Centers for Disease Control and Prevention
National Center for Immunization and Respiratory Diseases

COVID-19 Epidemiology

The Forum Collaborative, November 2, 2023

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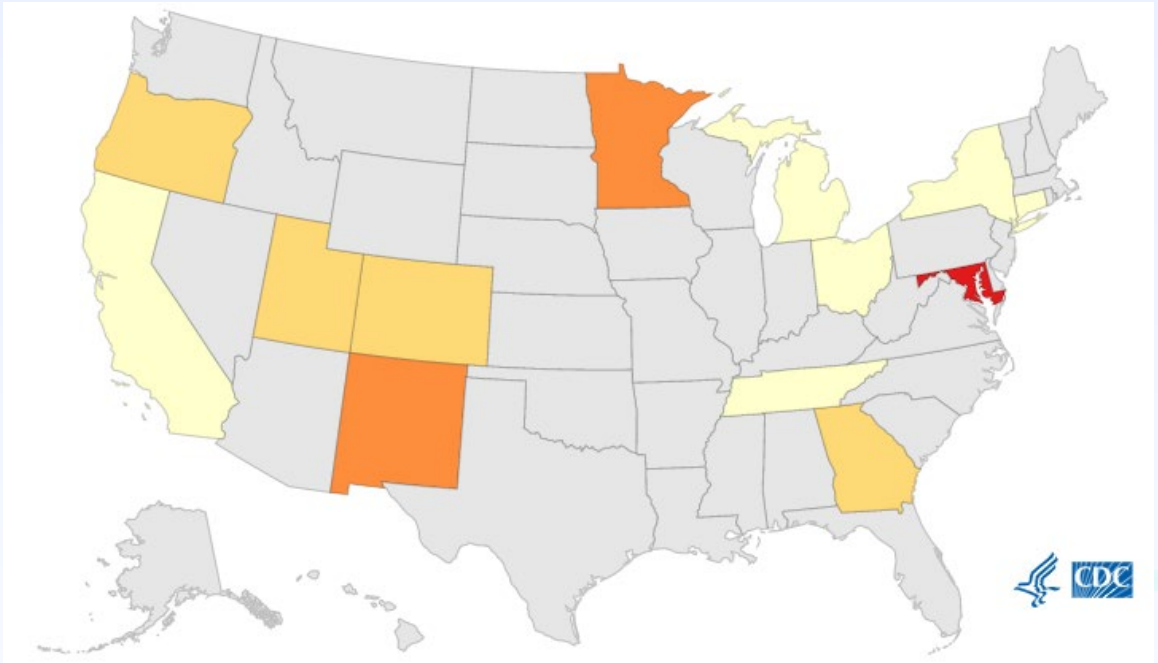
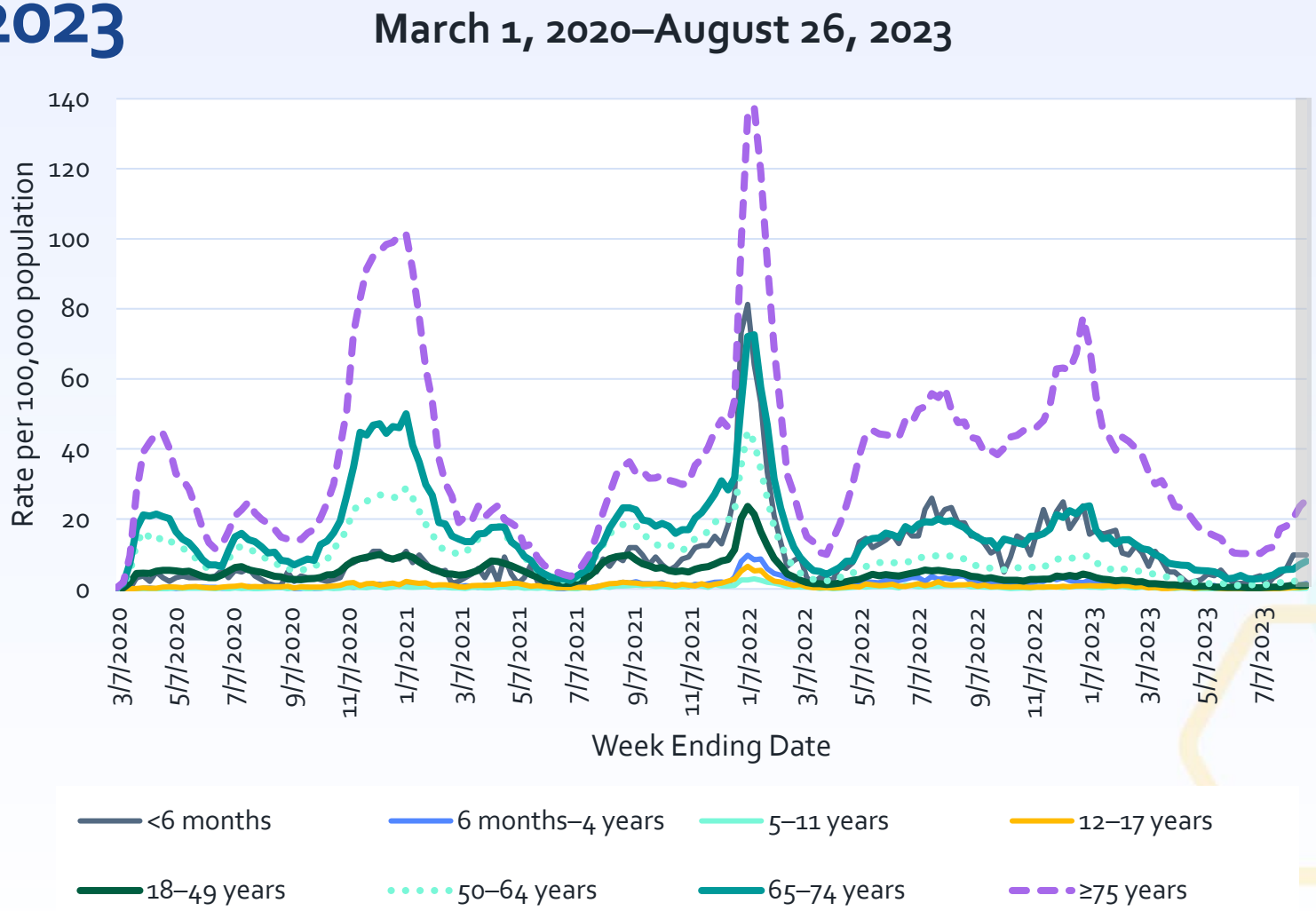
NCIRD
National Center for Immunization and Respiratory Diseases

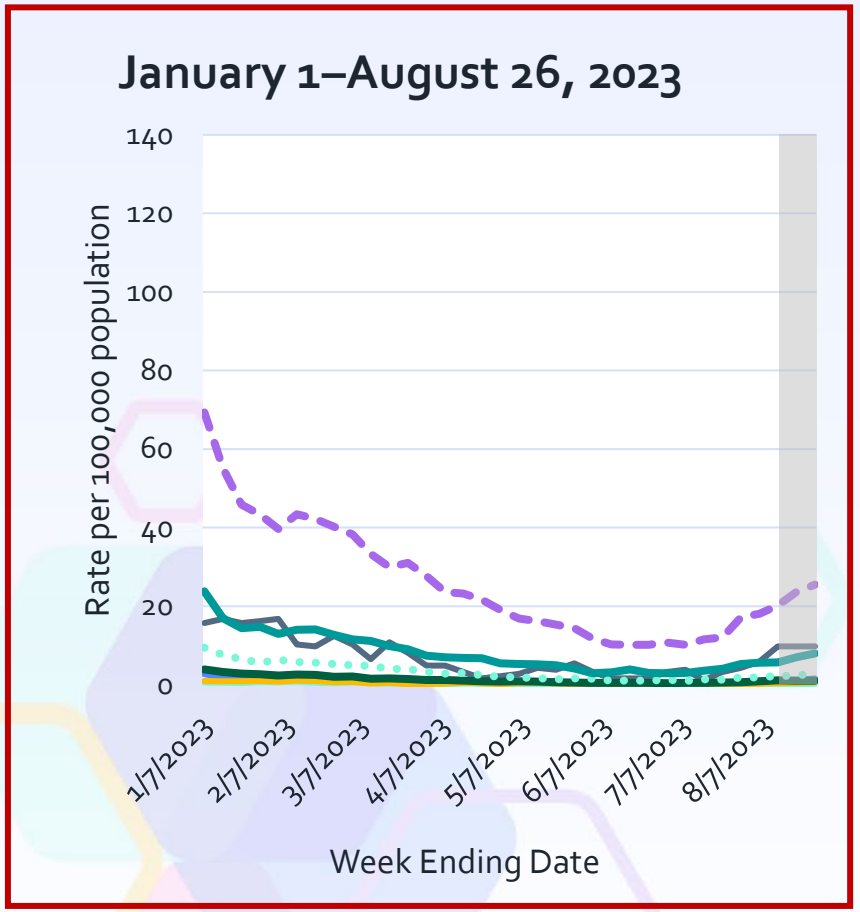
COVID-NET: A RESP-NET population-based hospitalization surveillance platform

- RESP-NET: COVID-NET, RSV-NET, FluSurv-NET
- >300 acute-care hospitals
- 98 counties in 13 states
- In 9 of 10 HHS regions
- ~10% of U.S. population
- Positive SARS-CoV-2 within 14 days of or during hospitalization
- Screening or clinician-driven testing
- Clinical data: representative sample of COVID-NET patients



Weekly Population-Based Rates of COVID-19-Associated Hospitalizations — COVID-NET, March 2020–August 26, 2023



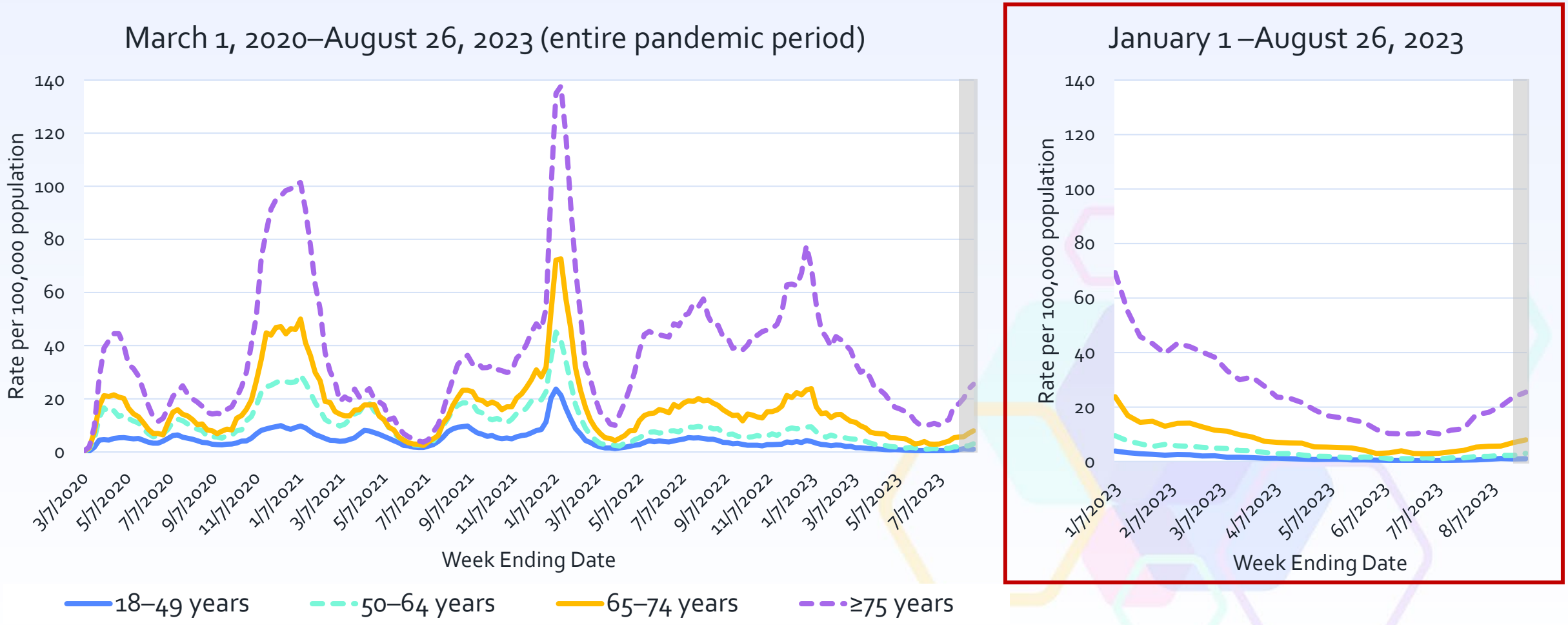


Rates highest in ≥75 years, followed by infants <6 months and adults 65–74 years

Gray boxes indicate potential reporting delays. Interpretation of trends should be excluded from these weeks.

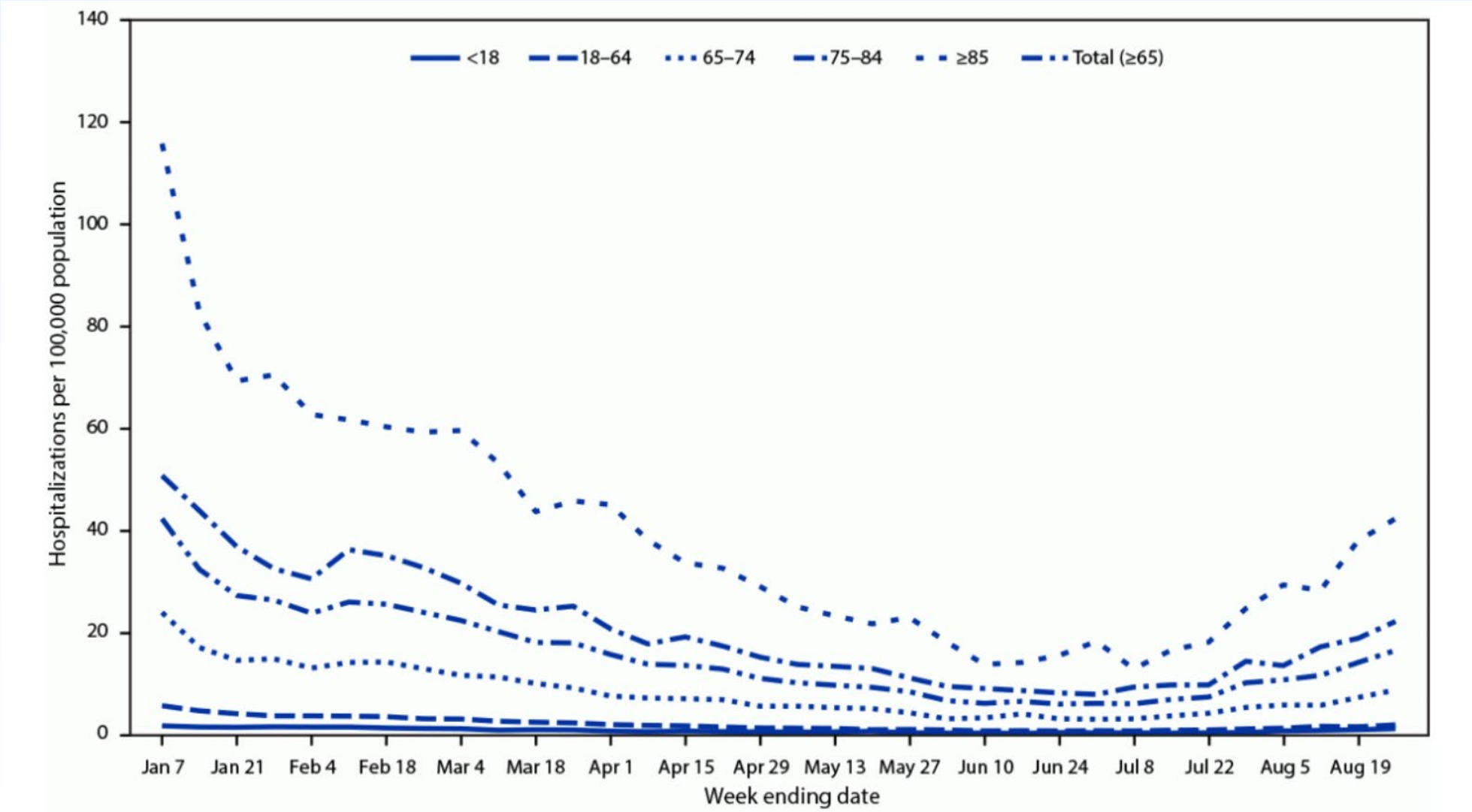
Epidemiology of COVID-19–associated hospitalizations among adults

Weekly Population-Based Rates of COVID-19-Associated Hospitalizations among Adults Ages ≥18 Years — COVID-NET, March 2020–August 2023



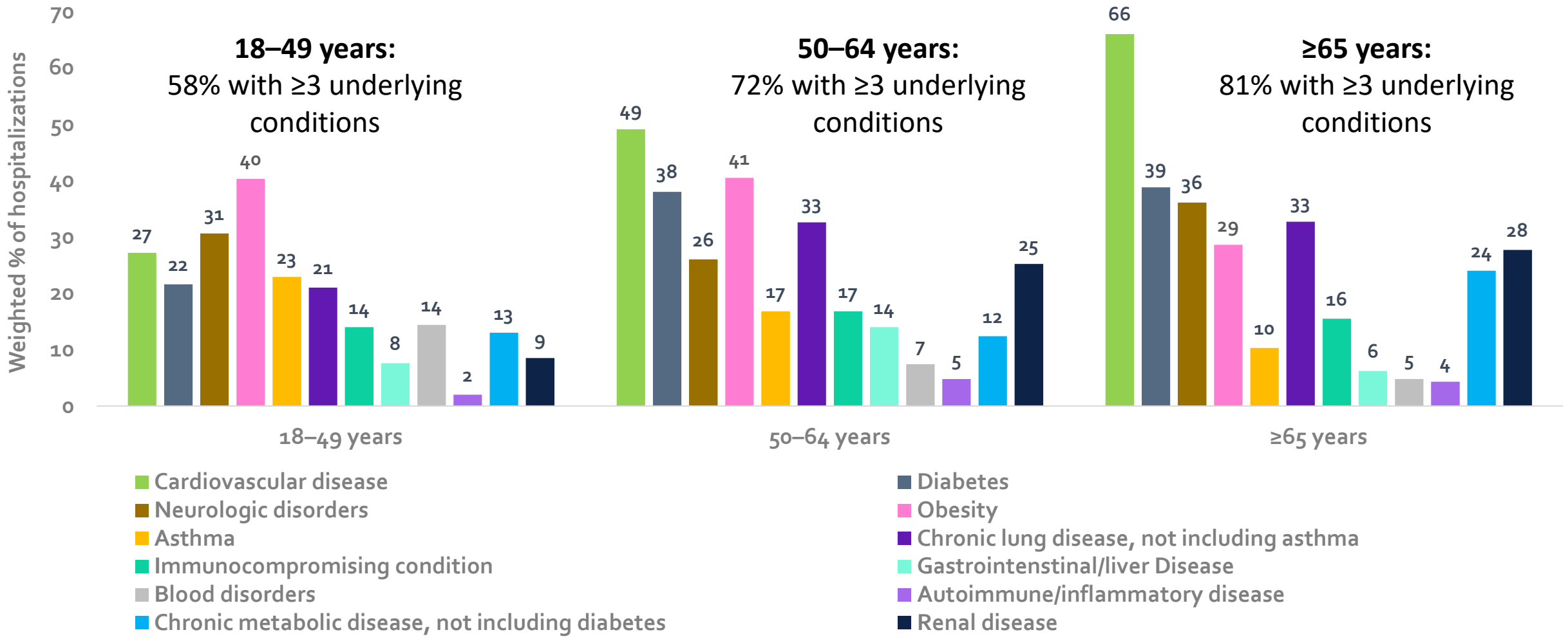
Gray boxes indicate potential reporting delays. Interpretation of trends should be excluded from these weeks.

COVID-19–Associated Hospitalizations Among U.S. Adults Aged ≥65 Years — COVID-NET, 13 States, January–August 2023



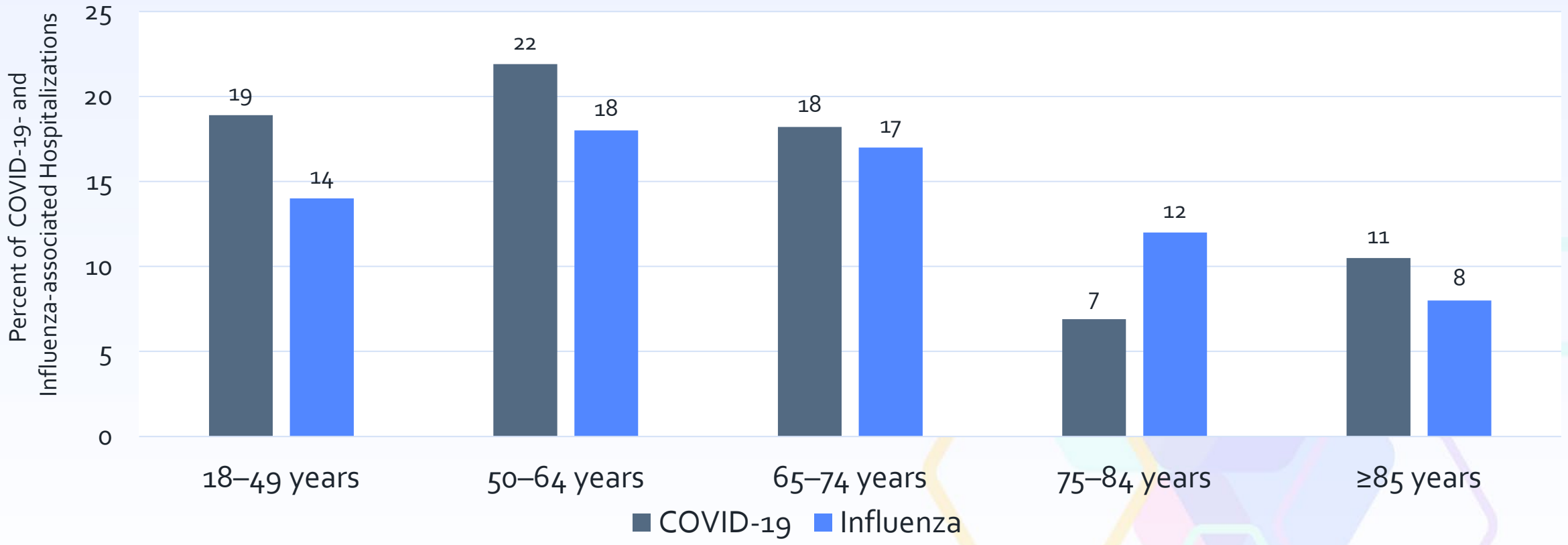
https://www.cdc.gov/mmwr/volumes/72/wr/mm7240a3.htm

Underlying Medical Conditions among Adults Ages ≥18 Years Hospitalized for COVID-19, by Age Group — COVID-NET, January–June 2023



Data are limited to hospitalizations where COVID-19 is a likely primary reason for admission.

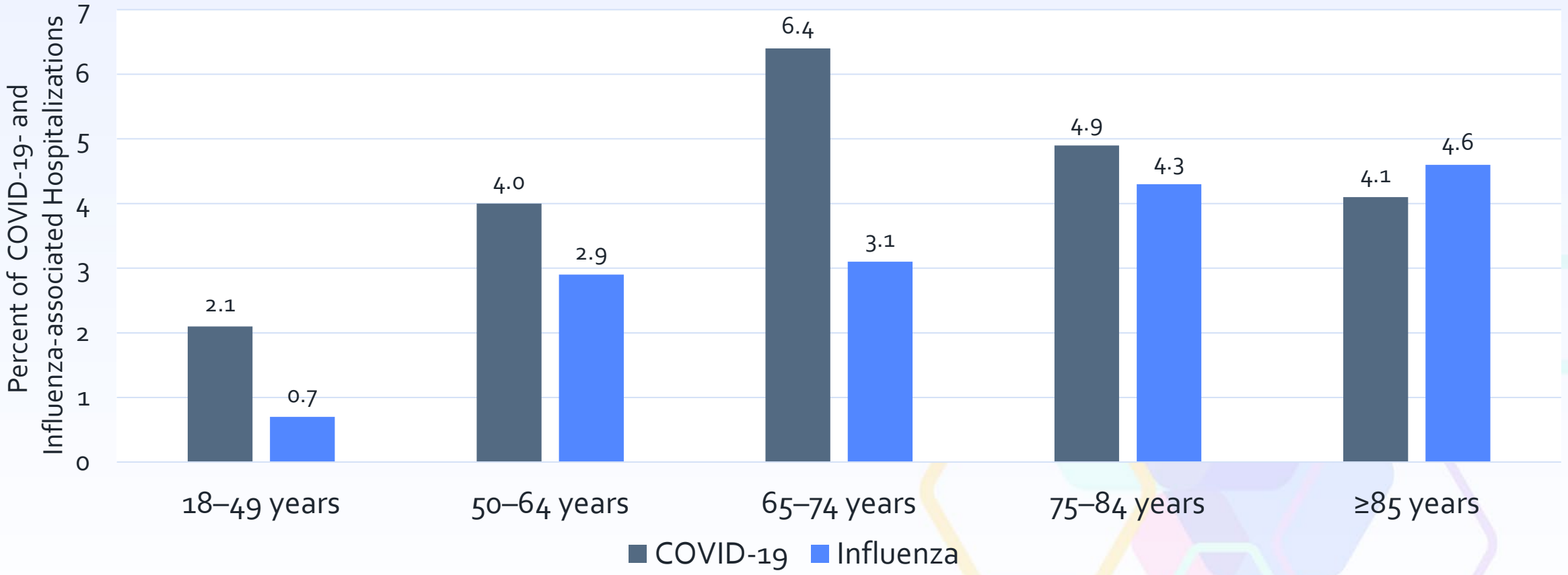
Percent of COVID-19- and Influenza-Associated Hospitalizations with ICU admission among Adults by Age Group — COVID-NET and FluSurv-NET*, 13 States, October 2022–April 2023



- *Influenza Hospitalization Surveillance Network*

Limited to COVID-NET hospitalizations with COVID-19-related illness as likely reason for admission

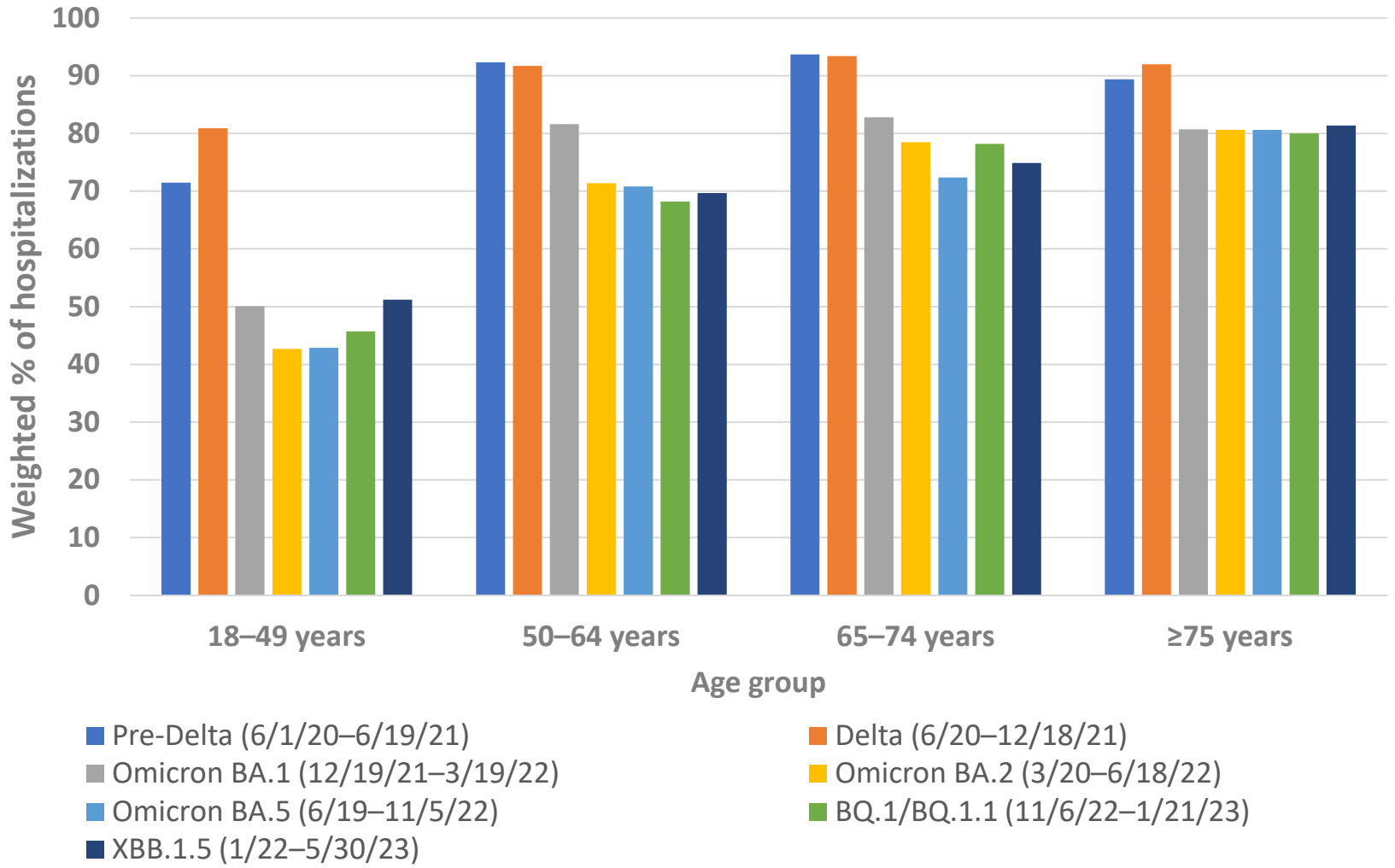
Percent of COVID-19- and Influenza-Associated Hospitalizations with in-hospital death among Adults by Age Group — COVID-NET and FluSurv-NET*, 13 States, October 2022–April 2023



- *Influenza Hospitalization Surveillance Network*

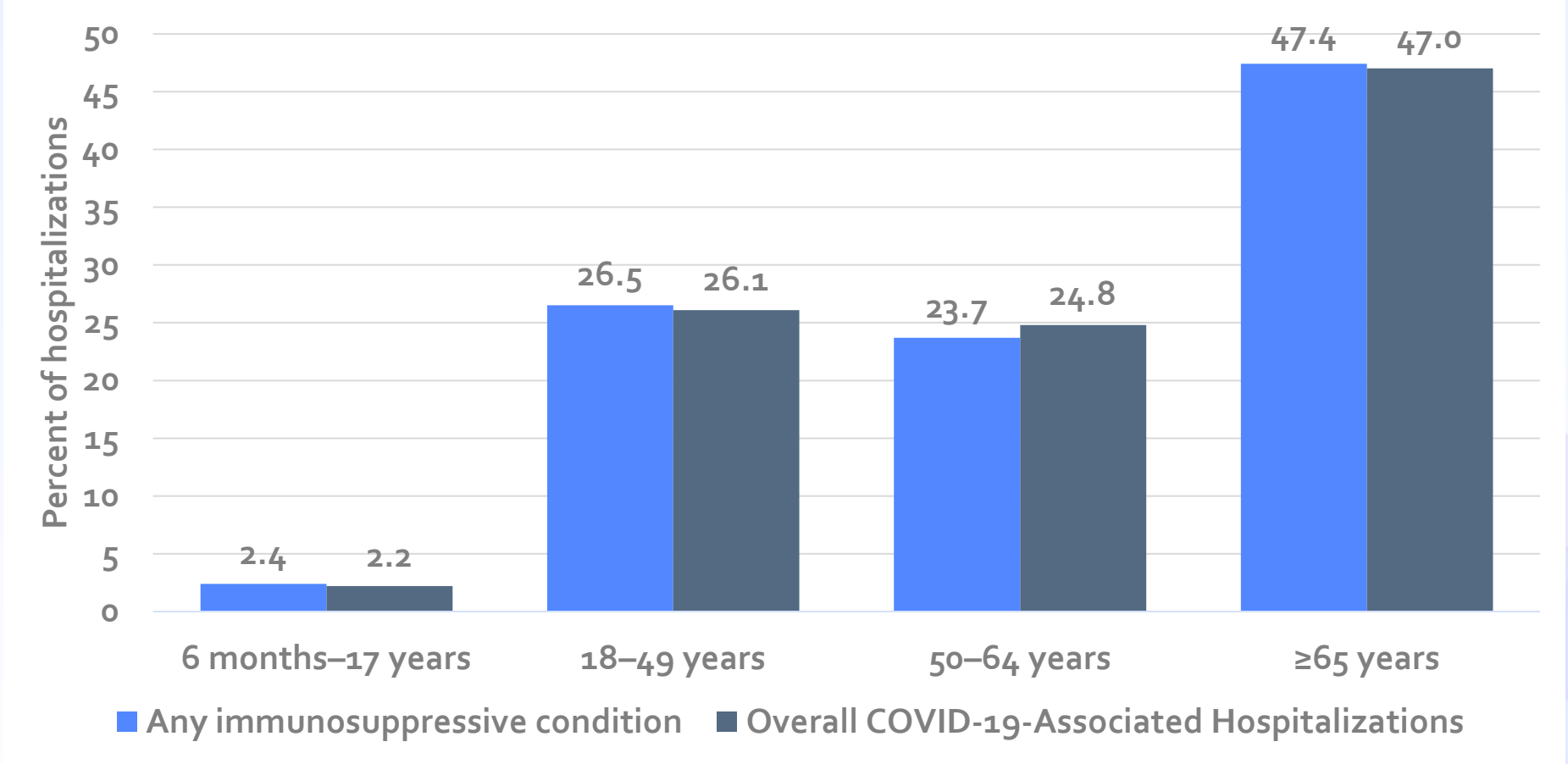
Limited to COVID-NET hospitalizations with COVID-19-related illness as likely reason for admission

Proportions of COVID-19-Associated Hospitalizations with COVID-19 as a Likely Reason for Admission among Adults, by Age and Variant Predominance Period — COVID-NET, June 2020–May 2023



The percent of COVID-19-associated hospitalizations with COVID-19 as the likely primary reason for admission increases with age.

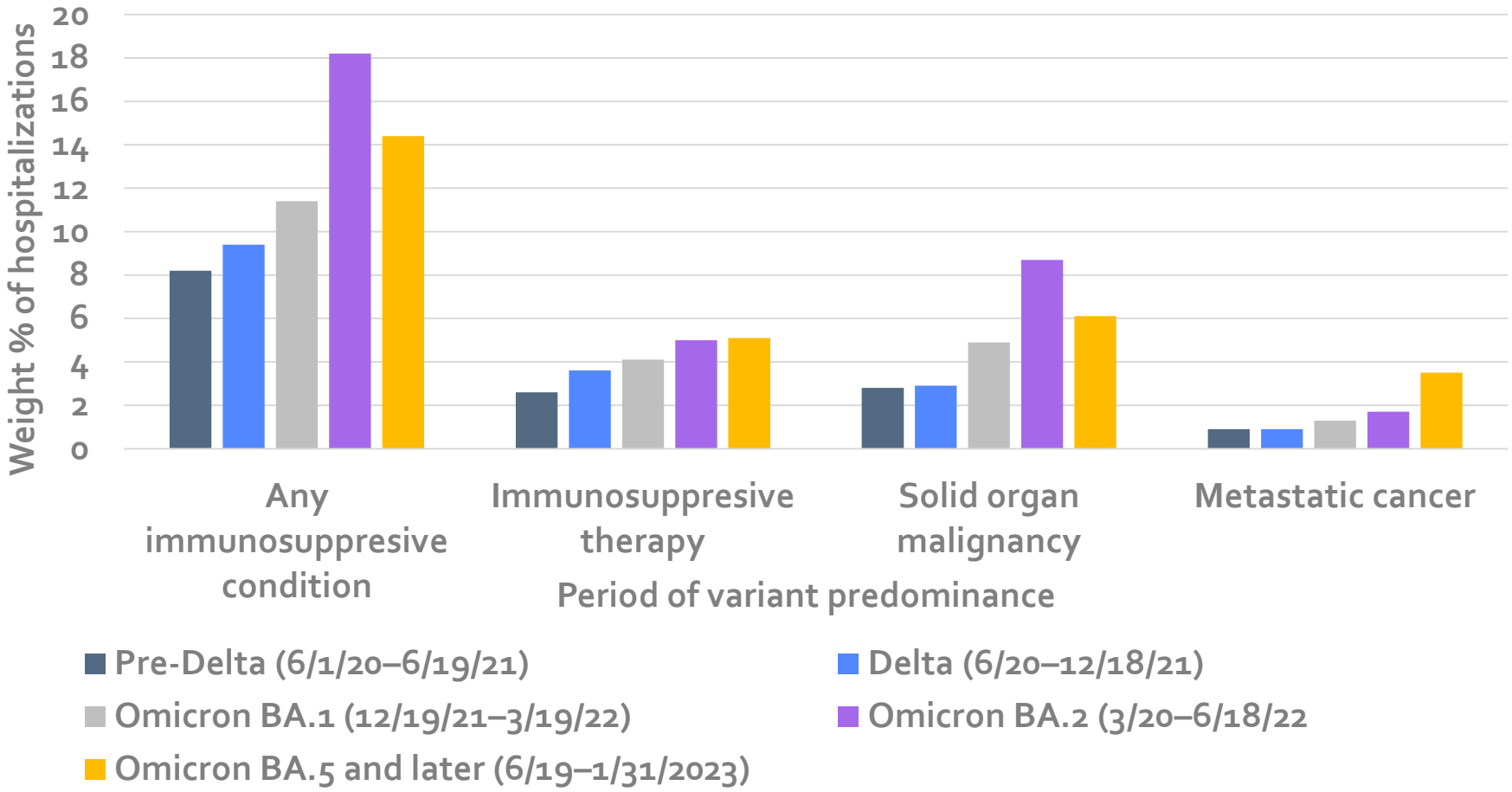
Proportion of COVID-19-Associated Hospitalizations with Immunocompromising Conditions and Overall by Age Group — COVID-NET, March 2020–January 2023



The age distribution of persons with immunosuppressive conditions matches that of all COVID-19-associated hospitalizations

Immunosuppressive conditions include: AIDS or CD4 count <200; complement deficiency, graft vs host disease, HIV infection, immunoglobulin deficiency/immunodeficiency, immunosuppressive therapy, leukemia, lymphoma/Hodgkin's or non-Hodgkin's lymphoma, metastatic cancer, multiple myeloma, solid organ malignancy, steroid therapy, stem cell/bone marrow transplant, and history of solid organ transplant.

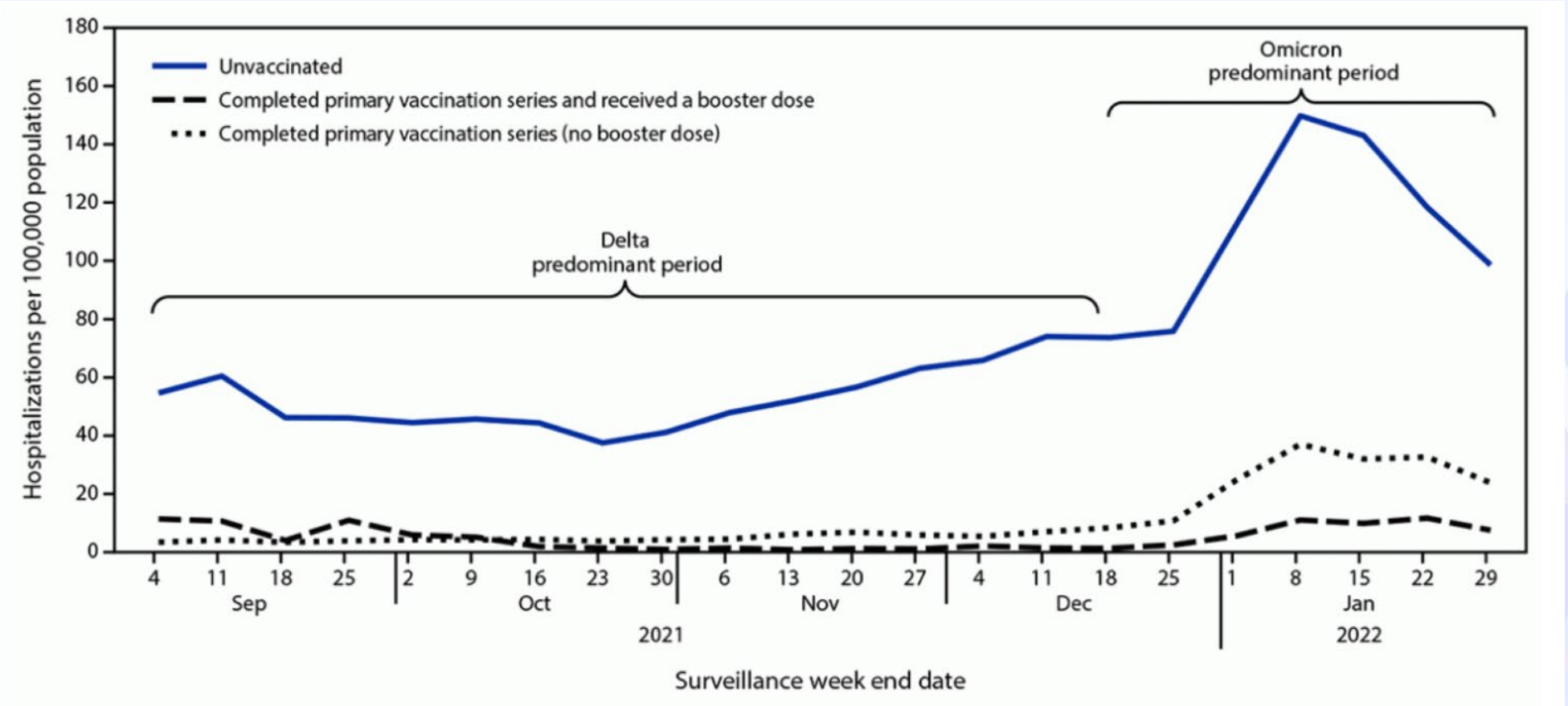
Proportions of COVID-19-Associated Hospitalizations with Immunocompromising Conditions by Variant Predominance Period — COVID-NET, June 2020–January 2023



The proportion of persons with immunosuppressive conditions comprising COVID-19-associated hospitalizations has increased over time

Immunosuppressive conditions include: AIDS or CD4 count <200; complement deficiency, graft vs host disease, HIV infection, immunoglobulin deficiency/immunodeficiency, immunosuppressive therapy, leukemia, lymphoma/Hodgkin's or non-Hodgkin's lymphoma, metastatic cancer, multiple myeloma, solid organ malignancy, steroid therapy, stem cell/bone marrow transplant, and history of solid organ transplant.

Weekly age-adjusted rates of COVID-19–associated hospitalizations among adults aged ≥18 years, by vaccination status, September 4, 2021–January 29, 2022



Unvaccinated adults were 12 times more likely to be hospitalized than those who received the primary series with an additional dose

Taylor et al. COVID-19–Associated Hospitalizations Among Adults During SARS-CoV-2 Delta and Omicron Variant Predominance, by Race/Ethnicity and Vaccination Status — COVID-NET, 14 States, July 2021–January 2022. MMWR; 2022: 71(12);466–473

COVID-19-associated hospitalizations

- Hospitalization rates increased in all age groups since mid-July
- Hospitalization rates highest in older adults > 65 years and infants <6 months
- Most hospitalized adults have multiple underlying medical conditions
- COVID-19 continues to cause severe illness; clinical outcomes generally comparable to influenza-associated hospitalizations
- Most adults hospitalized for COVID-19 since January 2023 had not received an updated bivalent booster
- Hospitalizations have decreased in Omicron era compared with Delta and pre-Delta
- The proportion of hospitalized adults with immunocompromising conditions has increased over time.

Acknowledgements

Coronavirus and Other Respiratory Viruses Division

Fiona Havers

Chris Taylor

Kadam Patel

Meredith McMorrow

Influenza Division

Shikha Garg

Catherine Bozio

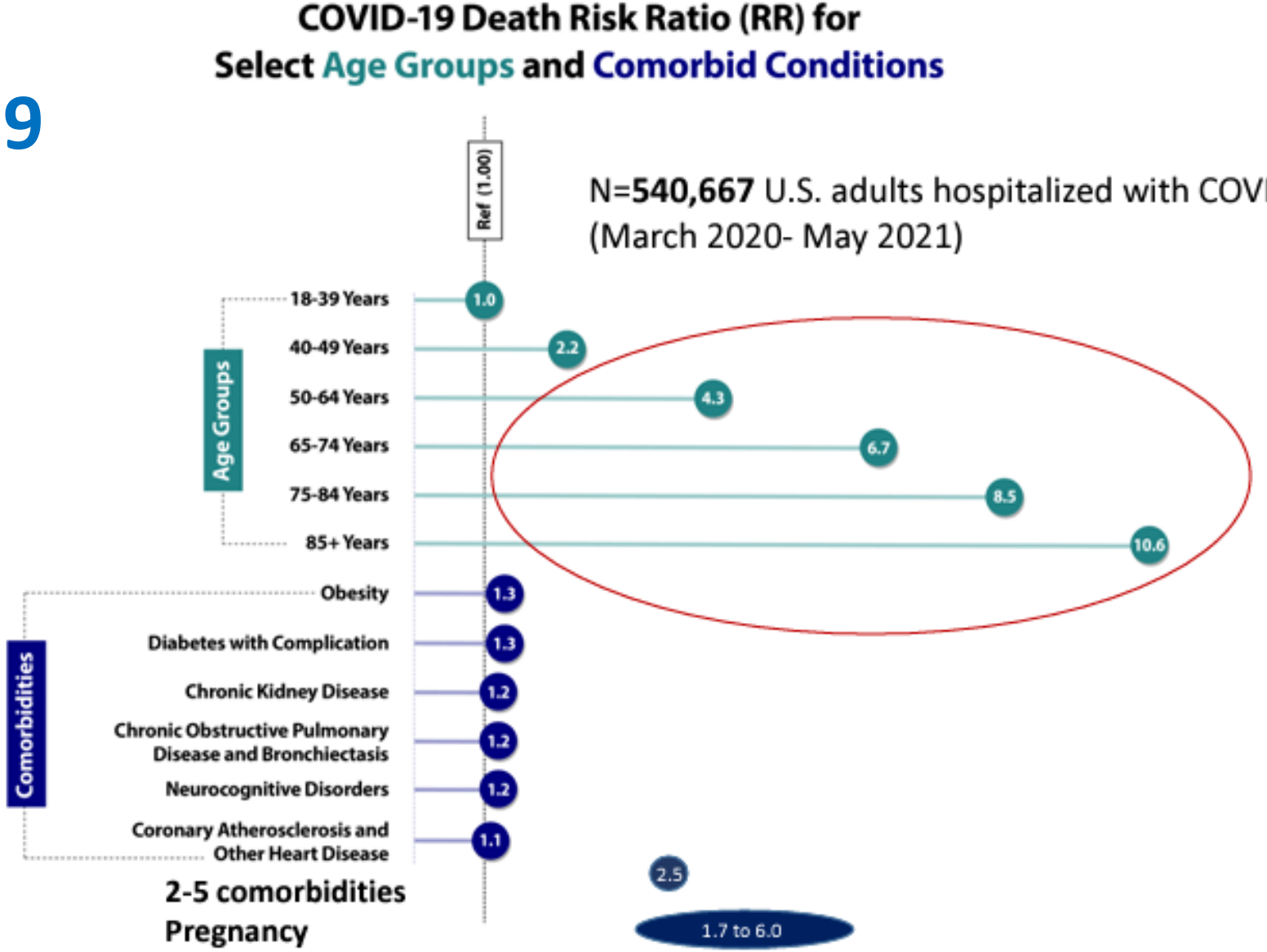
Alissa O'Halloran

Dawud Ujamaa

RESP-NET Site investigators and staff

Risk Factors for Severe COVID-19

Risk factors for Severe COVID-19



Adapted from: Kompaniyets L, et al., https://www.cdc.gov/pcd/issues/2021/pdf/21_0123.pdf; *BMJ* 2020;370:m3320; Zambrano LD, et al, MMWR Morb Mortal Wkly Rep. 2020;69(44):1641. Epub 2020 Nov 6; https://www.fhi.no/en/publ/2022/COVID-19-Omicron-variant-and-risk-factors-for-severe-disease/

Who is at High Risk of Severe Disease?

Tier	NIH Categories for Prioritization	Risk/Evidence	CDC Categories
1	• **Immunocompromised individuals** not expected to mount an adequate immune response to COVID-19 vaccination or SARS-CoV-2 infection due to their underlying conditions, regardless of vaccine status (see Immunocompromising Conditions below); or • **Unvaccinated individuals at the highest risk of severe disease** (anyone aged ≥75 years or anyone aged ≥65 years with additional risk factors).	Highest (systematic review)	• Unvaccinated persons • 65 years and older • One or more of the following conditions: asthma. cerebrovascular disease, chronic kidney disease, chronic lung disease*, chronic liver disease†, chronic kidney disease, disabilities, obesity, diabetes type 1 and 2, cystic fibrosis, HIV, depression, dementia, schizophrenia, physical inactivity, pregnancy, hematologic malignancy, solid organ or blood stem transplant, primary immunodeficiencies, immunosuppressive medications, smoker, tuberculosis
2	• **Unvaccinated individuals not included in Tier 1** who are at risk of severe disease (anyone aged ≥65 years or anyone aged <65 years with clinical risk factors)	Suggestive High (cohort, case-control, or cross-sectional studies)	• <65 years old and one or more UC listed • One or more of the following: overweight, substance abuse, sickle cell
3	• **Vaccinated individuals at risk of severe disease** (anyone aged ≥65 years or anyone aged <65 years with clinical risk factors)	Inconclusive (one study or several small studies)	• Alpha 1 antitrypsin deficiency, bronchopulmonary dysplasia, hepatitis B, Hepatitis C, hypertension, thalassemia

*Bronchiectasis, COPD (Chronic obstructive pulmonary disease), interstitial lung disease, pulmonary embolism, pulmonary hypertension
†Cirrhosis, non-alcoholic fatty liver disease, alcoholic liver disease, autoimmune hepatitis

PLOS ONE

Population risk factors for severe disease and mortality in COVID-19: A global systematic review and meta-analysis

- 76 studies with 17.86 million patients across 14 countries
- Factors associated with severe disease:
  - Age >75 years old (OR: 2.65, 95% CI: 1.81–3.90) important risk factor
  - Males had higher risk compared to females (OR: 2.05, 95% CI: 1.39–3.04)
  - Severely obese individuals were at higher risk compared to non-severely obese individuals (OR: 2.57, 95% CI: 1.31–5.05)
  - Active cancer (OR: 1.46, 95% CI: 1.04–2.04) was associated with increased risk of severe outcome.
  - Diabetes (OR: 1.99, 95% CI: 0.92–4.29), Hypertension (OR: 1.33, 95% CI: 0.99–1.80), and CKD (OR: 1.27, 95% CI: 0.70–2.29) showed no significant elevated risk.
- When considering mortality as the outcome, the risk associated with age >75 is elevated further (OR: 5.57, 95% CI: 3.10–10.00)

Booth et al. Population risk factors for severe disease and mortality in COVID-19. PLoS ONE. 2021

THE LANCET Regional Health Americas

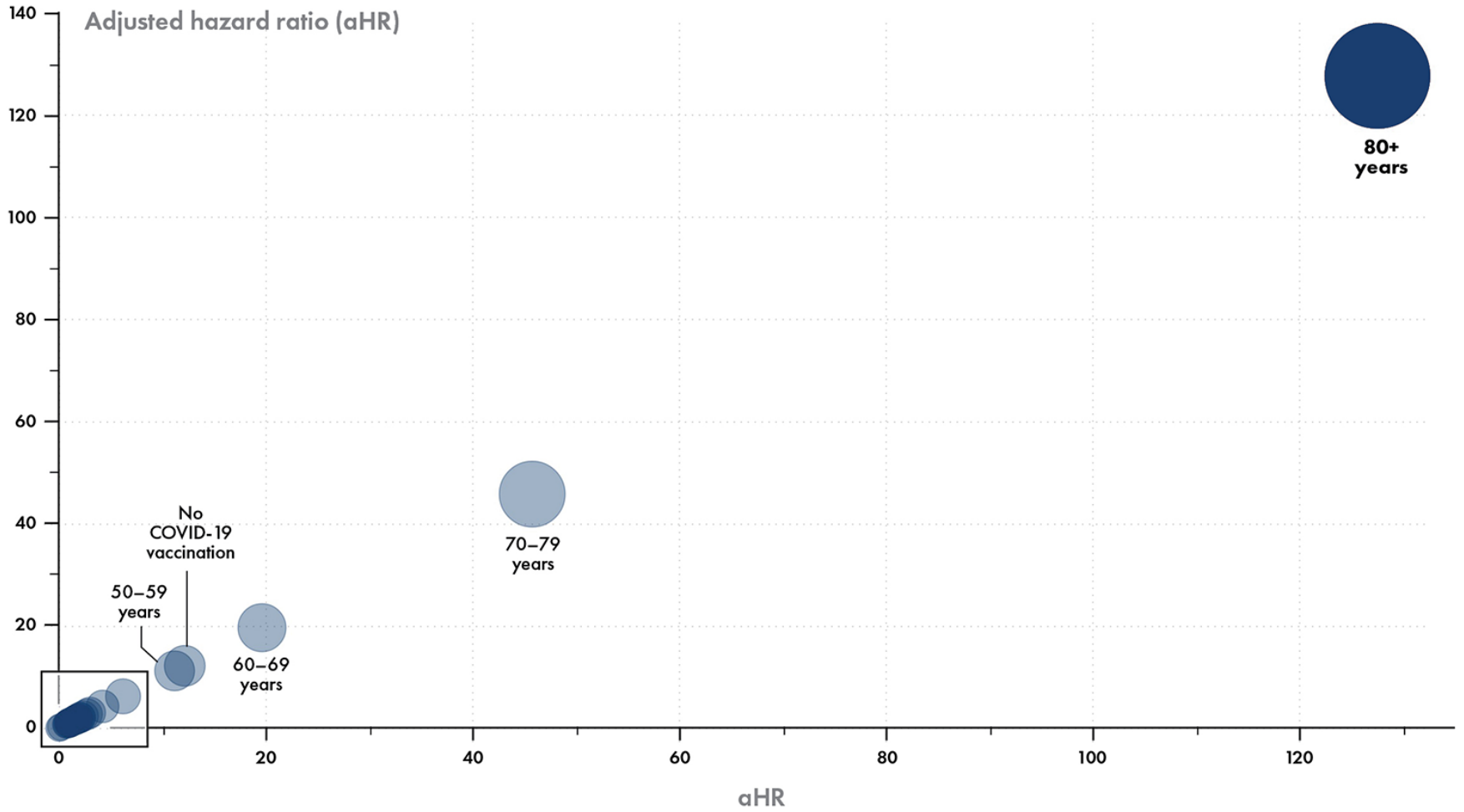
Risk of severe clinical outcomes among persons with SARS-CoV-2 infection with differing levels of vaccination during widespread Omicron (B.1.1.529) and Delta (B.1.617.2) variant circulation in Northern California: A retrospective cohort study

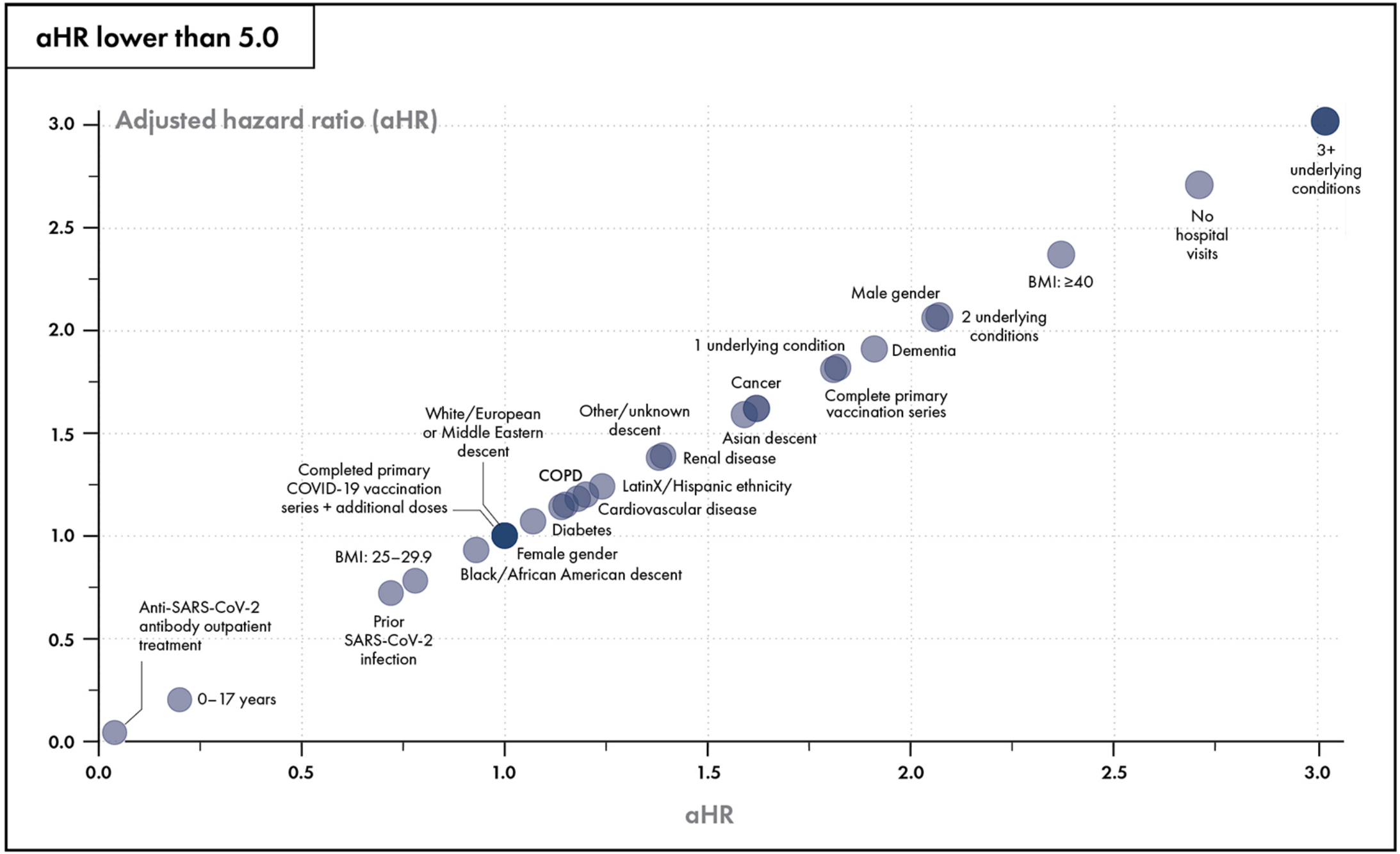
- The strongest risk factors for all severe clinical outcomes were
  - older age (aHR = 10.99 (95% CI: 9.75, 12.39),
  - higher body mass index [≥ 40] (aHR = 2.75 (95% CI: 2.32, 2.78),
  - select comorbidities such as diabetes, atherosclerotic cardiovascular disease, renal disease and dementia
  - Increasing Charlson Score
- Vaccination status continues to reduce the risk of severe COVID-19 despite reports of immune evasion by the Omicron SARS-CoV-2 variant

Characteristic	Any Hospitalization n (%)	Any Hospitalization aHR (CI)
Age, years		
0-17	81 (0.4%)	0.12 (0.1, 0.16)
18-39	1,253 (2.9%)	1.0
40-49	924 (4.7%)	1.61 (1.48, 1.76)
50-59	1,184 (7.4%)	2.67 (2.46, 2.9)
60-69	1,225 (11.5%)	3.94 (3.6, 4.3)
70-79	1,003 (20.2%)	5.86 (5.27, 6.52)
80+	954 (40.9%)	10.99 (9.75, 12.39)

Skarbinski et al. The Lancet Regional Health – Americas 2022;12: 100297. Published online 16 June 2022 https://doi.org/10.1016/j.lana.2022.100297

Factors associated with severe clinical outcomes among persons with SARS-CoV-2 infection in Northern California, December 18, 2021 –January 7, 2022




aHR lower than 5.0
Adjusted hazard ratio (aHR)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
aHR
3+ underlying conditions
No hospital visits
BMI: ≥40
Male gender
2 underlying conditions
1 underlying condition
Dementia
Cancer
Complete primary vaccination series
Asian descent
White/European or Middle Eastern descent
Other/unknown descent
Renal disease
Completed primary COVID-19 vaccination series + additional doses
COPD
LatinX/Hispanic ethnicity
Cardiovascular disease
Diabetes
Female gender
BMI: 25–29.9
Black/African American descent
Anti-SARS-CoV-2 antibody outpatient treatment
Prior SARS-CoV-2 infection
0–17 years

JAMA Network | Open

Original Investigation | Infectious Diseases

Factors Associated With Severe COVID-19 Among Vaccinated Adults Treated in US Veterans Affairs Hospitals

- Among 110 760 patients with infections following vaccination, 10 612 (9.6%) had severe COVID-19.
- The strongest association with risk of severe disease after vaccination was age
  - increased among patients aged 50 years or older with an adjusted odds ratio (aOR) of 1.42 (CI, 1.40-1.44) per 5-year increase in age
  - patients aged 80 years or older had an aOR of 16.58 (CI, 13.49-20.37) relative to patients aged 45 to 50 years
- Immunocompromising conditions, including receipt of different classes of immunosuppressive medications
- Chronic conditions associated with end-organ disease, such as
  - heart failure (aOR, 1.74; CI, 1.61-1.88),
  - dementia (aOR, 2.01; CI, 1.83-2.20), and
  - chronic kidney disease (aOR, 1.59; CI, 1.49-1.69)

JAMA Internal Medicine | Original Investigation

Risk Factors Associated With Post–COVID-19 Condition
A Systematic Review and Meta-analysis

Vasiliki Tsampasian, MD, MSc; Hussein Elghazaly, MBBS; Rahul Chattopadhyay, MBBS, MSc; Maciej Debski, MD, PhD; Thin Kyi Phyu Naing, MBBS; Pankaj Garg, PhD; Allan Clark, PhD; Eleana Ntatsaki, MD(Res), MA; Vassilios S. Vassiliou, MBBS, PhD

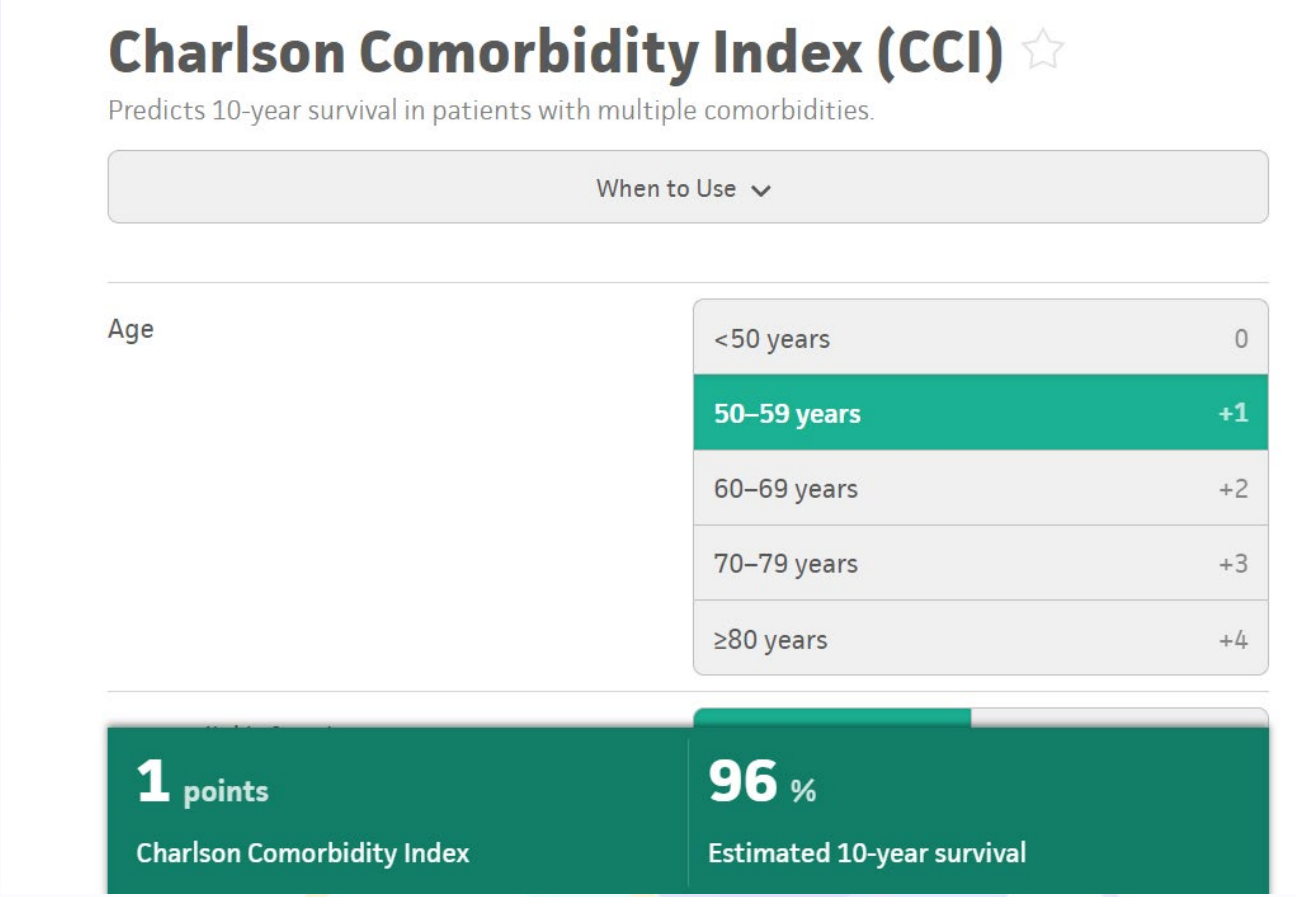
- 41 articles and a total of 860,783 patients that were included
- Increased risk for developing PCC included:
  - Female sex (OR=1.56; 95%CI,1.41-1.73), age (OR=1.21; 95%CI,1.11-1.33), high BMI or obesity (OR=1.15; 95%CI,1.08-1.23), and smoking (OR=1.10; 95% CI,1.07-1.13)
- High risk of PCC was associated with presence of comorbidities and previous hospitalization or ICU admission (OR=2.48; 95%CI,1.97-3.13 and OR=2.37; 95%CI,2.18-2.56,respectively)
  - Comorbidities included anxiety and/or depression (OR, 1.19; 95% CI, 1.02-1.40), asthma (OR, 1.24; 95% CI, 1.15-1.35), chronic kidney disease (OR, 1.12; 95% CI, 0.98 -1.28), chronic obstructive pulmonary disease (OR, 1.38; 95% CI, 1.08 -1.78), diabetes (OR, 1.38; 95% CI, 1.08 to 1.78), immunosuppression (OR, 1.50; 95% CI, 1.05-2.15), and ischemic heart disease (OR, 1.28; 95% CI, 1.19-1.38)
- Patients who had been vaccinated against COVID-19 with 2 doses had a significantly lower risk of developing PCC compared with patients who were not vaccinated (OR=0.57; 95%CI,0.43-0.76)

https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2802877

Charlson Comorbidity Index

Estimates 10-year survival in patients with multiple co-morbidities

- Age
- Cardiovascular disease
- Cerebrovascular disease
- Diabetes
- Dementia
- Chronic kidney disease
- Chronic liver disease
- Solid tumor
- Leukemia
- Lymphoma
- AIDS
- Connective tissue disease
- Peptic ulcer disease



https://www.mdcalc.com/calc/3917/charlson-comorbidity-index-cci

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

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National Center for Immunization and Respiratory Diseases