# Supplemental Online Content

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This supplemental material has been provided by the authors to give readers additional information about their work.

**Statistical supplement: COVID-19-associated hospitalizations among vaccinated and unvaccinated adults aged ≥18 years – COVID-NET, 13 states, January 1, 2021 – April 30, 2022**

***COVID-NET Sampling/Weighting Methodology***

COVID-NET surveillance sites transmit a minimum dataset required for cases to be included in surveillance (county, age, sex, race/ethnicity, hospital admission date, and SARS-CoV-2 testing data results) on all identified cases to CDC on a weekly basis. Since the minimum data elements of site, age, and hospital admission date were known for all cases upon first report to CDC, these fields were used to stratify cases for sampling. Sampling periods were selected since sampling needed to occur on a near-real-time basis. For each sampling period, sample sizes were calculated for the entire surveillance network to achieve desired precision around clinical estimates of interest. Approaches were developed to divide the resulting necessary sample size among the 14 surveillance sites. Sites drew random samples of cases based on CDC specifications, conducted medical chart abstractions on sampled cases, and transmitted data to CDC. CDC weighted the data to reflect the sample design.

Clinical data were weighted to reflect the probability of selection and adjusted for non-response if case report forms were not completed for a given sampled case. Data were raked, as described below. This process aims to align the weighted case distribution in COVID-NET by site, age, sex, and race/ethnicity with the COVID-NET catchment population totals. Since weight adjustments yielded more dispersed weights, weights were trimmed [1] to minimize overdispersion. The full weighting process is described below:

1. *Imputation:* About 2% of sampled cases were missing race/ethnicity and 0.1% were missing sex. Both fields were used in raking procedures, so data were imputed for cases missing either field using hot deck imputation where site, age group, and admission month were used to select imputation donors.[2]
2. *Base weight*: The base weight was calculated as the total number of COVID-NET cases divided by the number of sampled cases in each sampling period, by site and age group.
3. *Non-response adjustment:* Non-response adjustment factors were calculated as the total number of sampled cases (complete and incomplete) divided by the number of completed sampled cases during each period. Factors were stratified by site and age group, and the non-

response adjusted weight was the product of the base weight and the nonresponse adjustment factor.

4. *First raking:* A SAS macro[1]was used to rake the non-response adjusted weights to known population totals.
    a. Four raking dimensions were used, listed in order below:
        1. Site by individual month
        2. Race/ethnicity by individual month
        3. Sex by individual month
        4. Age group by individual month
5. *Weight trimming:* Weight trimming was applied to the raked weights, where $W_{Fi}$ is the final weight for the $i$-th case in the $F$-th strata, $m_F$ is the median and $\sigma_F$ is the interquartile range of the weights.
    a. $W_{Fi} = \begin{cases} m_F + 2.9\sigma_F & \text{, if } W_{Fi} \geq m_F + 3\sigma_F \\ max(1, m_F - 3\sigma_F) & \text{, if } W_{Fi} \leq max(1, m_F - 3\sigma_F) \\ W_{Fi} & W_{Fi} \quad \text{, otherwise,} \end{cases}$
6. *Second raking:* A second round of raking was applied to adjust the trimmed weights to sum to the population totals, using the same dimensions above. The final sample weight was obtained after iterating these dimensions to convergence.

***Vaccination definitions, weighting of cases with known vaccination status***

Vaccinated cases were defined as having received a second dose of a 2-dose series or one dose of a single-dose series ≥14 days before a positive SARS-CoV-2 test, regardless of booster dose status. If the SARS-CoV-2 test date was not available, hospital admission date was used. Patients who had received at least one dose of vaccine but had not completed a primary vaccination series were excluded from this analysis.

Vaccination status for hospitalized cases and vaccine coverage for the underlying catchment area were determined by state immunization information system (IIS) data, as previously described.[3] COVID-19 vaccination status (doses, dates administered, and product) was determined from state IISs for all sampled COVID-NET cases. In addition to the minimum data elements required for each case, some sites opted to collect vaccine information on all cases. With this additional information, non-sampled cases are able to be included in analyses regarding vaccination data. If a site did not opt to collect vaccine

information on non-sampled cases, their original sample weight is applied and only sampled cases are included in analyses. The inclusion of non-sampled cases allows COVID-NET to retain a representative sample while allowing for much more precise estimates regarding vaccine data.

***Propensity Score Analysis***

In the analysis comparing outcomes between vaccinated and unvaccinated hospitalized patients, the main analysis was a multivariate logistic regression model that included the entire eligible sample, and adjusted for the following covariates: race/ethnicity; age category; sex; site; long-term care facility residence; and underlying medical conditions. However, to check the robustness of our results, we also accounted for potential confounding using a second method using a propensity score matched cohort.[3,4,5] The propensity score calculated for each patient estimated the probability of vaccination use based on baseline covariates, regardless of actual vaccination status. The propensity score for each individual was calculated using a multivariable logistic regression model; the dependent variable was vaccination status. The propensity score model used included the following covariates: race/ethnicity; age category; sex; site; long-term care facility residence; and underlying medical conditions, including obesity, diabetes, chronic lung disease, cardiovascular disease, neurologic disease, renal disease, immunosuppressive conditions, liver or gastrointestinal tract disease, blood disorder, and rheumatologic or autoimmune diseases.

Using the propensity score, we matched vaccinated cases with unvaccinated cases who had similar propensity scores using a 1:1 greedy matching algorithm.[3,4,5] The propensity-matched cohort selected vaccinated and unvaccinated cases who had similar baseline characteristics except for vaccination status (Supplementary Table 4). Using these propensity-matched cohorts, models for ICU status and in-hospital death used logistic regression. To account for residual confounding, the logistic regression model adjusted for the same variables used in the model that generated the propensity score.

References:

1. Izrael D, Hoaglin DC, Battaglia MP. A SAS Macro for Balancing a Weighted Sample. 2000.

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5. Karabon P. Applying Propensity Score Methods to Complex Survey Data Using PROC PSMATCH. SAS;Paper 3634-2019. https://www.sas.com/content/dam/SAS/support/en/sas-global-forum-proceedings/2019/3634-2019.pdf; accessed February 16, 2022.

**Supplementary Table 1. Categorization of Underlying Medical Conditions**[a]

| | |
|---|---|
| Chronic Lung Disease | • Active tuberculosis<br>• Asbestosis<br>• Asthma/Reactive airway disease<br>• Bronchiectasis<br>• Bronchiolitis obliterans<br>• Chronic bronchitis<br>• Chronic respiratory failure<br>• Cystic fibrosis<br>• Emphysema/Chronic Obstructive Pulmonary Disease<br>• Interstitial lung disease<br>• Obstructive sleep apnea<br>• Oxygen dependent<br>• Pulmonary fibrosis<br>• Restrictive lung disease<br>• Sarcoidosis |
| Diabetes Mellitus | |
| Other Chronic Metabolic Disease (except Diabetes Mellitus) | • Adrenal Disorders (Addison's, Adrenal Insufficiency, Cushing Syndrome, Congenital Adrenal Hyperplasia)<br>• Glycogen or other storage diseases<br>• Hyper/Hypo function of pituitary gland<br>• Inborn errors of metabolism<br>• Metabolic Syndrome<br>• Parathyroid Dysfunction (Hyperparathyroidism, Hypoparathyroidism)<br>• Thyroid dysfunction (Grave's disease, Hashimoto's Disease, Hyperthyroidism, Hypothyroidism) |
| Blood Disorders/Hematologic Conditions | • Alpha thalassemia<br>• Aplastic anemia<br>• Beta thalassemia<br>• Coagulopathy (Factor V Leiden, Von Willebrand Disease)<br>• Hemoglobin S-beta thalassemia<br>• Leukopenia<br>• Myelodysplastic syndrome<br>• Neutropenia<br>• Pancytopenia<br>• Polycythemia vera<br>• Sickle cell disease<br>• Splenectomy/Asplenia<br>• Thrombocytopenia |
| Cardiovascular Disease (except hypertension) | • Aortic aneurysm, history of<br>• Aortic/Mitral/Tricuspid/Pulmonic valve replacement, history of<br>• Aortic regurgitation<br>• Aortic stenosis<br>• Atherosclerotic cardiovascular disease<br>• Atrial fibrillation<br>• Atrioventricular blocks<br>• Automated implantable devices/Pacemaker<br>• Bundle branch block<br>• Cardiomyopathy |

| | |
|---|---|
| | • Carotid stenosis<br>• Cerebral vascular accident/Incident/Stroke, history of<br>• Congenital heart disease<br>• Coronary artery bypass grafting, history of<br>• Coronary artery disease<br>• Deep vein thrombosis, history of<br>• Heart failure/congestive heart failure<br>• Myocardial infarction, history of<br>• Mitral regurgitation<br>• Mitral stenosis<br>• Peripheral artery disease<br>• Peripheral vascular disease<br>• Pulmonary embolism, history of<br>• Pulmonary hypertension<br>• Pulmonic regurgitation<br>• Pulmonic stenosis<br>• Transient ischemic attack, history of<br>• Tricuspid regurgitation<br>• Tricuspid stenosis<br>• Ventricular fibrillation, history of<br>• Ventricular tachycardia, history of |
| Hypertension | |
| Neurologic Disorder | • Amyotrophic lateral sclerosis<br>• Cerebral palsy<br>• Cognitive dysfunction<br>• Dementia/Alzheimer's disease<br>• Developmental delay<br>• Down syndrome/Trisomy 21<br>• Edward's syndrome/Trisomy 18<br>• Epilepsy/seizure/seizure disorder<br>• Mitochondrial disorder<br>• Multiple sclerosis<br>• Muscular dystrophy<br>• Myasthenia gravis<br>• Neural tube defects/Spina bifida<br>• Neuropathy<br>• Parkinson's disease<br>• Plegias/Paralysis/Quadriplegia<br>• Scoliosis/Kyphoscoliosis<br>• Traumatic brain injury, history of |
| History of Guillain-Barre Syndrome | |
| Immunocompromised Conditions | • AIDS or CD4 count <200<br>• Complement deficiency<br>• Graft vs. host disease<br>• HIV Infection<br>• Immunoglobulin deficiency/Immunodeficiency<br>• Immunosuppressive therapy (within the last 12 months prior to admission)<br>• Leukemia[b]<br>• Lymphoma/Hodgkins/Non-Hodgkins[b] |

| | |
|---|---|
| | • Metastatic cancer[b]<br>• Multiple myeloma[b]<br>• Solid organ malignancy[b]<br>• Steroid therapy (within 2 weeks of admission)<br>• Transplant, hematopoietic stem cell (Bone marrow transplant, peripheral stem cell transplant), history of<br>• Transplant, solid organ, history of |
| Renal Disease | • Chronic kidney disease/chronic renal insufficiency<br>• Dialysis<br>• End stage renal disease<br>• Glomerulonephritis<br>• Nephrotic syndrome<br>• Polycystic kidney disease |
| Gastrointestinal/Liver Disease | • Alcoholic hepatitis<br>• Autoimmune hepatitis<br>• Barrett's esophagitis<br>• Chronic liver disease<br>• Chronic pancreatitis<br>• Cirrhosis/End stage liver disease<br>• Crohn's disease<br>• Esophageal varices<br>• Esophageal strictures<br>• Hepatitis B, chronic<br>• Hepatitis C, chronic<br>• Non-alcoholic fatty liver disease/Non-alcoholic steatohepatitis<br>• Ulcerative colitis |
| Rheumatologic/Autoimmune Conditions | • Ankylosing spondylitis<br>• Dermatomyositis<br>• Juvenile idiopathic arthritis<br>• Kawasaki disease<br>• Microscopic polyangiitis<br>• Polyarteritis nodosum<br>• Polymyalgia rheumatica<br>• Polymyositis<br>• Psoriatic arthritis<br>• Rheumatoid arthritis<br>• Systemic Lupus Erythematosus/Lupus<br>• Systemic sclerosis<br>• Takayasu arteritis<br>• Temporal/Giant Cell arteritis<br>• Vasculitis, other |
| Other, specify | • Post-partum (2 weeks or less)<br>• Feeding tube dependent<br>• Tracheostomy dependent/ventilator dependent<br>• Wheelchair dependent<br>• Free text field for other underlying medical conditions that were not specified above |

[a]Underlying medical conditions were selected before hospitalization surveillance began.

[b]Current/in treatment or diagnosed in previous 12 months

**Supplementary Table 2. Demographics of a representative sample of hospitalized adults aged ≥18 years with laboratory-confirmed COVID-19-associated hospitalization admitted January 1, 2021–April 30, 2022, by vaccination status — COVID-NET, 13 States**[a]

| Characteristics | Adults ≥18 years | Unvaccinated n (weighted %) [b] | Partially vaccinated, n (weighted %) [b,c] | Vaccinated with a primary series without a booster dose n (weighted %) [b] | Vaccinated with a booster dose [b] |
|---|---|---|---|---|---|
| **Total**[d] | **146,658** | **98,244 (69.3)** | **9,062 (6.2)** | **30,556 (19.1)** | **8,796 (5.4)** |
| **Age group** (median, IQR) | 60 (45-73) | 57 (42-69) | 65 (53-77) | 67 (53-78) | 72 (59-81) |
| 18–49 years | 44,716 | 35,354 (80.7) | 2,116 (4.3) | 6,022 (12.4) | 1,224 (2.6) |
| 50–64 years | 40,115 | 28,636 (74.2) | 2,537 (5.9) | 7,257 (16.2) | 1,685 (3.7) |
| 65–74 years | 27,841 | 17,149 (63.3) | 1,810 (7.1) | 6,819 (23.2) | 2,063 (6.4) |
| 75–84 years | 21,269 | 11,144 (54.9) | 1,568 (7.3) | 6,353 (28.1) | 2,204 (9.7) |
| ≥85 years | 12,717 | 5,961 (50.6) | 1,031 (9.8) | 4,105 (28.3) | 1,620 (11.2) |
| **Sex** | | | | | |
| Male | 72,443 | 48,561 (69.4) | 4,511 (6.3) | 14,987 (18.9) | 4,384 (5.3) |
| Female | 74,215 | 49,683 (69.2) | 4,551 (6.0) | 15,569 (19.4) | 4,412 (5.4) |
| **Race and Ethnicity**[e] | | | | | |
| White | 73,135 | 45,888 (64.9) | 4,504 (6.1) | 17,194 (22.0) | 5,549 (7.0) |
| Black | 33,584 | 24,166 (76.3) | 2,288 (6.4) | 5,972 (14.7) | 1,158 (2.6) |
| Hispanic or Latino | 21,937 | 16,174 (74.5) | 1,216 (6.0) | 3,660 (15.8) | 887 (3.8) |
| American Indian or Alaska Native | 1,941 | 1,363 (66.7) | 150 (8.7) | 338 (20.4) | 90 (4.2) |
| Asian or Pacific Islander | 5,837 | 3,632 (65.2) | 392 (7.4) | 1,295 (20.4) | 518 (6.9) |
| Other/Unknown[f] | 10,027 | 6,884 (69.6) | 504 (4.9) | 2,061 (20.0) | 578 (5.5) |
| **Month of admission** | | | | | |
| January 2021 | 11,146 | 10,580 (93.9) | 564 (6.1) | 2 (0.0) | 0 (0.0) |
| February 2021 | 7,859 | 6,935 (88.9) | 863 (10.4) | 61 (0.7) | 0 (0.0) |
| March 2021 | 6,666 | 5,563 (85.3) | 895 (11.6) | 208 (3.1) | 0 (0.0) |
| April 2021 | 8,029 | 6,483 (81.3) | 1,144 (13.4) | 402 (5.3) | 0 (0.0) |
| May 2021 | 5,237 | 4,269 (80.9) | 480 (9.7) | 488 (9.4) | 0 (0.0) |

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|---|---|---|---|---|---|
| June 2021 | 2,307 | 1,800 (76.6) | 143 (7.0) | 364 (16.3) | 0 (0.0) |
| July 2021 | 4,481 | 3,461 (77.2) | 209 (4.4) | 811 (18.4) | 0 (0.0) |
| August 2021 | 12,101 | 9,159 (74.2) | 654 (4.8) | 2,288 (20.9) | 0 (0.0) |
| September 2021 | 10,688 | 7,727 (72.0) | 535 (4.0) | 2,400 (23.4) | 26 (0.6) |
| October 2021 | 10,258 | 6,795 (66.2) | 442 (4.1) | 2,950 (29.1) | 71 (0.6) |
| November 2021 | 10,506 | 6,952 (65.6) | 394 (3.4) | 2,963 (28.7) | 197 (2.3) |
| December 2021 | 14,686 | 9,077 (63.6) | 626 (4.0) | 4,203 (27.6) | 780 (4.8) |
| January 2022 | 27,723 | 13,693 (47.7) | 1,415 (5.2) | 9,097 (33.5) | 3,518 (13.6) |
| February 2022 | 8,721 | 3,733 (42.5) | 434 (4.7) | 2,621 (30.8) | 1,933 (22.0) |
| March 2022 | 2,932 | 1,063 (35.3) | 139 (4.8) | 799 (26.7) | 931 (33.3) |
| April 2022 | 3,318 | 954 (29.7) | 125 (3.3) | 899 (25.9) | 1,340 (41.1) |

Abbreviations: COVID-19 = coronavirus disease 2019; COVID-NET = COVID-19–Associated Hospitalization Surveillance Network; IQR = interquartile range.
[a]California, Connecticut, Colorado, Georgia, Maryland (data excluded beginning December 4, 2021), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah
[b]Percentages are weighted and represent row percentages
[c] 8,153 (6.3%) of hospitalized cases were partially vaccinated at the time of hospitalization and excluded from further analyses.
[d]318 additional cases were excluded from all analyses due to unknown vaccination status
[e]Data on race and ethnicity were categorized as follows: non-Hispanic White (White), non-Hispanic Black (Black), non-Hispanic Asian or Pacific Islander (Asian/Pacific Islander), non-Hispanic American Indian or Alaska Native (American Indian/Alaska Native) and Other/Unknown. If ethnicity was unknown (8% of cases), non-Hispanic ethnicity was assumed.
[f]Includes multiple race (615, 0.4%) and unknown race (9,412, 5%).

**Supplementary Table 3. Reason for admission by demographics and vaccination status of a representative sample of hospitalized adults aged ≥18 years with laboratory-confirmed COVID-19-associated hospitalization admitted January 1, 2021–April 30, 2022 — COVID-NET, 13 States[a]**

| Characteristics | Total | COVID-19 related illness [b] | OB/Labor and delivery admission [b] | Surgery [b] | Psychiatric admission needing acute medical care [b] | Trauma [b] | Other [b] | Unknown reason [b] |
|---|---|---|---|---|---|---|---|---|
| **Total** | **13,043** | **11,127 (86.6)** | **707 (5.0)** | **219 (1.4)** | **270 (2.2)** | **290 (2.0)** | **190 (1.7)** | **240 (1.2)** |
| Age group | | | | | | | | |
| 18-49 years | 4,477 | 3,220 (71.9) | 707 (16.3) | 77 (1.5) | 182 (4.6) | 118 (2.3) | 102 (2.4) | 71 (1.0) |
| 50-64 years | 4,328 | 3,988 (92.6) | 0 (0.0) | 82 (1.6) | 61 (1.4) | 62 (1.6) | 49 (1.5) | 86 (1.3) |
| 65+ years | 4,238 | 3,919 (93.5) | 0 (0.0) | 60 (1.1) | 27 (0.9) | 110 (2.1) | 39 (1.2) | 83 (1.2) |
| 65-74 years | 1,949 | 1,806 (94.1) | 0 (0.0) | 33 (0.9) | 16 (0.8) | 34 (1.6) | 20 (1.2) | 40 (1.3) |
| 75-84 years | 1,466 | 1,363 (94.5) | 0 (0.0) | 16 (1.2) | 6 (0.4) | 41 (1.6) | 12 (1.3) | 28 (1.0) |
| 85+ years | 823 | 750 (90.7) | 0 (0.0) | 11 (1.3) | 5 (1.7) | 35 (3.8) | 7 (1.2) | 15 (1.3) |
| **Sex** | | | | | | | | |
| Male | 6,433 | 5,759 (90.8) | 0 (0.0) | 115 (1.2) | 151 (2.6) | 174 (2.4) | 102 (1.9) | 132 (1.3) |
| Female | 6,610 | 5,368 (82.6) | 707 (9.8) | 104 (1.6) | 119 (1.8) | 116 (1.6) | 88 (1.5) | 108 (1.1) |
| **Race/Ethnicity[c]** | | | | | | | | |
| White | 7,305 | 6,342 (88.9) | 260 (3.0) | 111 (1.1) | 148 (1.8) | 169 (2.1) | 107 (1.6) | 168 (1.5) |
| Black | 2,628 | 2,230 (85.8) | 172 (6.1) | 43 (1.0) | 58 (2.4) | 57 (2.2) | 32 (1.6) | 36 (0.9) |
| American Indian or Alaska Native | 184 | 160 (88.0) | 10 (7.4) | 1 (0.4) | 4 (1.6) | 4 (1.1) | 4 (1.1) | 1 (0.3) |
| Asian or Pacific Islander | 515 | 429 (81.2) | 46 (7.9) | 10 (1.7) | 11 (4.9) | 9 (0.8) | 9 (3.0) | 1 (0.6) |
| Hispanic or Latino | 1,877 | 1,531 (82.6) | 185 (9.2) | 46 (2.9) | 32 (1.2) | 35 (1.5) | 34 (2.3) | 14 (0.4) |
| Other/Unknown[d] | 533 | 435 (83.9) | 34 (4.3) | 8 (1.8) | 17 (4.8) | 16 (3.1) | 4 (0.3) | 19 (1.9) |
| **Vaccination Status** | | | | | | | | |
| Unvaccinated | 9,994 | 8,575 (87.5) | 582 (5.3) | 136 (1.0) | 202 (2.0) | 191 (1.9) | 116 (1.2) | 192 (1.2) |
| Vaccinated (with or without a booster dose) | 3,049 | 2,552 (84.3) | 125 (4.2) | 83 (2.3) | 68 (2.7) | 99 (2.3) | 74 (3.1) | 48 (1.1) |
| Vaccinated without a booster dose | 2,432 | 2,061 (85.4) | 86 (4.3) | 54 (1.9) | 52 (2.4) | 84 (2.2) | 59 (2.8) | 36 (1.0) |
| Boosted | 617 | 491 (80.5) | 39 (4.0) | 29 (3.8) | 16 (3.7) | 15 (2.4) | 15 (4.1) | 12 (1.5) |
| **Time period** | | | | | | | | |
| Pre-Delta (January 2020 – June 2021) | 5,657 | 4,819 (86.9) | 327 (5.0) | 118 (1.8) | 117 (2.0) | 135 (2.2) | 67 (1.2) | 74 (0.9) |
| Delta (July 2021 – December 2021) | 4,882 | 4,369 (91.9) | 163 (2.9) | 35 (0.4) | 69 (1.4) | 7.1 (2.2) | 64 (1.2) | 111 (1.3) |
| Omicron (January 2022 – April 2022) | 2,504 | 1,939 (80.3) | 217 (7.4) | 66 (2.0) | 84 (3.3) | 84 (2.7) | 59 (2.9) | 55 (1.3) |

Abbreviations: COVID-19 = coronavirus disease 2019; COVID-NET = COVID-19–Associated Hospitalization Surveillance Network; IQR = interquartile range.

[a] California, Connecticut, Colorado, Georgia, Maryland (data excluded beginning December 4, 2021), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

[b] Percentages are weighted and represent row percentages

[c]Data on race and ethnicity were categorized as follows: non-Hispanic White (White), non-Hispanic Black (Black), non-Hispanic Asian or Pacific Islander (Asian/Pacific Islander), non-Hispanic American Indian or Alaska Native (American Indian/Alaska Native) and Other/Unknown. If ethnicity was unknown (8% of cases), non-Hispanic ethnicity was assumed.

[d]Includes multiple race (71, 0.7%) and unknown race (462, 4%).

**Supplementary Table 4. Month of hospital admission, code status, underlying medical conditions and time from vaccination to hospitalization among a representative sample of hospitalized adults who are unvaccinated and vaccinated with a primary series, with and without a booster dose, aged ≥18 years with laboratory-confirmed COVID-19-associated hospitalization admitted January 1, 2021–April 30, 2022 — COVID-NET, 13 States[a]**

| Category | Adults ≥18 years (January 2021 – April 2022) | | | | Vaccinated adults ≥18 years (October 2021-April 2022)[b] | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Unvaccinated n (weighted %)[b] | Vaccinated with a primary series with and without a booster dose, n (weighted %)[b] | p-value[d] | Total | Vaccinated without booster, n (weighted %) | Vaccinated with booster, n (weighted %) | p-value[c] |
| **Month of hospital admission (row percent)** | | | | **<.001** | | | | **<.001** |
| January 2021 | 853 | 853 (100.0) | 0 (0.0) | | | | | |
| February 2021 | 741 | 738 (99.7) | 3 (0.3) | | | | | |
| March 2021 | 740 | 718 (96.4) | 22 (3.6) | | | | | |
| April 2021 | 751 | 701 (93.4) | 50 (6.6) | | | | | |
| May 2021 | 982 | 867 (89.7) | 115 (10.3) | | | | | |
| June 2021 | 832 | 668 (82.6) | 164 (17.4) | | | | | |
| July 2021 | 785 | 597 (80.1) | 188 (19.9) | | | | | |
| August 2021 | 817 | 615 (77.8) | 202 (22.2) | | | | | |
| September 2021 | 1,011 | 753 (74.6) | 258 (25.4) | | | | | |
| October 2021 | 706 | 489 (68.4) | 217 (31.6) | | 217 | 212 (98.3) | 5 (1.7) | |
| November 2021 | 685 | 494 (67.1) | 191 (32.9) | | 191 | 177 (91.8) | 14 (8.2) | |
| December 2021 | 553 | 380 (68.3) | 173 (31.7) | | 173 | 144 (83.8) | 29 (16.2) | |
| January 2022 | 491 | 250 (49.0) | 241 (51.0) | | 241 | 171 (69.8) | 70 (30.2) | |
| February 2022 | 394 | 172 (47.0) | 222 (53.0) | | 222 | 141 (62.8) | 81 (37.2) | |
| March 2022 | 405 | 157 (35.9) | 248 (64.1) | | 248 | 119 (48.3) | 129 (51.7) | |
| April 2022 | 381 | 123 (25.7) | 258 (74.3) | | 258 | 99 (29.6) | 159 (70.4) | |

| Category | Adults ≥18 years (January 2021 – April 2022) | | | | Vaccinated adults ≥18 years (October 2021-April 2022)[b] | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Unvaccinated n (weighted %) [b] | Vaccinated with a primary series with and without a booster dose, n (weighted %) [b] | p-value[d] | Total | Vaccinated without booster, n (weighted %) | Vaccinated with booster, n (weighted %) | p-value[c] |
| **Code status on admission** | | | | **<.001** | | | | 0.486 |
| Full code | 9,348 | 7,323 (84.9) | 2,025 (78.6) | | 1,237 | 867 (79.2) | 370 (75.7) | |
| DNR/DNI/CMO | 830 | 489 (6.6) | 341 (14.7) | | 197 | 122 (14.3) | 75 (17.6) | |
| Unknown | 949 | 763 (8.5) | 186 (6.7) | | 116 | 74 (6.5) | 42 (6.7) | |
| **Underlying medical condition**[d] | | | | | | | | |
| **Any underlying medical condition** | 10,116 | 7,658 (89.9) | 2,458 (96.9) | **<.001** | 1,487 | 1,016 (97.4) | 471 (95.8) | 0.280 |
| **Hypertension** | 6,012 | 4,252 (53.5) | 1,760 (71.6) | **<.001** | 1,039 | 693 (71.4) | 346 (71.5) | 0.982 |
| **Obesity**[e] | 5,368 | 4,330 (47.9) | 1,038 (38.0) | **<.001** | 613 | 441 (37.9) | 172 (31.1) | 0.096 |
| **Chronic metabolic disease** | 4,392 | 3,096 (38.8) | 1,296 (51.9) | **<.001** | 774 | 530 (52.9) | 244 (47.2) | 0.176 |
| **Diabetes mellitus** | 3,448 | 2,455 (31.4) | 993 (40.2) | **<.001** | 588 | 405 (40.5) | 183 (35.9) | 0.267 |
| **Chronic lung disease** | 5,734 | 3,953 (48.2) | 1,781 (70.0) | **<.001** | 1,078 | 728 (70.2) | 350 (69.7) | 0.906 |
| Asthma/Reactive airway disease | 1,546 | 1,149 (12.6) | 397 (14.0) | 0.196 | 248 | 172 (14.4) | 76 (13.3) | 0.657 |
| COPD | 1,171 | 730 (9.3) | 441 (19.4) | **<.001** | 285 | 190 (19.9) | 95 (21.0) | 0.756 |
| **Cardiovascular disease**[f] | 3,744 | 2,379 (31.6) | 1,365 (53.9) | **<.001** | 827 | 542 (53.3) | 285 (56.7) | 0.423 |
| Heart failure | 1,229 | 705 (10.8) | 524 (20.1) | **<.001** | 310 | 199 (19.1) | 111 (23.7) | 0.163 |
| Coronary artery disease | 1,340 | 842 (11.3) | 498 (18.7) | **<.001** | 297 | 192 (17.1) | 105 (24.2) | **0.033** |
| **Neurologic disease** | 1,883 | 1,157 (14.8) | 726 (30.2) | **<.001** | 429 | 286 (31.5) | 143 (30.3) | 0.776 |
| **Renal disease** | 1679 | 992 (14.4) | 687 (30.1) | **<.001** | 398 | 245 (29.9) | 153 (34.2) | 0.299 |
| **Immunosuppressive condition** | 1,437 | 877 (10.8) | 560 (23.3) | **<.001** | 342 | 198 (19.9) | 144 (32.5) | **0.001** |
| Solid organ malignancy | 511 | 301 (3.7) | 210 (9.6) | **<.001** | 122 | 77 (9.2) | 45 (9.7) | 0.838 |
| Transplant | 170 | 81 (1.5) | 89 (4.4) | **<.001** | 54 | 21 (2.5) | 33 (10.4) | 0.838 |

| Category | Adults ≥18 years (January 2021 – April 2022) | | | | Vaccinated adults ≥18 years (October 2021-April 2022)[b] | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Unvaccinated n (weighted %) [b] | Vaccinated with a primary series with and without a booster dose, n (weighted %) [b] | p-value[d] | Total | Vaccinated without booster, n (weighted %) | Vaccinated with booster, n (weighted %) | p-value[c] |
| **Gastrointestinal or liver disease** | 1,150 | 81 (1.5) | 355 (12.9) | **0.002** | 211 | 149 (13.8) | 62 (10.4) | 0.259 |
| **Blood disorder** | 439 | 269 (3.0) | 170 (7.0) | **<.001** | 102 | 64 (8.2) | 38 (6.0) | 0.318 |
| **Rheumatologic or autoimmune disease** | 774 | 465 (5.9) | 309 (13.5) | **<.001** | 184 | 107 (12.3) | 77 (19.1) | 0.0327 |
| **Vaccination to Admission time,[g] Median (IQR)** | | | 180 (103-246) | | 211 (109-262) | | | |
| 14-90 days after vaccination | | | 556 (19.0) | | 207 | 42 (5.7) | 165 (44.7) | |
| 91-150 days after vaccination | | | 584 (18.2) | | 274 | 76 (7.0) | 198 (39.7) | |
| >=150 days after vaccination | | | 1,372 (61.4) | | 1,043 | 932 (86.1) | 111 (13.3) | |

Abbreviations: Abbreviations: COVID-19 = coronavirus disease 2019; COVID-NET = COVID-19–Associated Hospitalization Surveillance Network; DNI = do not intubate; DNR = do not resuscitate; CMO=comfort measure only; COPD=Chronic obstructive pulmonary disease; ICU = intensive care unit; IQR = interquartile range;

[a]California, Connecticut, Colorado, Georgia, Maryland (data excluded beginning December 4, 2021), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah. Note that column percentages are shown except where row percentages are indicated.

[b] **Unvaccinated:** Population-based rates of COVID-19-associated hospitalizations among persons with a positive SARS-CoV-2 test who have no record of receiving any COVID-19 vaccine; **Vaccinated:** Population-based rates of COVID-19-associated hospitalizations among persons with a positive SARS-CoV-2 test collected ≥14 days after vaccination with a primary series, defined as either the second dose of a two-dose vaccine series or after one dose of a single dose vaccine. When not otherwise specified, vaccinated persons include those who may have received additional or booster doses; **Vaccinated without a booster dose:** Population-based rates of COVID-19-associated hospitalizations among vaccinated persons who have received a primary series and who have not received an additional or booster dose. This includes both those eligible and not yet eligible for an additional or booster dose; **Vaccinated with a booster dose:** Population-based rates of COVID-19-associated hospitalizations among persons vaccinated with a primary series who have received an additional or booster dose on or after August 13, 2021, with a positive SARS-CoV-2 test collected ≥14 days after receipt of an additional or booster dose. Because the immune status of all cases is not known, an additional dose (recommended for persons with a weakened immune system) cannot be distinguished from a booster dose. This is a relevant consideration because vaccines can be less effective in persons with a weakened immune system.

[c] Statistical significance for univariate analyses was determined as p<0.10

[d] Overall condition categories as defined in Supplementary Table 1.

[e]Obesity is defined as calculated body mass index (BMI) ≥30 kg/m2, and if BMI is missing, by International Classification of Diseases discharge diagnosis codes.

[f] Cardiovascular disease excludes hypertension.

[g] Time from vaccination to admission is the number of days between the most last vaccine dose received plus 14 days and date of hospital admission.

**Supplementary Table 5. Multivariable model[a] assessing factors associated with severe COVID-19 disease (ICU, in-hospital death) in hospitalized adults with laboratory-confirmed COVID-19-associated hospitalization admitted January 1, 2021–April 30, 2022, and restricted to those with COVID-19 as a likely reason for admission — COVID-NET, 13 States[b]**

| Category | No severe illness n (weighted %) | Have severe illness n (weighted %) | Unadjusted risk ratio | Adjusted risk ratio | p-value |
|---|---|---|---|---|---|
| **Age group** | 61 (48-74) | 63 (52-74) | | | |
| 18-49 years | 2,590 (27.1) | 630 (20.2) | Ref. | Ref. | Ref. |
| 50-64 years | 2,975 (29.2) | 1,013 (31.9) | 1.35 (1.2, 1.51) | 1.33 (1.19, 1.47) | **<.001** |
| 65+ years | 2,907 (43.7) | 1,012 (47.9) | 1.35 (1.21, 1.51) | 1.34 (1.19, 1.5) | **<.001** |
| **Sex** | | | | | |
| Male | 4,218 (50.2) | 1,541 (56.6) | 1.22 (1.12, 1.32) | 1.23 (1.14, 1.33) | **<.001** |
| Female | 4,254 (49.8) | 1,114 (43.4) | Ref. | Ref. | Ref. |
| **Race/Ethnicity[c]** | | | | | |
| White | 4,853 (51.1) | 1,489 (52.5) | Ref. | Ref. | Ref. |
| Black | 1,705 (25.5) | 525 (22.9) | 0.9 (0.8, 1.02) | 0.98 (0.84, 1.15) | 0.850 |
| Hispanic or Latino | 1,170 (12.5) | 361 (12.8) | 1 (0.9, 1.11) | 1.07 (0.95, 1.2) | 0.281 |
| American Indian or Alaska Native | 103 (1.2) | 57 (1.7) | 1.27 (1.03, 1.56) | 1.3 (1.06, 1.6) | **0.013** |
| Asian or Pacific Islander | 313 (4.7) | 116 (4.7) | 0.98 (0.78, 1.23) | 1.06 (0.86, 1.31) | 0.590 |
| Other/Unknown[d] | 328 (4.9) | 107 (5.4) | 1.05 (0.85, 1.3) | 1.11 (0.93, 1.34) | 0.256 |
| **Time period** | | | | | |
| Pre-Delta (January 2021- June 2021) | 3,737 (35.6) | 1,082 (32.1) | Ref. | Ref. | Ref. |
| Delta (July 2021- December 2021) | 3,193 (35.7) | 1,176 (43.5) | 1.26 (1.12, 1.41) | 1.34 (1.16, 1.55) | **<.001** |
| Omicron (January 2022- April 2022) | 1,542 (28.8) | 397 (24.5) | 0.96 (0.82, 1.11) | 1.01 (0.82, 1.24) | 0.911 |
| **Vaccinated with a primary series with or without a booster dose** | 1,984 (25.6) | 568 (24.7) | 0.96 (0.8, 1.16) | 0.83 (0.65, 1.07) | 0.158 |
| **LTCF residence[e]** | 425 (6.4) | 179 (8.2) | 1.22 (0.99, 1.51) | 1.24 (0.98, 1.56) | 0.070 |
| **Underlying medical condition** | | | | | |
| Obesity[f] | 4,054 (44.9) | 1,314 (47.0) | 1.07 (0.96, 1.19) | 1.1 (0.98, 1.23) | 0.097 |
| Diabetes | 2,474 (31.9) | 974 (39.2) | 1.27 (1.18, 1.38) | 1.22 (1.13, 1.32) | **<.001** |
| Chronic lung disease | 4,297 (53.0) | 1,437 (56.2) | 1.1 (1.02, 1.19) | 1.02 (0.94, 1.11) | 0.621 |
| Cardiovascular disease[g] | 2,756 (36.4) | 988 (40.2) | 1.13 (1.02, 1.25) | 1.01 (0.9, 1.14) | 0.805 |
| Neurologic disease | 1,404 (18.5) | 479 (19.4) | 1.05 (0.91, 1.2) | 1 (0.84, 1.17) | 0.960 |
| Renal disease | 1,198 (17.5) | 481 (21.1) | 1.19 (1.05, 1.35) | 1.11 (0.99, 1.25) | 0.066 |
| Immunosuppressive condition | 1,057 (13.4) | 380 (16.1) | 1.18 (1.04, 1.34) | 1.17 (1, 1.38) | 0.056 |
| Gastrointestinal or liver disease | 843 (10.0) | 307 (10.9) | 1.08 (0.89, 1.31) | 1.03 (0.86, 1.23) | 0.754 |
| Blood disorder | 312 (4.0) | 127 (4.1) | 1.02 (0.76, 1.36) | 0.96 (0.73, 1.28) | 0.795 |

| | | | | | |
|---|---|---|---|---|---|
| Rheumatologic or autoimmune disease | 572 (7.4) | 202 (9.1) | 1.19 (0.88, 1.59) | 1.09 (0.77, 1.53) | 0.628 |

Abbreviations: COVID-19 = coronavirus disease 2019; COVID-NET = COVID-19–Associated Hospitalization Surveillance Network; LTCF = long-term care facility

[a]Log-linked Poisson Regression using generalized estimating equations (GEE) clustered on site with exchangeable covariance structure

[b]California, Connecticut, Colorado, Georgia, Maryland (data excluded beginning December 4, 2021), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

[c]Data on race and ethnicity were categorized as follows: non-Hispanic White (White), non-Hispanic Black (Black), Non-Hispanic American Indian or Alaska Native, Non-Hispanic Asian or Pacific Islander, and, Other/Unknown. If ethnicity was unknown (8%), non-Hispanic ethnicity was assumed.

[d]Includes multiple race (53, .5%) and unknown race (382, 4.5%)

[e]Long-term care facility (LTCF) residence was defined as residence in rehabilitation facilities, assisted living/residential care, group homes, nursing homes, skilled nursing facilities, long-term care facilities, long-term acute care hospitals, residential care facilities or other long-term care facilities.

[f]Obesity is defined as calculated body mass index (BMI) ≥30 kg/m2, and if BMI is missing, by International Classification of Diseases discharge diagnosis codes.

[g]Cardiovascular disease excludes hypertension.

**Supplementary Table 6. Demographics and characteristics of propensity score matched cohort used for assessment of factors associated with severe COVID-19 disease (ICU, in-hospital death) by vaccination status among those with COVID-19 as a likely reason for admission**

| Category | Total | Unvaccinated, n (weighted %) | Vaccinated[a], n (weighted %) | P-value |
|---|---|---|---|---|
| **Total** | **4,000** | **2,000 (55.0)** | **2,000 (45.0)** | |
| **Age group (Median, IQR)** | | | | 0.594 |
| 18-49 years | 698 | 353 (15.1) | 345 (16.2) | |
| 50-64 years | 1,303 | 656 (25.4) | 647 (26.7) | |
| 65+ years | 1,999 | 991 (59.5) | 1,008 (57.1) | |
| **Sex** | | | | 0.579 |
| Male | 2,054 | 1,043 (51.3) | 1,011 (52.7) | |
| Female | 1,946 | 957 (48.7) | 989 (47.3) | |
| **Race/Ethnicity[b]** | | | | 0.879 |
| White | 2,634 | 1,316 (58.4) | 1,318 (57.2) | |
| Black | 633 | 316 (21.4) | 317 (19.9) | |
| Hispanic or Latino | 413 | 207 (9.4) | 206 (11.2) | |
| American Indian or Alaska Native | 55 | 28 (1.5) | 27 (1.7) | |
| Asian or Pacific Islander | 128 | 65 (4.3) | 63 (4.3) | |
| Other/Unknown[c] | 137 | 68 (5.1) | 69 (5.7) | |
| **Time period (row percent)** | | | | **0.005** |
| Pre-Delta (January 2021 - June 2021) | 609 | 276 (10.6) | 333 (6.5) | |
| Delta (July 2021 - December 2021) | 2,025 | 1,072 (42.4) | 953 (44.8) | |
| Omicron (January 2022 - April 2022) | 1,366 | 652 (47.0) | 714 (48.8) | |
| **LTCF residence[d]** | 309 | 125 (7.6) | 184 (7.3) | 0.846 |
| **Obesity[e]** | 1,669 | 852 (38.7) | 817 (39.1) | 0.873 |
| **Diabetes** | 1,387 | 677 (36.2) | 710 (37.8) | 0.508 |
| **Chronic lung disease** | 2,565 | 1,276 (63.9) | 1,289 (63.6) | 0.914 |
| **Cardiovascular disease[f]** | 1,873 | 920 (48.2) | 953 (47.1) | 0.675 |
| **Neurologic disease** | 889 | 419 (21.7) | 470 (23.7) | 0.350 |
| **Renal disease** | 818 | 387 (22.9) | 431 (22.6) | 0.895 |
| **Immunosuppressive condition** | 717 | 360 (16.9) | 357 (19.0) | 0.280 |
| **Gastrointestinal or liver disease** | 492 | 226 (11.5) | 266 (12.7) | 0.473 |

| | | | | |
|---|---|---|---|---|
| **Blood disorder** | 207 | 99 (5.0) | 108 (5.0) | 0.959 |
| **Rheumatologic or autoimmune disease** | 382 | 196 (9.0) | 186 (10.7) | 0.286 |

Abbreviations: COVID-19 = coronavirus disease 2019; COVID-NET = COVID-19–Associated Hospitalization Surveillance Network; ICU = intensive care unit.

[a] Vaccinated persons include those who were vaccinated with a primary series and who may have received additional or booster doses

[b]Data on race and ethnicity were categorized as follows: Hispanic or Latino, non-Hispanic White (White), non-Hispanic Black (Black), Non-Hispanic American Indian or Alaska Native, Non-Hispanic Asian or Pacific Islander, and Other/Unknown. If ethnicity was unknown (8% of cases), non-Hispanic ethnicity was assumed.

[c]Includes multiple race (20, 0.6%) and unknown race (117, 4.8%)

[d]Long-term care facility (LTCF) residence was defined as residence in rehabilitation facilities, assisted living/residential care, group homes, nursing homes, skilled nursing facilities, long-term care facilities, long-term acute care hospitals, residential care facilities or other long-term care facilities.

[e]Obesity is defined as calculated body mass index (BMI) ≥30 kg/m2, and if BMI is missing, by International Classification of Diseases discharge diagnosis codes.

[f]Cardiovascular disease excludes hypertension.

**Supplementary Table 7. Monthly rate ratios of COVID-19-associated hospitalizations in unvaccinated vs vaccinated (with and without a booster dose), [a] patients among all adults aged ≥18 years and by age group, [b] January 24, 2021–April 30, 2022 — COVID-NET, 13 States[c]**

| | Rate ratio vaccinated with a primary series with or without a booster vs. unvaccinated | | | | Rate ratio vaccinated with a primary series without booster vs. unvaccinated | | | | Rate ratio vaccinated with a primary series with booster vs. unvaccinated | | | | Rate ratio vaccinated with a primary series and booster vs. vaccinated with primary series without booster | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | all adults ≥18 years (age-adjusted) | 18–49 years | 50–64 years | ≥65 years | all adults ≥18 years (age-adjusted) | 18–49 years | 50–64 years | ≥65 years | all adults ≥18 years (age-adjusted) | 18–49 years | 50–64 years | ≥65 years | all adults ≥18 years (age-adjusted) | 18–49 years | 50–64 years | ≥65 years |
| **2021** | | | | | — | — | — | — | — | — | — | — | — | — | — | — |
| February | 5.2 | 15.6 | 12.9 | 3.0 | — | — | — | — | — | — | — | — | — | — | — | — |
| March | 7.9 | 17.0 | 8.2 | 6.0 | — | — | — | — | — | — | — | — | — | — | — | — |
| April | 16.3 | 27.5 | 25.7 | 11.3 | — | — | — | — | — | — | — | — | — | — | — | — |
| May | 17.7 | 19.0 | 22.1 | 15.2 | — | — | — | — | — | — | — | — | — | — | — | — |
| June | 12.9 | 13.8 | 17.1 | 10.6 | — | — | — | — | — | — | — | — | — | — | — | — |
| July | 13.4 | 20.2 | 18.6 | 9.0 | — | — | — | — | — | — | — | — | — | — | — | — |
| August | 13.2 | 20.7 | 20.4 | 8.8 | — | — | — | — | — | — | — | — | — | — | — | — |
| September | 13.6 | 24.0 | 19.8 | 9.5 | 13.8 | 24.6 | 19.9 | 9.7 | 5.6 | 3.7 | 11.6 | 5.2 | 0.4 | 0.1 | 0.6 | 0.5 |
| October | 11.8 | 15.7 | 14.3 | 9.9 | 11.2 | 15.8 | 14.1 | 9.1 | 23.1 | 12.8 | 23.5 | 33.5 | 2.1 | 0.8 | 1.7 | 3.7 |
| November | 13.2 | 16.1 | 15.6 | 11.6 | 10.5 | 15.7 | 14.3 | 8.4 | 37.8 | 27.5 | 47.5 | 38.4 | 3.6 | 1.7 | 3.3 | 4.6 |
| December | 12.5 | 9.4 | 12.8 | 13.7 | 8.1 | 8.3 | 10.2 | 7.4 | 32.6 | 24.2 | 29.9 | 38.4 | 4.0 | 2.9 | 2.9 | 5.2 |
| **2022** | | | | | | | | | | | | | | | | |
| January | 7.1 | 4.7 | 6.1 | 8.8 | 4.4 | 4.0 | 4.3 | 4.5 | 12.8 | 7.9 | 11.2 | 16.5 | 2.9 | 2.0 | 1.7 | 3.6 |
| February | 6.2 | 4.1 | 5.4 | 7.7 | 4.2 | 3.5 | 3.9 | 4.5 | 8.8 | 5.7 | 8.0 | 10.8 | 2.1 | 1.6 | 2.1 | 2.4 |
| March | 4.6 | 3.3 | 4.4 | 5.3 | 3.8 | 3.8 | 4.0 | 3.8 | 4.9 | 2.8 | 4.8 | 6.4 | 1.3 | 0.8 | 1.2 | 1.7 |
| April | 3.5 | 3.0 | 3.5 | 3.7 | 3.3 | 3.2 | 3.1 | 3.4 | 3.6 | 2.9 | 3.9 | 3.9 | 1.1 | 0.9 | 1.3 | 1.2 |
| **Range** | 3.5-17.7 | 3.0-27.5 | 3.5-25.7 | 3.0-15.2 | 3.3-13.8 | 3.2-24.6 | 3.1-19.9 | 3.4-9.7 | 3.6-37.8 | 2.8-27.5 | 3.9-47.5 | 3.9-38.4 | 0.4-4.0 | 0.1-2.9 | 0.6-3.3 | 0.5-5.2 |
| **January-June 2021 Cumulative rate ratio per 100,000 person-weeks (95% CI)** | **14.9 (14.2-15.5)** | **19.7 (17.4-22.3)** | **21.3 (19.2-23.6)** | **11.1 (10.6-11.7)** | — | — | — | — | — | — | — | — | — | — | — | — |

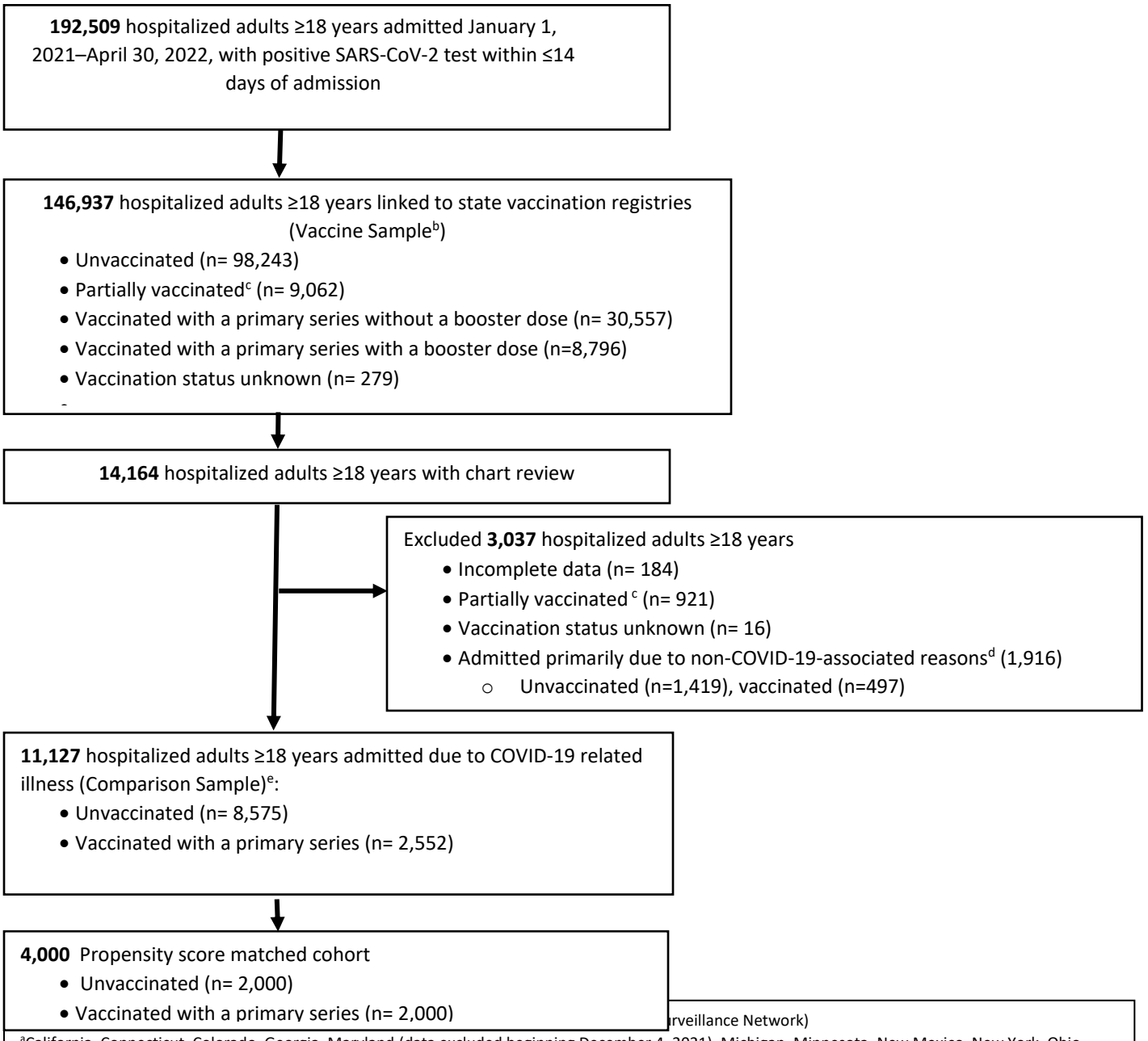
| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **July-December 2021 Cumulative rate ratio per 100,000 person-weeks (95% CI)** | **12.2 (12.0-12.4)** | **14.8 (14.2-15.3)** | **15.4 (15.0-16.0)** | **10.1 (9.8-10.3)** | — | — | — | — | — | — | — | — | — | — | — | — |
| **January-April 2022 Cumulative rate ratio per 100,000 person-weeks (95% CII)** | **6.8 (6.6-6.9)** | **4.6 (4.4-4.8)** | **5.9 (5.6-6.1)** | **8.3 (8.1-8.5)** | — | — | — | — | — | — | — | — | — | — | — | — |

[a] **Unvaccinated:** Population-based rates of COVID-19-associated hospitalizations among persons with a positive SARS-CoV-2 test who have no record of receiving any COVID-19 vaccine; **Vaccinated:** Population-based rates of COVID-19-associated hospitalizations among persons with a positive SARS-CoV-2 test collected ≥14 days after vaccination with a primary series, defined as either the second dose of a two-dose vaccine series or after one dose of a single dose vaccine. When not otherwise specified, vaccinated persons include those who may have received additional or booster doses; **Vaccinated no booster:** Population-based rates of COVID-19-associated hospitalizations among vaccinated persons who have received a primary series and who have not received an additional or booster dose. This includes both those eligible and not yet eligible for an additional or booster dose; **Vaccinated with booster dose:** Population-based rates of COVID-19-associated hospitalizations among persons vaccinated with a primary series who have received an additional or booster dose on or after August 13, 2021, with a positive SARS-CoV-2 test collected ≥14 days after receipt of an additional or booster dose. Because the immune status of all cases is not known, an additional dose (recommended for persons with a weakened immune system) cannot be distinguished from a booster dose. This is a relevant consideration because vaccines can be less effective in persons with a weakened immune system.

[b] Boxes shaded in grey indicate months where age-specific rate ratios are likely not stable, as less than 5% of the age group-specific population of the COVID-NET surveillance catchment area had received additional or booster doses 14 or more days prior to the timeframe indicated. Cells represented by a dash (—) are time periods where either booster doses were not available or very few individuals had received a booster dose.

[c] California, Connecticut, Colorado, Georgia, Maryland (data excluded beginning December 4, 2021), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

**Supplementary Figure. Selection of cases for analysis of adults ≥18 years with laboratory-confirmed COVID-19-associated hospitalization admitted January 1, 2021 – April 30, 2022, by vaccination status — COVID-NET, 13 States[a]**




rveillance Network)

[a]California, Connecticut, Colorado, Georgia, Maryland (data excluded beginning December 4, 2021), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah

[b]Vaccine sample includes representative random sample from each site (sampled cases) as well as all non-sampled cases if all cases from a single site and age strata had vaccination status available.

[c]Received one dose of two-dose series (for Pfizer/BioNTech and Moderna) or had received the final dose of a primary series <14 days prior to positive SARS-CoV-2 test.

[d]Includes cases admitted due to OB/Labor and delivery admission (707), surgery (219), psychiatric admission needing acute medical care (270), trauma (290), "other" (190), and unknown reasons (240).

[e]Comparison sample includes only those sampled cases with complete medical chart abstraction who were either unvaccinated or vaccinated with a primary series; vaccinated cases who had evidence of prior SARS-CoV-2 infection prior to qualifying as completing a primary series were excluded.

NOTE: For both the vaccine sample and the analytic sample, sampling weights were created based on the probability of selection. Weights were adjusted for non-response, adjusted to population catchment totals based on combinations of surveillance site, time period of admission, age, sex, and race/ethnicity via published raking procedures, and trimmed to reduce variability, as previously described.[1]