Daily Change in COVID-19 Cases, US
January 22, 2020 – January 19, 2022

TOTAL Cases Reported Since 1/22/20
68,671,563
NEW Cases Reported to CDC on 1/19/22
768,190

Change in 7-Day Case Average
-5.0%

Current 7-Day Case Average (1/13/22 - 1/19/22)
744,616
Prior 7-Day Case Average (1/6/22 - 1/12/22)
783,922
New Admissions of Patients with Confirmed COVID-19, US
August 1, 2020 – January 18, 2022

Patients Currently Hospitalized with COVID on 1/18/22
144,441

New Admissions on 1/18/22
21,111

Peak in New Admissions (1/12/22)
23,042

Change in 7-Day Average of New Admissions
+1.1%

Current 7-Day Average of New Admissions (1/12/22 - 1/18/22)
20,990

Prior 7-Day Average of New Admissions (1/5/22 - 1/11/22)
20,757
Daily Change in COVID-19 Deaths, US
January 22, 2020 – January 19, 2022

TOTAL Deaths Reported Since 1/22/2020
856,288

NEW Deaths Reported to CDC on 1/19/22
2,542

Change in 7-Day Death Average
-0.3%

Current 7-Day Death Average (1/13/22 - 1/19/22)
1,749

Prior 7-Day Death Average (1/6/22 - 1/12/22)
1,754

Forecasted Total Deaths by 01/22/22
860,000 to 866,000
Vaccine effectiveness of 2 vs 3 doses of mRNA vaccines for Delta and Omicron

Vaccine Effectiveness against ER and Urgent Care Visits

Vaccine Effectiveness

<6 months after dose 2  >6 months after dose 2  after a 3rd dose

86%  76%  94%

Delta

Source MMWR: http://dx.doi.org/10.15585/mmwr.mm7104e3.
Vaccine effectiveness of 2 vs 3 doses of mRNA vaccines for Delta and Omicron

Vaccine Effectiveness against ER and Urgent Care Visits

- Delta
  - <6 months after dose 2: 86%
  - >6 months after dose 2: 76%
  - after a 3rd dose: 94%

- Omicron
  - <6 months after dose 2: 52%
  - >6 months after dose 2: 38%
  - after a 3rd dose: 82%

Source MMWR: http://dx.doi.org/10.15585/mmwr.mm7104e3.
Vaccine effectiveness of 2 vs 3 doses of mRNA vaccines for Delta and Omicron

Vaccine Effectiveness against Hospitalization

- Delta
- Omicron

Source MMWR: http://dx.doi.org/10.15585/mmwr.mm7104e3.
Rates of COVID-19 Cases by Vaccination Status and Booster Doses

*On December 1, 2021, the first case of COVID-19 attributed to the Omicron variant was reported in the United States.

Source: CDC COVID Data Tracker - Rates of COVID-19 Cases and Deaths by Vaccination Status
When new variants arise, why does immune protection against infection diminish much more than does protection against severe disease?
Adaptive Immune Responses to SARS-CoV-2 Infection and Vaccination

- Infection or vaccination
  - B cell
    - T-cell help sustains B-cell proliferation/maturation
      - CD8+ T cells
      - CD4+ T cells
        - Memory B cell
          - Memory T-cells
            - CD8+ T cells
            - CD4+ T cells
          - Plasma cell
            - (makes antibodies)
Simplified Explanation of the Very Complex Immune Responses to Viral Infections

- **Antibodies**, made by B-cells with “help” from T-cells, primarily *prevent infection*
  - More specific than T cells and are shorter lived
  - Backed up by memory B cells that are more durable

- **T cells** generally *prevent progression* of viral infection by directing other immune cells or killing virus-infected cells directly
  - More cross-reactive than antibodies (greater breadth) and are longer lasting
Simplified Explanation of the Very Complex Immune Responses to Viral Infections

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Antigens and Epitopes

- **Antigens** are molecules capable of stimulating an immune response

- **Antigens** have many components -- **epitopes** -- that can be recognized by the immune system
  - B-cell epitopes: recognized by antibodies
  - T-cell epitopes: recognized by T-cells

- With vaccines, antigen determinants are referred to as **immunogens**
SARS-CoV-2: B-Cell and T-Cell Epitopes

**B-cell epitopes**

- Antibodies bind to B-cell epitopes on the surface of the spike protein. Viral mutations cause changes in surface amino acids that can interfere with antibody binding.

**T-cell epitopes**

- T-cells “see” epitopes that are on the surface or buried within viral proteins. Changes that affect antibody binding often do not impact T cell recognition.
Majority of SARS-CoV-2 Spike Epitopes are Conserved Across Variants

CD4 T-Cell epitopes

- Average Across Variants Tested: 91% conserved
- Delta: 92% conserved
- Omicron: 72% conserved

CD8 T-Cell epitopes

- Average Across Variants Tested: 94% conserved
- Delta: 95% conserved
- Omicron: 86% conserved

SARS-CoV-2 Vaccination Induces Immunological Memory Able To Cross-Recognize Variants From Alpha to Omicron
A Tarke, A Sette et al.

T cell responses to spike epitopes across SARS-CoV-2 variants, including Omicron, are largely preserved 6 months after vaccination
Lab Studies Demonstrate That T-Cells Induced From Vaccination or Prior Infection Hold Up Well Against Omicron

- Minimal Cross-Over Between Mutations Associated With Omicron Variant of SARS-CoV-2 and CD8+ T Cell Epitopes Identified in COVID-19 Convalescent Individuals
  - AD Redd, AAR Tobian et al.

- Divergent SARS CoV-2 Omicron-Specific T- and B-cell Responses in COVID-19 Vaccine Recipients
  - CH GeurtsvanKessel, RD devries et al.

- SARS-CoV-2 Spike T Cell Responses Induced Upon Vaccination or Infection Remain Robust Against Omicron
  - R Keeton, C Rio et al.

- Preserved T Cell Reactivity to the SARS-CoV-2 Omicron Variant Indicates Continued Protection in Vaccinated Individuals
  - L De Marco, L Battistini et al.

- Vaccines Elicit Highly Cross-Reactive Cellular Immunity to the SARS-CoV-2 Omicron Variant
  - J Liu, DH Barouch et al.

- Ancestral SARS-CoV-2-Specific T Cells Cross-Recognize Omicron
  - Y Gao, M Buggert et al.
COVID-19 Vaccine Effectiveness Against Omicron Variant, UK

**Symptomatic infection**
- 2 doses mRNA vaccine
  - Wk 2-4: 65-70%
  - Wk 10+: 30%
- 2 doses mRNA vaccine + boost
  - Wk 2-4: 65-75%
  - Wk 10+: 45-50%

**Hospitalization**
- 2 doses vaccine + boost (all brands)
  - Wk 2-4: 92%
  - Wk 10+: 83%

Source: UK Health Security Agency, 1/20/2022
**Bottom Line**

- Protection against SARS-CoV-2 infection is mediated mostly by antibodies
  - Short-lived
  - Variants with extensive mutations more easily escape protection from infection

- Protection against severe disease is mediated predominantly by memory B cells and CD4/CD8 T cells.
  - Longer-lived and broadly active across variants

- Our current vaccines continue to induce immune responses that provide strong protection against severe COVID-19 disease, hospitalization and death
Protect Yourself From COVID-19

- Up-to-date vaccination is essential

Visit – vaccines.gov

Text – your ZIP code to 438829

Call – 1-800-232-0233