I-VAC Pediatric Learning Collaborative for COVID-19 Vaccination

Please use your first name and health center name when you join the session

Use the “chat” feature to let us know if you have a question

Please remember to **mute your microphone** unless speaking

If you can’t connect audio via computer or lose computer audio at anytime, you can call in to session at **(669) 900-6833, Meeting ID 836-7953-1057##**
Disclosures

• No one in a position to control the education content of the activity has any relevant financial disclosures with ineligible companies to disclose.

• What gets said here today may change based on new data and recommendations
  – Knowledge is shared more rapidly through ECHO
Agenda

- Bivalent vaccine
- Why Vaccinate
- Long COVID and kids
- COVID Update
COVID-19 Bivalent Boosters

COVID-19 Vaccine, Bivalent
Pediatric Schedule: Ages 6 months–4 Years

Ages 6 months–4 years
(Primary Series: Moderna)

Ages 6 months–4 years
(Primary Series: Pfizer-BioNTech)

ACIP meeting 10/19/2022.
Pediatric Schedule: Ages 5–11 Years

**Ages 5 years**
(Primary Series: Moderna or Pfizer-BioNTech)

- Primary
- 3-8 or 4-8 weeks*
- Primary
- At least 2 months
- ONLY Pfizer Bivalent Booster

Regardless of previous monovalent booster doses given

**Ages 6–11 years**
(Primary Series: Moderna or Pfizer-BioNTech)

- Primary
- 3-8 or 4-8 weeks*
- Primary
- At least 2 months
- Pfizer or Moderna Bivalent Booster

Regardless of previous monovalent booster doses given

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*I- VAC\[
\]

ACIP meeting 10/19/2022.
Pediatric Schedule: Ages 12-17 Years

Ages 12–17 years
(Primary Series: Moderna, Novavax, or Pfizer-BioNTech)

Primary ➔ 3-8 or 4-8 weeks* ➔ Primary

At least 2 months ➔ Pfizer or Moderna Bivalent Booster

Regardless of previous monovalent booster doses given

*3-8 week interval for Pfizer-BioNTech; 4-8 week interval for Moderna

ACIP meeting 10/19/2022.
Immunocompromised Hosts

- Essentially add one more dose

**Pediatric Schedule: Ages 6 months–4 Years (Moderately or Severely Immunocompromised)**

- Ages 6 months–4 years (Primary Series: Moderna)
  - 4 weeks → Primary
  - At least 4 weeks → Primary

- Ages 6 months–4 years (Primary Series: Pfizer-BioNTech)
  - 3 weeks → Primary
  - At least 8 weeks → Primary

**Pediatric Schedule: Ages 5–11 Years (Moderately or Severely Immunocompromised)**

- Ages 5 years (Primary Series: Moderna or Pfizer-BioNTech)
  - 3 or 4 weeks* → Primary
  - At least 4 weeks → Primary
  - At least 2 months → Primary
  - ONLY Pfizer-BioNTech

- Ages 6–11 years (Primary Series: Moderna or Pfizer-BioNTech)
  - 3 or 4 weeks* → Primary
  - At least 4 weeks → Primary
  - At least 2 months → Primary
  - ONLY Pfizer-BioNTech

**Pediatric Schedule: Ages 12–17 Years (Moderately or Severely Immunocompromised)**

- Ages 12–17 years (Primary Series: Moderna or Pfizer-BioNTech)
  - 3 or 4 weeks* → Primary
  - At least 4 weeks → Primary
  - At least 2 months → Primary
  - ONLY Pfizer-BioNTech

- Ages 12–17 years (Primary Series: Novavax)
  - 3 weeks → Primary
  - At least 2 months → Primary
  - ONLY Pfizer-BioNTech

*1 week interval for Novavax; 4-week interval for Moderan

# Booster Bivalent Vaccines

![Image](https://illinoisaap.org/wp-content/uploads/2022/10/4_2.png)

## STORAGE, HANDLING AND PREP:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Indications and Formulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vial Cap Color</td>
<td>ORANGE</td>
<td>GRAY</td>
<td>DARK BLUE with a GRAY label border</td>
</tr>
<tr>
<td>Preparation</td>
<td>Dilute</td>
<td>Do Not Dilute</td>
<td>Do Not Dilute</td>
</tr>
<tr>
<td>Dose Volume/Dose</td>
<td>0.2 mL/10 mcg</td>
<td>0.3 mL/30 mcg</td>
<td>6 to 11 years: 0.25 mL/25 mcg 12 years and older: 0.5 mL/50 mcg</td>
</tr>
<tr>
<td>Doses per Vial</td>
<td>10 booster after dilution</td>
<td>6 booster</td>
<td>Varies by age: 5 booster or 10 booster</td>
</tr>
<tr>
<td>ULT Freezer (-90°C to -60°C)</td>
<td>12 months</td>
<td>12 months</td>
<td>DO NOT STORE</td>
</tr>
<tr>
<td>Refrigerator (2°C to 8°C)</td>
<td>10 weeks</td>
<td>10 weeks</td>
<td>30 Days</td>
</tr>
<tr>
<td>Room Temperature (8°C to 25°C) including thaw time</td>
<td>12 hours prior to first puncture</td>
<td>12 hours prior to first puncture</td>
<td>24 hours</td>
</tr>
<tr>
<td>After First Puncture (2°C to 25°C)</td>
<td>Discard after 12 hours</td>
<td>Discard after 12 hours</td>
<td>Discard after 12 hours</td>
</tr>
</tbody>
</table>

For more information, please visit: [https://illinoisaap.org/wp-content/uploads/2022/10/4_2.png](https://illinoisaap.org/wp-content/uploads/2022/10/4_2.png)
UPDATED COVID-19 BOOSTERS ARE HERE!

Updated boosters provide increased protection against COVID-19

FOR WHO: People 5 years and older who completed a primary series

WHEN: At least 2 months after last COVID-19 vaccine dose

https://illinoisaap.org/wp-content/uploads/2022/10/4_2.png
Moderna Bivalent Compared to Monovalent

3rd Dose of Bivalent Beta Vaccine Elicited Higher Beta Neutralizing Antibody Responses than Monovalent and Prototype Vaccine through 6 Months
Study 205 Part A and Study 201 Part C, Per-Protocol Immunogenicity Set, No Prior Infection

Beta Neutralizing Antibody ID50 GMT

<table>
<thead>
<tr>
<th></th>
<th>Day 29</th>
<th>Day 181</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prototype mRNA-1273 (N = 149)</td>
<td>921</td>
<td>139</td>
</tr>
<tr>
<td>Monovalent Beta mRNA-1273.351 (N = 20)</td>
<td>1117</td>
<td>142</td>
</tr>
<tr>
<td>Bivalent Beta mRNA-1273.211 (N = 295)</td>
<td>1032</td>
<td>327</td>
</tr>
</tbody>
</table>

- 6.6-fold decrease
- 8.2-fold decrease
- 3.2-fold decrease

Bivalent Beta vs. Monovalent Beta
- Day 29 GMR 0.92
- Day 181 GMR 2.30

3. Moderna unpublished data.
Risk of Cardiac Problems: Infection Vs. Vaccine

Risk of heart complications* is higher after COVID-19 infection than after mRNA COVID-19 vaccination among males and females of all ages

TEEN BOYS (ages 12–17 years) had
2–6x
the risk of heart complications after infection compared to after vaccination†

YOUNG MEN (ages 18–29 years) had
7–8x
the risk of heart complications after infection compared to after vaccination†

COVID-19 vaccination is the best way to protect against COVID-19 and rare heart complications


* Myocarditis, pericarditis, or multisystem inflammatory syndrome among U.S. patients in 40 healthcare systems, Jan 1, 2021–Jan 31, 2022
† Compared with the risk after second dose of mRNA COVID-19 vaccine

Risk from vaccine for those under 12 around 2.5/million doses

MMWR April 8, 2022 / 71(14);517-523
https://www.cdc.gov/mmwr/volumes/71/wr/mm7114e1.htm?s_cid=mm7114e1_w
Definition of Long COVID or Post Acute SARS-CoV-2 Sequelae (PASC)

• No fully agreed upon definition
  - NIH: ongoing, relapsing, or new symptoms or other health effects occurring after the acute phase of SARS-CoV-2 infection that is present 4 or more weeks after the acute infection
  - CDC: post–COVID-19 conditions of new, recurring, or persistent health problems people experience 4 or more weeks after being infected with SARS-CoV-2
  - WHO: post–COVID-19 conditions occurring 3 or more months from the onset of SARS-CoV-2 infection that cannot be explained by an alternative diagnosis and last for at least 2 months

• Over 200 symptoms have been attributed to long COVID, many of them nonspecific and highly prevalent in the general population, such as fatigue, sleep disturbance, concentration difficulties, loss of appetite, and muscle or joint pain

JAMA Pediatr. 2022;176(10):1000-1009.
https://jamanetwork.com/journals/jamapediatrics/fullarticle/2795569?utm_campaign=articlePDF&utm_medium=articlePDFlink&utm_source=articlePDF&utm_content=jamapediatrics.2022.2800
PIDJ 2021;40:e482–e487.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8575095/
### Symptoms

Other changes in smell/taste  
Loss of smell  
Hair loss  
Chest pain  
Abnormal liver enzymes  
Generalized pain  
Anxiety symptoms  
Skin rashes  
Fatigue/malaise  
Fever/chills  
Cardiorespiratory signs/symptoms  
Diarrhea  
Respiratory failure  
Allergies  
Skin signs/symptoms  
Genitourinary signs/symptoms  
Nausea and vomiting  
General signs/symptoms

### Health conditions

- COVID-19
- Myocarditis
- Acute respiratory distress syndrome
- Myositis
- Mental health treatment
- Disorders of teeth/gingiva
- Other/lil-defined heart disease
- Fluid/electrolyte disturbance
- Thrombophlebitis and thromboembolism
- Acute kidney injury
- Tonsillitis
- Bronchiolitis
- Pneumonia
- Other specified inflammatory condition of skin
- Obesity
- Communication/motor disorders
- Gastroenteritis

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[1]

https://jamanetwork.com/journals/jamapediatrics/fullarticle/2795599?utm_campaign=articlePDF&utm_medium=articlePDFlink&utm_source=articlePDF&utm_content=jamapediatrics.2022.2800
Proportions for Syndromic, Systemic, and Medication Features of Post-acute Sequelae of SARS-CoV-2: EMR Retrospective Study in the US

<table>
<thead>
<tr>
<th>PASC feature</th>
<th>Persons, No.</th>
<th>Incidence proportion, % (95% CI)</th>
<th>Incidence proportion difference, % (95% CI)</th>
<th>Standardized morbidity ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Viral test result positive</td>
<td>Viral test result negative</td>
<td>Viral test result positive</td>
<td>Viral test result negative</td>
</tr>
<tr>
<td>Syndromic²</td>
<td>54061</td>
<td>548304</td>
<td>19.7 (19.4-20.0)</td>
<td>19.9 (19.8-20.0)</td>
</tr>
<tr>
<td>Systemic²</td>
<td>52027</td>
<td>529741</td>
<td>13.6 (13.3-13.9)</td>
<td>9.6 (9.5-9.7)</td>
</tr>
<tr>
<td>Medication</td>
<td>40742</td>
<td>425741</td>
<td>19.3 (18.9-19.7)</td>
<td>17.3 (17.2-17.4)</td>
</tr>
<tr>
<td>Syndromic or systemic³</td>
<td>50180</td>
<td>510045</td>
<td>28.7 (28.3-29.1)</td>
<td>26.1 (26.0-26.3)</td>
</tr>
<tr>
<td>Syndromic, systemic, or medication⁴</td>
<td>41756</td>
<td>424215</td>
<td>41.9 (41.4-42.4)</td>
<td>38.2 (38.1-38.4)</td>
</tr>
</tbody>
</table>

Kaplan-Meier Plot for Risk of Any Syndromic, Systemic, or Medication Feature of PASC

JAMA Pediatr. 2022;176(10):1000-1009.

https://jamanetwork.com/journals/jamapediatrics/fullarticle/2795569?utm_campaign=articlePDF&utm_medium=articlePDFlink&utm_source=articlePDF&utm_content=jamapediatrics.2022.2800
Risk Factors for Long COVID

- Children cared for in the intensive care unit during the acute illness phase
- Children younger than 5 years
- Children with complex chronic conditions

JAMA Pediatr. 2022;176(10):1000-1009.
https://jamanetwork.com/journals/jamapediatrics/fullarticle/2795569?utm_campaign=articlePDF&utm_medium=articlePDFlink&utm_source=articlePDF&utm_content=jamapediatrics.2022.2800
Proportion of Children and Adolescents with Persistent Symptoms after SARS-CoV-2 Infection: Controlled International Studies

<table>
<thead>
<tr>
<th>First author</th>
<th>Country</th>
<th>Study</th>
<th>Age (y)a</th>
<th>Timing</th>
<th>Cases</th>
<th>Controls</th>
<th>Prevalence of patients with persisting symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miller</td>
<td>UK</td>
<td>PCS</td>
<td>nr. ≤17</td>
<td>4w</td>
<td>8/174</td>
<td>72/4504</td>
<td>5%</td>
</tr>
<tr>
<td>Molteni</td>
<td>UK</td>
<td>PCS</td>
<td>median 13 (10-15)</td>
<td>4w</td>
<td>77/1734</td>
<td>15/1734</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8w</td>
<td>25/1734</td>
<td>nr</td>
<td>2%</td>
</tr>
<tr>
<td>Radtke</td>
<td>Switzerland</td>
<td>PCS</td>
<td>median 11 (nr)</td>
<td>4w</td>
<td>10/109</td>
<td>121/1246</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12w</td>
<td>4/109</td>
<td>28/1246</td>
<td>4%</td>
</tr>
<tr>
<td>Stephenson</td>
<td>UK</td>
<td>PCS</td>
<td>range 11-17</td>
<td>12w</td>
<td>2038/3065</td>
<td>1993/3739</td>
<td>53%</td>
</tr>
</tbody>
</table>

Studies with controls

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8575095/
Outcomes of Patients Hospitalized for Acute COVID-19 or MIS-C with Persistent Symptoms 2-4 Months after Hospitalization

Outcomes of Patients Hospitalized for Acute COVID-19 or MIS-C with Ongoing Activity Impairment 2-4 Months after Hospitalization

### Risk Factors Associated with Persistent Symptoms or Impaired Activity 2-4 Months After Hospitalization for COVID-19 or MIS-C

#### Acute COVID-19 Persistent Symptoms

<table>
<thead>
<tr>
<th>Number of Organ Systems Involved</th>
<th>Variable Group</th>
<th>Reference Group</th>
<th>Adjusted Risk Difference % (95% CI)</th>
<th>Adjusted Risk Ratio (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Organ Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Existing Condition</td>
<td>23/79 (29.1)</td>
<td>4/40 (10.0)</td>
<td>8 (2 to 14)</td>
<td>1.29 (1.04 to 1.59)</td>
<td>.02</td>
</tr>
<tr>
<td>Invasive Mechanical Ventilation</td>
<td>7/21 (33.3)</td>
<td>20/98 (20.4)</td>
<td>13 (0 to 26)</td>
<td>2.22 (0.82 to 5.96)</td>
<td>.12</td>
</tr>
<tr>
<td>Vasopressor-Dependent Shock</td>
<td>9/19 (47.4)</td>
<td>18/100 (18.0)</td>
<td>28 (-3 to 59)</td>
<td>0.58 (0.25 to 1.31)</td>
<td>.19</td>
</tr>
</tbody>
</table>

#### Acute COVID-19 Impaired Activity

<table>
<thead>
<tr>
<th>Number of Organ Systems Involved</th>
<th>Variable Group</th>
<th>Reference Group</th>
<th>Adjusted Risk Difference % (95% CI)</th>
<th>Adjusted Risk Ratio (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Organ Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Existing Condition</td>
<td>16/79 (20.3)</td>
<td>1/40 (2.5)</td>
<td>6 (1 to 12)</td>
<td>1.37 (1.06 to 1.78)</td>
<td>.02</td>
</tr>
<tr>
<td>Invasive Mechanical Ventilation</td>
<td>6/21 (28.6)</td>
<td>11/98 (11.2)</td>
<td>12 (3 to 22)</td>
<td>5.62 (0.79 to 40.16)</td>
<td>.09</td>
</tr>
<tr>
<td>Vasopressor-Dependent Shock</td>
<td>7/19 (36.8)</td>
<td>10/100 (10.0)</td>
<td>28 (-3 to 59)</td>
<td>0.87 (0.30 to 2.50)</td>
<td>.80</td>
</tr>
</tbody>
</table>

#### MIS-C Persistent Symptoms

<table>
<thead>
<tr>
<th>Number of Organ Systems Involved</th>
<th>Variable Group</th>
<th>Reference Group</th>
<th>Adjusted Risk Difference % (95% CI)</th>
<th>Adjusted Risk Ratio (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Organ Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Existing Respiratory Condition</td>
<td>10/19 (52.6)</td>
<td>19/111 (17.1)</td>
<td>35 (11 to 59)</td>
<td>3.09 (1.55 to 6.14)</td>
<td>.01</td>
</tr>
<tr>
<td>Other Pre-Existing Condition</td>
<td>3/30 (10.0)</td>
<td>19/111 (17.1)</td>
<td>-10 (-25 to 5)</td>
<td>0.51 (0.17 to 1.54)</td>
<td>.23</td>
</tr>
<tr>
<td>Obesity</td>
<td>12/50 (24.0)</td>
<td>20/101 (19.8)</td>
<td>6 (-8 to 20)</td>
<td>1.29 (0.68 to 2.46)</td>
<td>.44</td>
</tr>
<tr>
<td>Invasive Mechanical Ventilation</td>
<td>9/33 (27.3)</td>
<td>23/127 (18.1)</td>
<td>2 (-15 to 19)</td>
<td>0.98 (0.43 to 2.27)</td>
<td>.97</td>
</tr>
</tbody>
</table>

#### MIS-C Impaired Activity

<table>
<thead>
<tr>
<th>Number of Organ Systems Involved</th>
<th>Variable Group</th>
<th>Reference Group</th>
<th>Adjusted Risk Difference % (95% CI)</th>
<th>Adjusted Risk Ratio (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Organ Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Existing Respiratory Condition</td>
<td>4/19 (21.1)</td>
<td>21/111 (18.9)</td>
<td>0 (-18 to 18)</td>
<td>1.27 (1.02 to 1.57)</td>
<td>.03</td>
</tr>
<tr>
<td>Other Pre-Existing Condition</td>
<td>9/30 (30.0)</td>
<td>21/111 (18.9)</td>
<td>0 (-17 to 18)</td>
<td>0.98 (0.39 to 2.46)</td>
<td>.97</td>
</tr>
<tr>
<td>Obesity</td>
<td>20/50 (40.0)</td>
<td>13/101 (12.9)</td>
<td>23 (7 to 38)</td>
<td>1.03 (0.55 to 1.94)</td>
<td>.93</td>
</tr>
<tr>
<td>Invasive Mechanical Ventilation</td>
<td>11/33 (33.3)</td>
<td>23/127 (18.1)</td>
<td>4 (-13 to 21)</td>
<td>2.52 (1.35 to 4.69)</td>
<td>.004</td>
</tr>
</tbody>
</table>

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COVID Hospitalizations Highest in 6 Mos - 4 Years: We Need to Vaccinate This Age Group

Overcoming COVID-19: Effectiveness of maternal monovalent mRNA primary series in prevention of hospitalization among infants ages 0-5 months by variant period and timing of vaccination during pregnancy

<table>
<thead>
<tr>
<th>Variant period and timing of second dose during pregnancy</th>
<th>Adjusted VE (95% CI)</th>
<th>Delta predominance</th>
<th>Omicron predominance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>During Delta predominant period (July 1, 2021 to December 18, 2021)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any time</td>
<td>80 (60 to 90)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>First 20 weeks</td>
<td>68 (19 to 87)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>After 20 weeks</td>
<td>88 (68 to 96)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>During Omicron predominant period (December 19, 2021 to March 8, 2022)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any time</td>
<td>38 (8 to 58)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>First 20 weeks</td>
<td>25 (-26 to 56)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>After 20 weeks</td>
<td>57 (25 to 75)</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

- Maternal COVID-19 primary series vaccination protected infants ages 0-5 months from hospitalization for COVID-19
- Protection was lower during Omicron than Delta predominance

Questions?
Next Session: Tuesday, November 8th

For any questions, email us at
pgower@peds.bsd.uchicago.edu