Clinical Laboratory COVID-19 Response Call
Monday, April 18, 2022, at 3:00PM ET

• Welcome
  – Jasmine Chaitram, Division of Laboratory Systems, CDC

• Opening Remarks
  – Dr. Rochelle Walensky, Director, CDC

• Medical Laboratory Professionals Week
  – Alexandra Mercante, Division of Laboratory Systems, CDC

• Infection-Induced and Hybrid Immunity
  – Jefferson Jones, Epidemiology Task Force, CDC

• SARS-CoV-2 Variants Update
  – Natalie Thornburg, Laboratory and Testing Task Force, CDC

• FDA Update
  – Tim Stenzel, US Food and Drug Administration (FDA)
About DLS

Vision
Exemplary laboratory science and practice advance clinical care, public health, and health equity.

Mission
Improve public health, patient outcomes, and health equity by advancing clinical and public health laboratory quality and safety, data and biorepository science, and workforce competency.
Four Goal Areas

Quality Laboratory Science
- Improve the quality and value of laboratory medicine and biorepository science for better health outcomes and public health surveillance

Highly Competent Laboratory Workforce
- Strengthen the laboratory workforce to support clinical and public health laboratory practice

Safe and Prepared Laboratories
- Enhance the safety and response capabilities of clinical and public health laboratories

Accessible and Usable Laboratory Data
- Increase access and use of laboratory data to support response, surveillance, and patient care
CDC Preparedness Portal


Find CLCR call information, transcripts, and audio recordings on this page.
Next Scheduled Call

The next call will be on

Monday, May 16 @ 3:00 PM to 4:00 PM ET
We Want to Hear From You!

Training and Workforce Development

Questions about education and training?
Contact LabTrainingNeeds@cdc.gov
How to Ask a Question

- **Using the Zoom Webinar System**
  - Click the **Q&A button** in the Zoom webinar system
  - Type your question in the **Q&A box** and submit it
  - Please do not submit a question using the chat button

- For media questions, please contact CDC Media Relations at [media@cdc.gov](mailto:media@cdc.gov)

- If you are a patient, please direct any questions to your healthcare provider
Division of Laboratory Systems

Slide decks may contain presentation material from panelists who are not affiliated with CDC. Presentation content from external panelists may not necessarily reflect CDC’s official position on the topic(s) covered.
Opening Remarks

Dr. Rochelle Walensky
Director, CDC
Division of Laboratory Systems

Medical Laboratory Professionals Week
April 24–30

Join DLS in celebrating Lab Week 2022 by:

• Saying “thank you" to a laboratory professional
• Participating in DLS’s Lab Week activities
• Accessing our digital toolkit and content

www.cdc.gov/csels/dls/lab-week/
Infection-Induced and Hybrid Immunity

Jefferson Jones, MD MPH
CDR, US Public Health Service
Epidemiology Task Force
Infection vs. Vaccine Induced Immunity

**Infection**
- Breadth of immune response (mucosal immunity, diverse targets)
- More variable response based on severity of disease

**Vaccination**
- More predictable and consistent immune response, with higher-titer antibodies (mRNA vaccines)
- Limited breadth of response and earlier waning of immunity (against infection)

**New Variants**

Problems with virus mutations lead to vaccine escape

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Prospects for durable immune control of SARS-CoV-2 and prevention of reinfection | Nature Reviews Immunology
Immune response to infection varies, especially by disease severity

- mRNA vaccines tend to produce more consistent, high-titer antibody response in comparison to infection (see figure)
- In multiple large epidemiologic studies, protection following infection was comparable to protection following vaccination
- Vaccination provides additional benefit for those with a history of SARS-CoV-2 infection
Persons with Hybrid Immunity are Better able to Neutralize Omicron than those with History of Infection or Vaccination Alone

- Omicron neutralization decreased substantially among both vaccinated individuals (A-D) and individuals with a history of prior infection (E-H)
- Neutralization titers were highest against the variant responsible for the initial infection (E-G)
- Neutralization of Omicron appeared to be best preserved in persons with a history of both infection and vaccination (H)
Correlates of Protection Might Differ Following Infection Versus Vaccination

- In a large U.K. study (n=>200,000), for a given antibody titer, level of protection against subsequent infection was higher for infected versus vaccinated (ChAdOx1 or BNT162b2)

From: Antibody responses and correlates of protection in the general population after two doses of the ChAdOx1 or BNT162b2 vaccines

https://www.nature.com/articles/s41591-022-01721-6
Protection Greater Among Persons With Previous Infection Than Vaccination — CA and NY

TABLE. Cohort sizes and cohort-specific incident laboratory-confirmed COVID-19 cases in California (N = 752,781) and New York (N = 355,819) — May 30–November 20, 2021

<table>
<thead>
<tr>
<th>State/Vaccination and diagnosis status*</th>
<th>No. of persons in each cohort (%)</th>
<th>No. (cumulative incidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>California</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccinated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous COVID-19 diagnosis</td>
<td>968,167 (4.5)</td>
<td>3,471 (3.6)</td>
</tr>
<tr>
<td>No previous diagnosis</td>
<td>15,484,235 (71.2)</td>
<td>240,045 (15.5)</td>
</tr>
<tr>
<td>Unvaccinated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous COVID-19 diagnosis</td>
<td>1,370,782 (6.3)</td>
<td>6,805 (5.0)</td>
</tr>
<tr>
<td>No previous diagnosis</td>
<td>3,911,146 (18.0)</td>
<td>502,460 (128.5)</td>
</tr>
<tr>
<td><strong>New York</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccinated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous COVID-19 diagnosis</td>
<td>485,649 (4.5)</td>
<td>2,355 (4.9)</td>
</tr>
<tr>
<td>No previous diagnosis</td>
<td>7,809,968 (72.2)</td>
<td>142,388 (18.2)</td>
</tr>
<tr>
<td>Unvaccinated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous COVID-19 diagnosis</td>
<td>527,140 (4.9)</td>
<td>3,250 (6.2)</td>
</tr>
<tr>
<td>No previous diagnosis</td>
<td>1,993,709 (18.4)</td>
<td>207,826 (104.2)</td>
</tr>
</tbody>
</table>


† Estimated hazard rate is laboratory-confirmed COVID-19-associated hospitalizations per 100,000 person-days visualized at midpoint of each reporting interval.

Studies have Shown Waning of Infection-induced Immunity Over Time

- Infection-induced immunity appears to wane at a slower rate in the first 6-9 months relative to immunity following primary series vaccination in those with no documented prior infection.

- Vaccination following infection further reduces risk of subsequent infection.

Figure 3: Estimated covariate-adjusted rates of confirmed infections per 100,000 at-risk days obtained from the Poisson regression analysis for the study period August 1, 2021, to September 30, 2021, stratified by sub-cohorts. Confidence intervals are not adjusted for multiplicity.
Waning of vaccine-induced immunity compared with infection-induced immunity (pre-Omicron in UK)

Without previous infection

Overall Risk of Reinfection Increased During the Omicron Wave

- **South Africa**: 2.4x increase in the hazard ratio for reinfection versus primary infection during Omicron as compared to the first wave

- **UK**: Vaccine effectiveness against symptomatic infection with Omicron was 0%-19% following 2-dose vaccination (Astra-Zeneca & Pfizer), 55-77% following 3-dose vaccination, and 19% for those with a history of prior infection

- **New York**: 84.4% of reinfections reported as of Feb 20, 2022, occurred after Dec 13, 2021

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Increased risk of SARS-CoV-2 reinfection associated with emergence of the Omicron variant in South Africa | medRxiv
2021-12-16-COVID19-Report-49.pdf (imperial.ac.uk)
Epidemiologic Data On Protection Against Omicron Infection – Czech Republic

- Both infection- and vaccination-induced (including booster) protection against Omicron lower than Delta and wanes quickly
- Hybrid immunity higher but also wanes

<table>
<thead>
<tr>
<th>Protection from Infection</th>
<th>Unvaccinated</th>
<th>Vaccinated &lt;2mo</th>
<th>Vaccinated &gt;2mo</th>
<th>Boosted &lt;2mo</th>
<th>Boosted &gt;2mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infect&lt;6 mo</td>
<td>68% (68-69%)</td>
<td>82% (75-87%)</td>
<td>86% (85-88%)</td>
<td>92% (89-94%)</td>
<td>82% (72-89%)</td>
</tr>
<tr>
<td>Infect&gt;6mo</td>
<td>13% (11-14%)</td>
<td>77% (76-78%)</td>
<td>45% (44-46%)</td>
<td>74% (73-75%)</td>
<td>48% (45-52%)</td>
</tr>
</tbody>
</table>
Protection against Hospitalization with Delta vs. Omicron, Including Persons with Hybrid Immunity

Using the same dataset

- Primary series vaccination alone provided limited protection during Omicron
- Persons with boosters or history of infection had greater protection
- Hybrid immunity generally appeared to offer even greater protection

<table>
<thead>
<tr>
<th>Effect ag. Hosp.</th>
<th>Omicron</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccination &lt;2mo</td>
<td>45% (29-57%)</td>
<td>75% (68-80%)</td>
</tr>
<tr>
<td>Vaccination &gt;2mo</td>
<td>29% (21-37%)</td>
<td>79% (78-81%)</td>
</tr>
<tr>
<td>Booster &lt;2mo</td>
<td>87% (84-88%)</td>
<td>98% (97-98%)</td>
</tr>
<tr>
<td>Booster&gt;2mo</td>
<td>79% (75-83%)</td>
<td>97% (95-98%)</td>
</tr>
<tr>
<td>Infection &lt;6mo</td>
<td>87% (73-94%)</td>
<td>100% (no case)</td>
</tr>
<tr>
<td>Infection &gt;6mo</td>
<td>92% (86-96%)</td>
<td>95% (93-96%)</td>
</tr>
</tbody>
</table>

Protection against hospitalization with Omicron:

<table>
<thead>
<tr>
<th>Protection from Hospitalization</th>
<th>Unvaccinated</th>
<th>Vaccinated &lt;2mo</th>
<th>Vaccinated &gt;2mo</th>
<th>Boosted &lt;2mo</th>
<th>Boosted &gt;2mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infect&lt;6 mo</td>
<td>87% (73-94%)</td>
<td>100% (no cases)</td>
<td>93% (49-99%)</td>
<td>100% (no cases)</td>
<td>72% (0-96%)</td>
</tr>
<tr>
<td>Infect&gt;6mo</td>
<td>92% (86-96%)</td>
<td>97% (80-100%)</td>
<td>90% (84-94%)</td>
<td>98% (95-99%)</td>
<td>97% (87-99%)</td>
</tr>
</tbody>
</table>

https://www.medrxiv.org/content/10.1101/2022.02.24.22271396v1.full-text
Protection from most to least
- 3 doses and + prior infection
- 2 doses + prior infection or 3 doses alone
- Prior infection alone
- 2 doses alone

For hospitalization, all provide high protection
- wide CI
- Lower for BA.1 among prior infection alone and 2 doses vaccine alone

https://www.medrxiv.org/content/10.1101/2022.03.22.22272745v1
Summary

- SARS-CoV-2 infection can cause severe disease, death, and long-term morbidity, whereas COVID-19 vaccination is safe and effective at preventing severe COVID-19 disease.
- History of infection appears to provide protection that is at least equivalent to primary series vaccination.
- Immunity following both vaccination and infection wanes over time, and both primary series vaccination and history of infection provided much lower protection during Omicron than during prior COVID-19 waves.
- Vaccination can boost the immune response in a previously infected individual.
- Hybrid immunity appears to be long-lasting and appears to have resulted in a greater ability to neutralize Omicron than either infection or vaccination alone.
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.
In vitro studies
Effector T-cell activity against wildtype (WT) and Omicron after infection, vaccination, or both

- T-cell activity against Omicron better preserved in prior infected, especially in hybrid
- T-cell activity against non-spike antigens higher in prior infected
- T-cell activity benefits from booster dose in prior infected and vaccinated

Memory B-cell Activity After Vaccination in Sars-cov-2 Naïve and Infected People

S+ (% of Bm): % of spike-binding memory b-cells

https://www.medrxiv.org/content/10.1101/2022.02.07.22270626v1.full-text
SARS-CoV-2-Neutralizing Serum Activity In Vaccinated And Convalescent Individuals

- NAb waning over time and reduced in Omicron vs Wuhan in both convalescent and vaccinated
- Vaccinating convalescent and 3rd mRNA vaccine boost Omicron nAb in both groups

https://www.nature.com/articles/s41591-021-01676-0
Neutralizing Antibody Titers Increase Following One Dose of Vaccine for Previously Infected People

https://www.science.org/doi/10.1126/sciimmunol.abi6950
Trends in Antibodies, T cells, and B cells in naïve and Previously Infected

- In naïve patients, antibodies wane but additional doses provide boost.
  - T cells and B cells show less waning than antibodies
- In infected patients, vaccines provide boost in antibodies and cellular response
  - Less waning than in naïve

Neutralizing Antibody Titers After Vaccination in Naïve Patients and After Vaccine Breakthrough Infections

B

vaccinated only
vaccinated-infected(omicron)
vaccinated-infected(delta)
vaccinated-infected(unknown/delta)-reinfected(omicron)

2 doses
3 doses
2 doses
3 doses
2 doses

Wuhan-1 delta omicron
Wuhan-1 delta omicron
Wuhan-1 delta omicron
Wuhan-1 delta omicron
Wuhan-1 delta omicron

7628 1453 92
65617 7079 3872
21907 9264 3000
45348 9724 11380
32052 10749 14911

SARS-CoV-2 neutralization after mRNA vaccination and variant breakthrough infection (medrxiv.org)
Epidemiologic Studies Pre-Omicron
Estimated Mean Time From Infection or 2\textsuperscript{nd} Vaccine Dose to Wane Below 67% Protection (Pre-Omicron)

- Same UK study
- Pfizer vaccine: 161-227 days
- Infection: 1-2 years

Sex and duration between vaccine doses

https://www.nature.com/articles/s41591-022-01721-6
Epidemiologic Data has also Shown Benefit of One-dose Vaccination Following Infection

- Large retrospective cohort study of previously infected in Israel (~150,000 participants aged ≥ 16y during Mar-Nov 2021)
- One BNT162b2 vaccine dose reduced risk of recurrent SARS-CoV-2 infection:
  - 82% lower risk among persons 16-64yrs
  - 60% lower risk among ≥65 yrs

Effectiveness of the BNT162b2 Vaccine after Recovery from Covid-19 (nejm.org)
Epidemiologic Studies With Omicron Data
Healthcare Worker Cohort Through Dec 27, 2021

- Protection against infection provided from previous infection or vaccination
- Hybrid immunity provided highest protection
SARS-CoV-2 Variants Update

Natalie Thornburg
Laboratory and Testing Task Force, CDC
FDA Update

Tim Stenzel
U.S. Food and Drug Administration (FDA)
U.S. Food and Drug Administration

- COVID-19 Emergency Use Authorization (EUA) Information for Medical Devices
  https://www.fda.gov/medical-devices/emergency-situations-medical-devices/emergency-use-authorizations

- COVID-19 In Vitro Diagnostic EUAs

- COVID-19 Frequently Asked Questions

- COVID-19 Updates

- FDA Townhall Meetings

- Independent Evaluations of COVID-19 Serological Tests
  https://open.fda.gov/apis/device/covid19serology/
COVID-19 Diagnostic Development
CDRH-EUA-Templates@fda.hhs.gov

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2. Then press star (*)

FDA MedWatch
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1-800-CDC-INFO (232-4636)

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