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Update on the Epidemiology of SARS-CoV-2 Strains

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COVID-19 Epidemiology Task Force
Centers for Disease Control and Prevention

April 6, 2022
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
Changing Landscape of Circulating Variants

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

Recent Trends in Weighted Variant Proportion Estimates & Nowcast


* 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.
Nowcast Estimates of Variant Proportions by HHS Region
March 27-April 2, 2022

Omicron Lineage

Regional proportions from specimens collected the week ending 4/2/2022.
US Territories not shown are included in HHS regions.
PR, VI - Region 2
AS, FM, GU, MH, MP, PW - Region 9

Lineages called using pango-designation (PANGO)-v1.2.127, pangolin v3.1.20, pangoLEARN version 02/02/2022 and Scorpio v0.3.16.
Lineage BA.1.1 is aggregated with B.1.1.529 at the regional level as it currently cannot be reliably called in each region.

HHS=Health and Human Services
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

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](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](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

Percentage of People with Antibodies (Anti-Nucleocapsid) Indicating Resolving or Past Infection with SARS-CoV-2, United States
August 30, 2020 - January 29, 2022

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/

Does not indicate:
- Antibodies from vaccination (anti-spike)
- Amount of antibodies or protection from reinfection
Daily Trends in Number of COVID-19 Deaths, United States

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.

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

Primary Series

- Capped at 95.0%

- 5-11 yrs: 27.3%
- 12-17 yrs: 56.3%
- 18-24 yrs: 58.5%
- 25-39 yrs: 63.0%
- 40-49 yrs: 71.0%
- 50-64 yrs: 78.5%
- 65-74 yrs: 91.4%
- 75+ yrs: 87.7%

Booster Dose

- 12-17 yrs: 23.4%
- 18-24 yrs: 30.4%
- 25-39 yrs: 35.2%
- 40-49 yrs: 43.2%
- 50-64 yrs: 52.4%
- 65-74 yrs: 66.1%
- 75+ yrs: 69.8%

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.

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.

Cases

Unvaccinated  
Vaccinated with a primary series only  
Vaccinated with a primary series and booster dose*

Deaths

Unvaccinated people aged 12 years and older had:

3.5X  
Risk of Testing Positive for COVID-19

3.2X  
Risk of Testing Positive for COVID-19

AND

21X  
Risk of Dying from COVID-19 in January, and

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.

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.

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.

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

<table>
<thead>
<tr>
<th></th>
<th>Unvaccinated weighted %</th>
<th>Fully vaccinated weighted %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td>N=8,013</td>
<td>N=1,768</td>
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<tr>
<td><strong>Age group</strong></td>
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<tr>
<td>18-49 years</td>
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<td>50-64 years</td>
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<tr>
<td>≥65 years</td>
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<td>72</td>
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<td><strong>LTCF residence</strong></td>
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<tr>
<td><strong>DNR/DNI/CMO</strong></td>
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<td>14</td>
</tr>
<tr>
<td><strong>Underlying medical conditions</strong>*</td>
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<td></td>
</tr>
<tr>
<td>Chronic lung disease</td>
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<td>42</td>
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<tr>
<td>Cardiovascular disease</td>
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<td>Neurologic disease</td>
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<tr>
<td>Renal disease</td>
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<td>30</td>
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<tr>
<td>Immunosuppressive condition</td>
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<td>24</td>
</tr>
<tr>
<td>≥3 Underlying medical conditions</td>
<td>50</td>
<td>76</td>
</tr>
</tbody>
</table>

* 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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For more information, contact CDC
1-800-CDC-INFO (232-4636)

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

<table>
<thead>
<tr>
<th>Classification</th>
<th>Definition</th>
<th>Variants</th>
</tr>
</thead>
</table>
| 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) |

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

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

Percentage of Deaths by Vaccination Status and Age Group
September 26, 2021 - January 29, 2022 (26 Jurisdictions)

Unvaccinated

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

Vaccinated with at least a primary series

Vaccinated with a primary series & booster dose

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.

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.