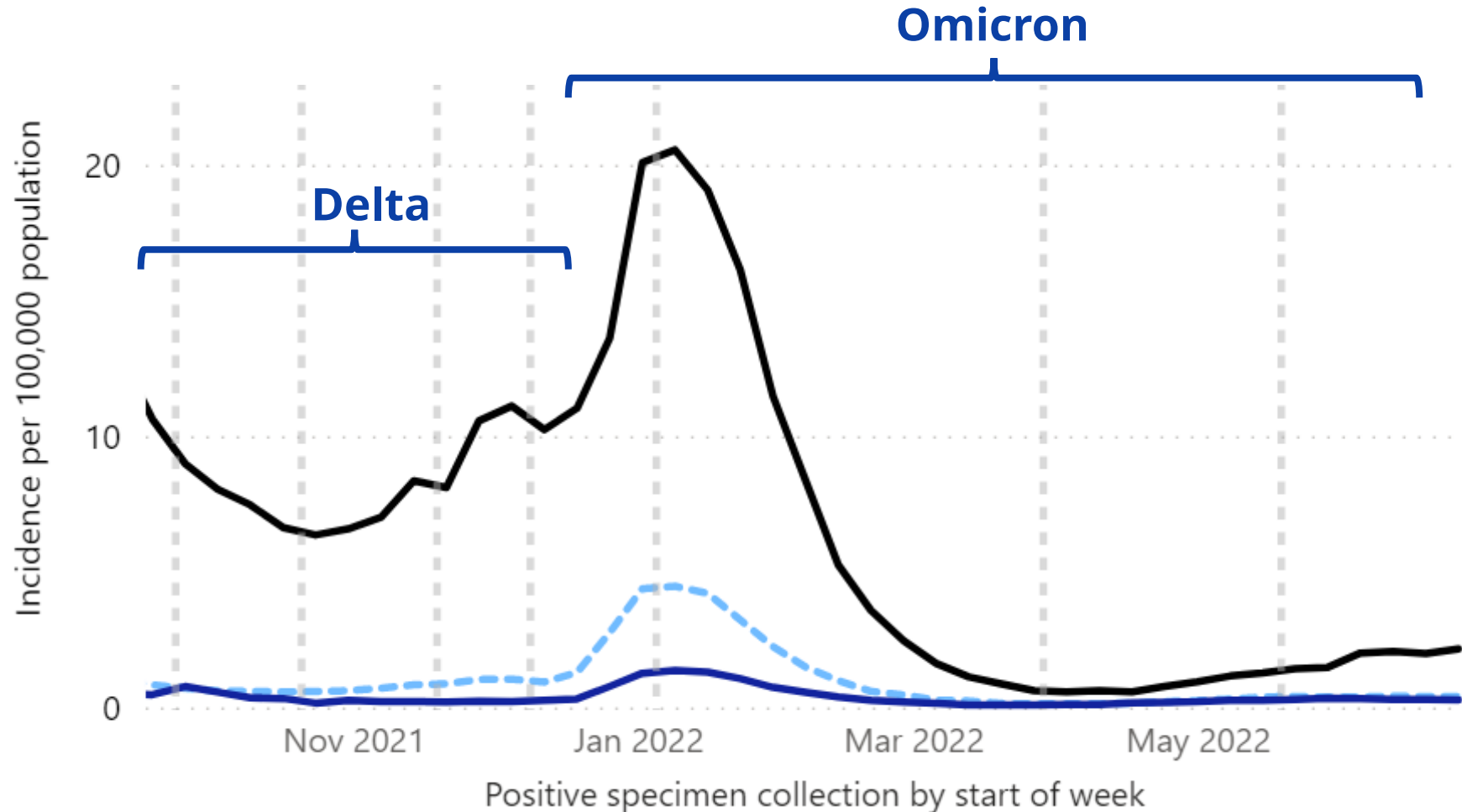


In June 2022, **unvaccinated** adults ages ≥ 18 years had **4.6X higher** COVID-19-associated hospitalization rates compared to those vaccinated with at least **one booster dose**

Age-Adjusted Rates of COVID-19-Associated Deaths by Vaccination Status and Receipt of Booster Dose* Among Ages ≥ 5 years

September 19, 2021 – July 2, 2022 (29 U.S. Jurisdictions)

— Unvaccinated — Vaccinated with primary series only — Vaccinated with primary series and 1+ booster dose*

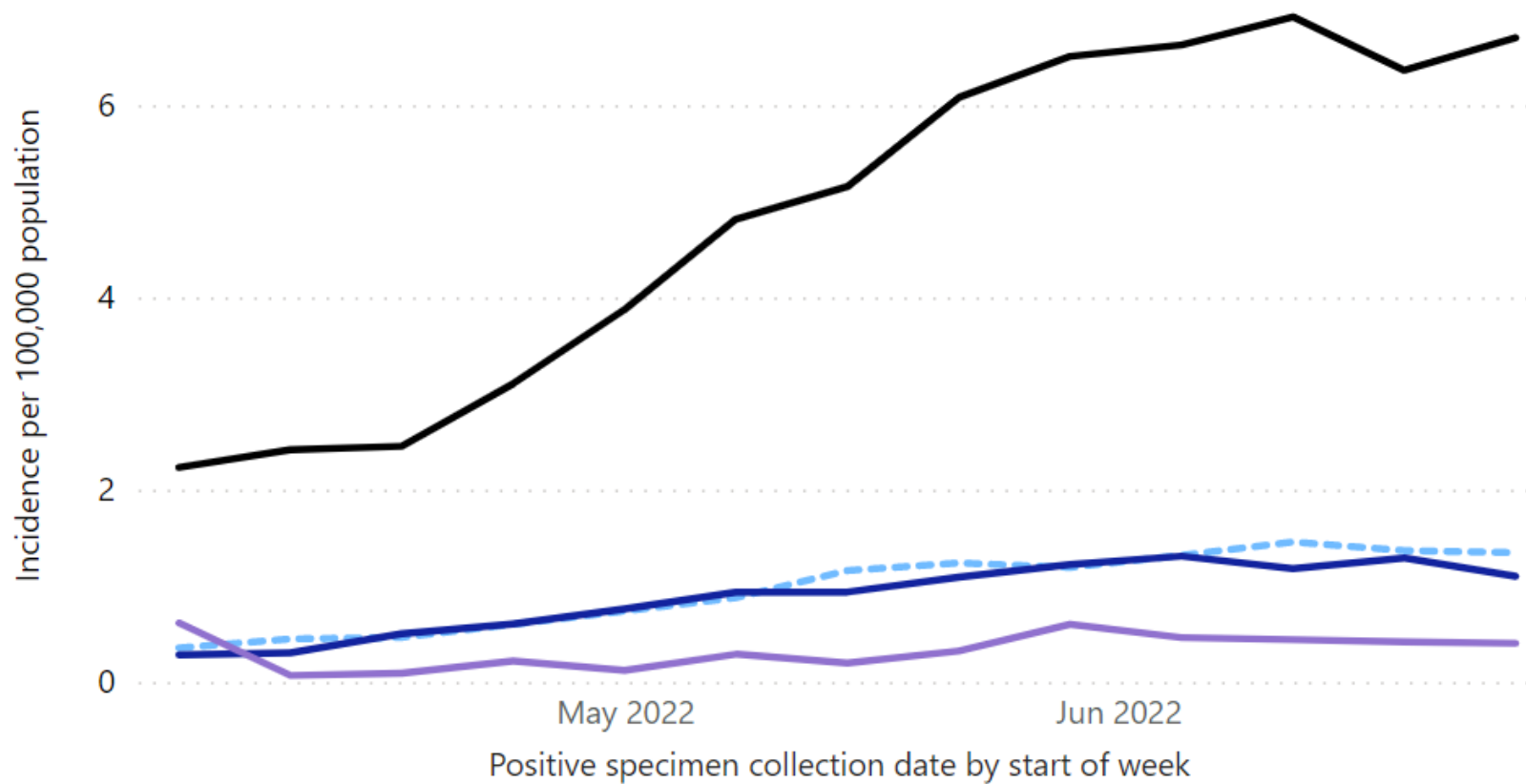


In June 2022, **unvaccinated** people ages ≥ 5 years had **8X higher** COVID-19-associated death rates compared to those with at least **one booster dose**

This was a decrease from **~20X** during January-March 2022

*This includes people who received booster doses and people who received additional doses. Vertical lines denote changes in booster dose recommendations. CDC COVID Data Tracker. <https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status> Accessed August 24, 2022

Death Rates by Vaccination Status and Receipt of 1st and 2nd Booster Doses Among People Ages ≥ 50 Years April 3–July 2, 2022 (25 U.S. Jurisdictions)



In June 2022, people ages 50 years and older with **≥ 2 booster doses** had **14 times** lower risk of dying from COVID-19, compared to **unvaccinated** people and **3 times** lower risk of dying from COVID-19 than people with **one booster dose**

— Unvaccinated — Primary series only — Primary series and 1 booster dose* — Primary series and 2+ booster doses*

*Includes either a booster or additional dose.

Risk of Severe COVID-19 Illness

- Unvaccinated people at higher risk of severe illness compared with vaccinated people
- Most (75%) vaccinated people with severe COVID-19 illness have multiple risk factors:
 - Older age (most ≥ 65 years, but with risk increasing with age)
 - Underlying medical conditions (with risk increasing with number of underlying conditions)
 - › Immunosuppression
 - › Diabetes mellitus
 - › Chronic kidney disease
 - › Chronic lung disease
 - › Chronic cardiovascular disease
 - › Chronic neurologic disease
- Antiviral drugs can help reduce risk of severe illness in people at higher risk, regardless of vaccination status

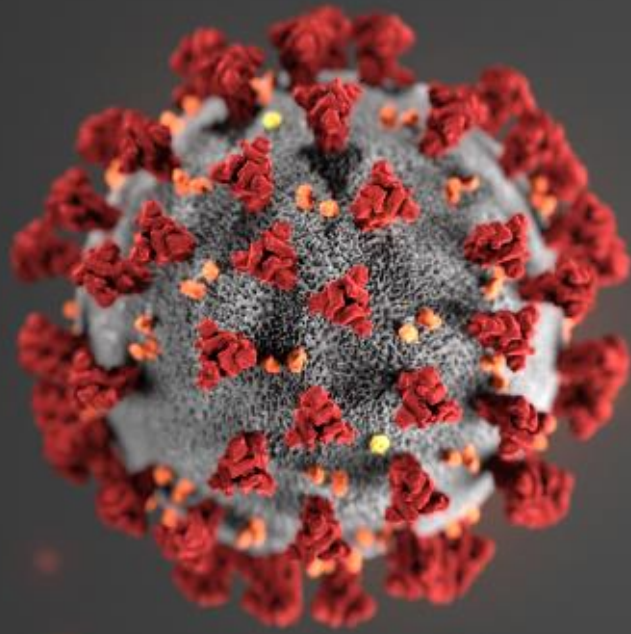
Yek et al. MMWR 2022;71:19–25. <https://www.cdc.gov/mmwr/volumes/71/wr/mm7101a4.htm>; Taylor et al. MMWR 2022;71:466-473: <http://dx.doi.org/10.15585/mmwr.mm7112e2> and unpublished COVID-NET data, as described [here](#); Malden et al. MMWR 2022; 71(25);830-833: <https://www.cdc.gov/mmwr/volumes/71/wr/mm7125e2.htm> ; Gold et al. MMWR 2022; 71(25);825-829: <https://www.cdc.gov/mmwr/volumes/71/wr/mm7125e1.htm> ; Najjar-Debbiny et al. CID 2022;; ciac443, <https://doi.org/10.1093/cid/ciac443>
Dryden-Peterson et al. medRxiv 2022.06.14.22276393; <https://doi.org/10.1101/2022.06.14.22276393>

Summary

- CDC continues to monitor emerging variants, like the sub-lineages of Omicron, including prevalence and impact on disease incidence, severity, and vaccine effectiveness over time
- Racial and ethnic minority groups have been disproportionately affected by COVID-associated hospitalization and mortality; these inequities have decreased over time but have not been eliminated
- Trend of increasing severe illness, including hospitalization and death, in people of older age and with underlying health conditions
- Currently approved vaccines offer protection against severe illness and death from COVID-19 — important to stay up to date with vaccination, including all boosters in eligible populations
- Therapeutics and multiple prevention measures should be used to protect people at higher risk of severe COVID-19 illness, regardless of vaccination status

Acknowledgements

- Amelia Johnson
- Lauren Linde
- Akilah Ali
- Justice King
- Meagan Stephenson
- Steve Evener
- Betsy Gunnels
- Benjamin Silk
- Chris Taylor
- Fiona Havers
- Ruth Link-Gelles
- Sara Oliver
- Evelyn Twentyman
- Katherine Fleming-Dutra
- Aron Hall
- Rebecca Kondor
- Phillip Shirk
- Clint Paden
- Natalie Thornburg
- Summer Galloway
- Dave Wentworth
- Taraesa Toney
- Andrea Yunyou
- State and local health departments: AL, AR, AZ, CA, CO, CT, DC, FL, GA, ID, IN, IO, KS, LA, MA, MD, MI, MN, NC, NE, NJ, NM, NY, NY City, OH, Philadelphia, RI, Seattle/King County, SD, TN, TX, UT, WA, WI, WV



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.

