



PEDIATRIC COVID-19 VACCINES: WHERE ARE WE NOW?

Rachel La Costa, PA-C, DMSc
Pediatric Hematology/Oncology PA
Adjunct PA Faculty

aapa2023

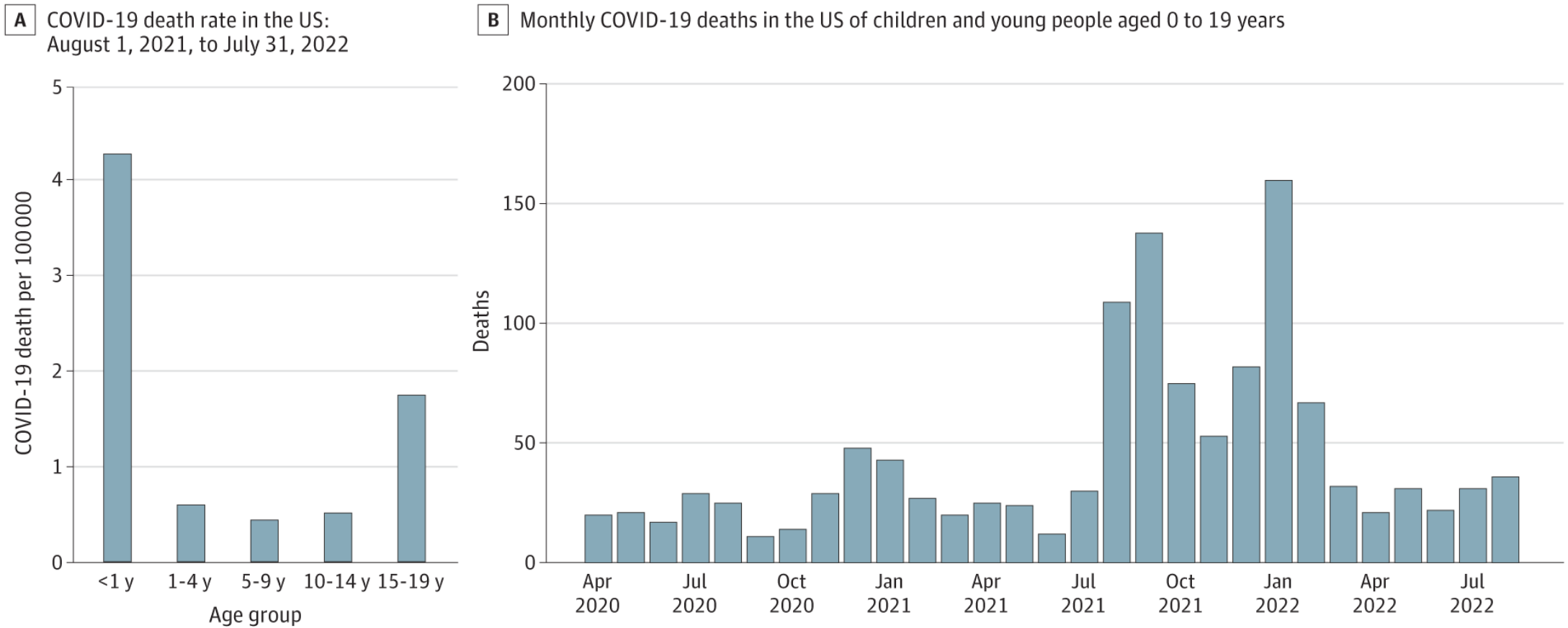
**AT THE CONCLUSION OF THIS SESSION,
PARTICIPANTS SHOULD BE ABLE TO:**

- Describe the guidelines for pediatric COVID-19 vaccination.
- Describe the effectiveness of COVID-19 vaccines in children.
- Identify the incidence of complications from COVID-19 vaccination in children.

COVID-19 IN CHILDREN

From: **Assessment of COVID-19 as the Underlying Cause of Death Among Children and Young People Aged 0 to 19 Years in the US**

JAMA Netw Open. 2023;6(1):e2253590. doi:10.1001/jamanetworkopen.2022.53590



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Table 1. Deaths Among Individuals Aged 0 to 19 Years

Leading causes of death (ICD-10 codes) ^a	Crude rate per 100 000	Deaths, No.	Rank	% Of all causes
#Certain conditions originating in the perinatal period (P00-P96)	12.7	10 387	1	25.7
#Accidents (unintentional injuries) (V01-X59, Y85-Y86)	9.1	7444	2	18.4
#Congenital malformations, deformations, and chromosomal abnormalities (Q00-Q99)	6.5	5286	3	13.1
#Assault (homicide) (*U01-*U02, X85-Y09, Y87.1)	3.4	2770	4	6.9
#Intentional self-harm (suicide) (*U03, X60-X84, Y87.0)	3.4	2756	5	6.8
#Malignant neoplasms (C00-C97)	2.1	1704	6	4.2
#Diseases of heart (I00-I09, I11, I13, I20-I51)	1.1	867	7	2.1
#COVID-19 (U07.1)	1.0	821	8	2.0
#Influenza and pneumonia (J09-J18)	0.6	472	9	1.2
#Cerebrovascular diseases (I60-I69)	0.4	297	10	0.7

^a Leading causes of death from the rankable causes on the National Center for Health Statistics 113 Selected Causes of Death List, for children and young people aged 0 to 19 years in 2019 in the US ranked, compared with COVID-19 deaths (August 1, 2021-July 31, 2022). COVID-19 was the eighth leading cause of death, and the fifth leading cause of death in disease-related causes of deaths (excluding unintentional injuries, assault, and suicide). The National Center for Health Statistics 113 Selected Causes of Death can be grouped into rankable causes of death, indicated by the # symbol. The * symbol indicates that U01-U03 are not ICD-10 codes but were introduced by NCHS in 2001 to classify deaths due to acts of terrorism.

From: **Assessment of COVID-19 as the Underlying Cause of Death Among Children and Young People Aged 0 to 19 Years in the US**

JAMA Netw Open. 2023;6(1):e2253590. doi:10.1001/jamanetworkopen.2022.53590

Table 2. Causes of Death Among Individuals Aged 0 to 19 Years: Certain Infectious and Parasitic Diseases and Diseases of the Respiratory System

Leading cause of death, certain infectious and parasitic diseases and diseases of the respiratory system (<i>ICD-10</i> code) ^a	No.		
	Crude rate (per 100 000)	Deaths, No.	Rank
#COVID-19 (U07.1)	1.0	821	1
#Influenza and pneumonia (J09-J18)	0.6	472	2
Other and unspecified infectious and parasitic diseases and their sequelae (A00, A05, A20-A36, A42-A44, A48-A49, A54-A79, A81-A82, A85.0-A85.1, A85.8, A86-B04, B06-B09, B25-B49, B55-B99, U07.1)	0.5	432	3
Other diseases of respiratory system (J00-J06, J30- J39, J67, J70-J98)	0.5	421	4
Pneumonia (J12-J18)	0.4	300	5
#Septicemia (A40-A41)	0.4	287	6
#Chronic lower respiratory diseases (J40-J47)	0.3	259	7
Certain other intestinal infections (A04, A07-A09)	0.3	223	8
Asthma (J45-J46)	0.3	206	9
Influenza (J09-J11)	0.2	172	10

^a Causes of death from the A00 to B99 (Certain infectious and parasitic diseases) and J00 to J98 (Diseases of the respiratory system) causes on the National Center for Health Statistics 113 Selected Causes of Death. Data are for children and young people aged 0 to 19 years in 2019 in the US ranked by number of deaths, compared with COVID-19 deaths (August 1, 2021-July 31, 2022). The National Center for Health Statistics 113 Selected Causes of Death can be grouped into rankable causes of death, indicated by the # symbol. Thus, categories overlap in the table, eg, pneumonia (*ICD-10* codes J12-J18) is a subset of the rankable cause #Influenza and pneumonia (J09-J18). COVID-19 was added as a rankable cause to the NCHS 113 Selected Causes of Death list in 2020.³




vaccines



Review

COVID-19 Epidemiology, Immunity, and Vaccine Development in Children: A Review

Jaime Fergie ¹, Mary M. Moran ², Alejandro Cane ², Shanti Pather ³, Özlem Türeci ³ and Amit Srivastava ^{4,*}

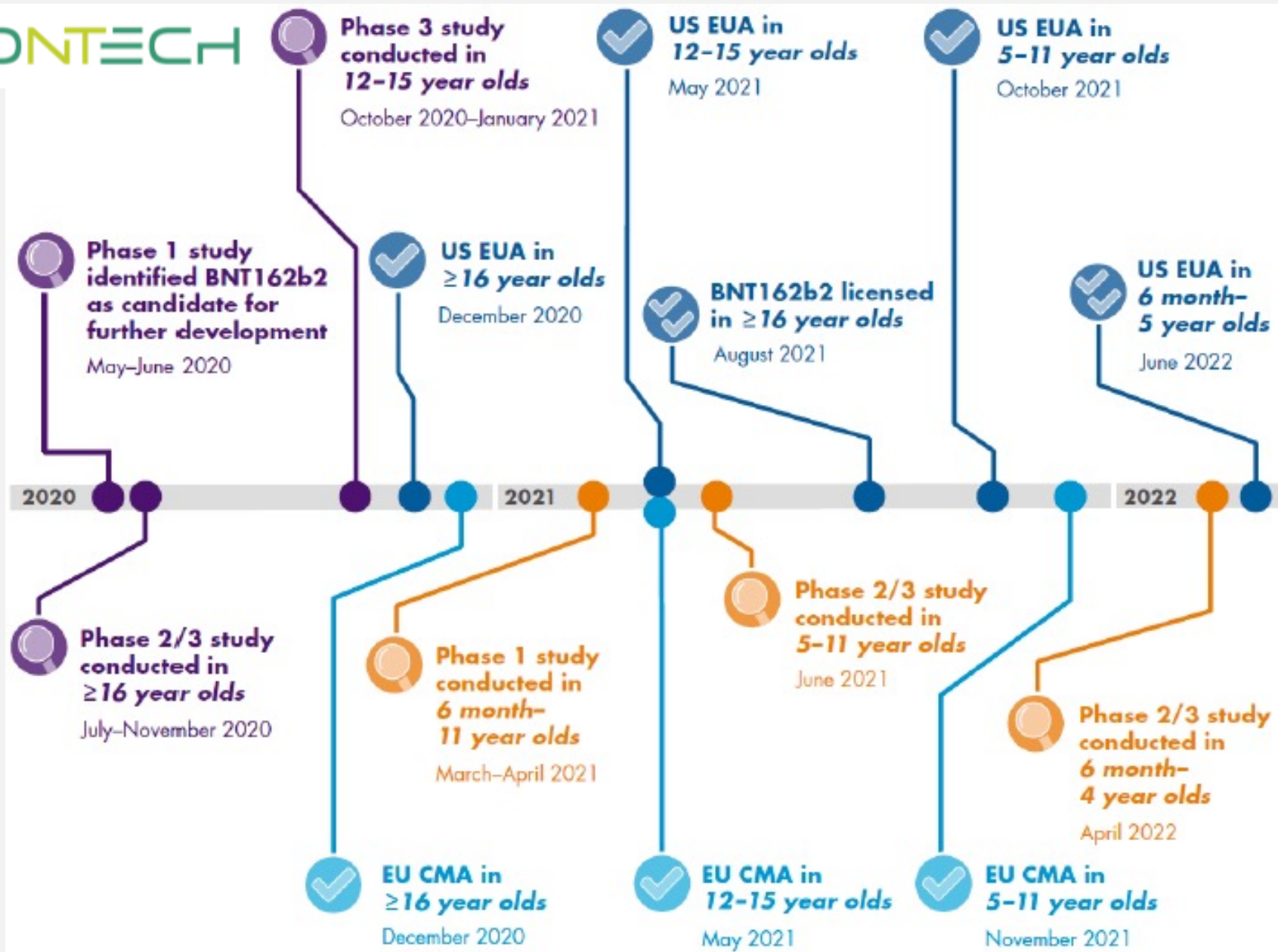


Figure 2. Timeline of the Development of BNT162b2 [46,47,51–57]. CMA, conditional marketing authorization; EUA, emergency use authorization.

COVID-19 VACCINES

mRNA Vaccines

Protein Subunit Vaccine





Children and teens aged 6 months–17 years

COVID-19 vaccine dosage is based on age on the day of vaccination, not on size or weight. Children get a smaller dose of COVID-19 vaccine than teens and adults.



Pfizer-BioNTech



AGE GROUP

6 MONTHS–4 YEARS

1st Dose
Pfizer-BioNTech
PRIMARY SERIES

2nd Dose
Pfizer-BioNTech
PRIMARY SERIES
3–8 weeks after 1st dose
More details: [Getting your 2nd dose](#)

3rd Dose
Pfizer-BioNTech
UPDATED (BIVALENT) PRIMARY SERIES
At least 8 weeks after 2nd dose

Up to Date: 2 weeks after 3rd dose; there is not a recommendation for an updated (bivalent) Pfizer-BioNTech booster for this age group

More details: [Staying up to date](#)



Children and teens aged 6 months–17 years

COVID-19 vaccine dosage is based on age on the day of vaccination, not on size or weight. Children get a smaller dose of COVID-19 vaccine than teens and adults.

Pfizer-BioNTech



AGE GROUP

5–11 YEARS

1st Dose **Pfizer-BioNTech**

PRIMARY SERIES

2nd Dose **Pfizer-BioNTech**

PRIMARY SERIES

3–8 weeks after 1st dose

More details: [Getting your 2nd dose](#)

3rd Dose **Pfizer-BioNTech**

UPDATED (BIVALENT) BOOSTER

At least 2 months after 2nd dose or last booster, children aged 5 years **can only get a Pfizer-BioNTech booster**, and children aged 6–11 years can get a Pfizer-BioNTech or Moderna booster.

Up to Date: Immediately after you have received the most recent booster recommended for you

More details: [Staying up to date](#)





Children and teens aged 6 months–17 years

COVID-19 vaccine dosage is based on age on the day of vaccination, not on size or weight. Children get a smaller dose of COVID-19 vaccine than teens and adults.

Pfizer-BioNTech



AGE GROUP

12–17 YEARS



1st Dose
Pfizer-BioNTech
PRIMARY SERIES

2nd Dose
Pfizer-BioNTech
PRIMARY SERIES
3–8 weeks after 1st dose
More details: [Getting your 2nd dose](#)

3rd Dose
Pfizer-BioNTech or Moderna
UPDATED (BIVALENT) BOOSTER
At least 2 months after 2nd dose or last booster

Up to Date: Immediately after you have received the most recent booster recommended for you
More details: [Staying up to date](#)



Children and teens aged 6 months–17 years

COVID-19 vaccine dosage is based on age on the day of vaccination, not on size or weight. Children get a smaller dose of COVID-19 vaccine than teens and adults.

Moderna



National Institutes of Health
Turning Discovery Into Health



AGE GROUP

6 MONTHS–5 YEARS

1st Dose
Moderna

PRIMARY SERIES

2nd Dose
Moderna

PRIMARY SERIES

4–8 weeks after 1st dose

More details: [Getting your 2nd dose](#)

3rd Dose
Moderna

UPDATED (BIVALENT) BOOSTER

At least 2 months after 2nd Moderna dose, children aged 6 months–4 years **can only get a Moderna booster**, and children aged 5 years can get a **Pfizer-BioNTech or Moderna updated booster**.

Up to Date: Immediately after receiving an updated (bivalent) booster

More details: [Staying up to date](#)





Children and teens aged 6 months–17 years

COVID-19 vaccine dosage is based on age on the day of vaccination, not on size or weight. Children get a smaller dose of COVID-19 vaccine than teens and adults.

Moderna



National Institutes of Health
Turning Discovery Into Health



AGE GROUP

6–17 YEARS



1st Dose
Moderna
PRIMARY SERIES

2nd Dose
Moderna
PRIMARY SERIES
4–8 weeks after 1st dose
More details: [Getting your 2nd dose](#)

3rd Dose
Pfizer-BioNTech or Moderna
UPDATED (BIVALENT) BOOSTER
At least 2 months after 2nd primary series dose

Up to Date: Immediately after receiving an updated (bivalent) booster
More details: [Staying up to date](#)



Children and teens aged 6 months–17 years

COVID-19 vaccine dosage is based on age on the day of vaccination, not on size or weight. Children get a smaller dose of COVID-19 vaccine than teens and adults.



Novavax



AGE GROUP

12-17 YEARS

Novavax is not authorized as a booster dose at this time.

1st Dose
Novavax
PRIMARY SERIES

2nd Dose
Novavax
PRIMARY SERIES
3-8 weeks after 1st dose
More details: [Getting your 2nd dose](#)

3rd Dose
Pfizer-BioNTech or Moderna
UPDATED (BIVALENT) BOOSTER
At least 2 months after 2nd primary series dose

Up to Date: Immediately after you have received the most recent booster recommended for you
More details: [Staying up to date](#)

COVID-19 VACCINES IN CHILDREN

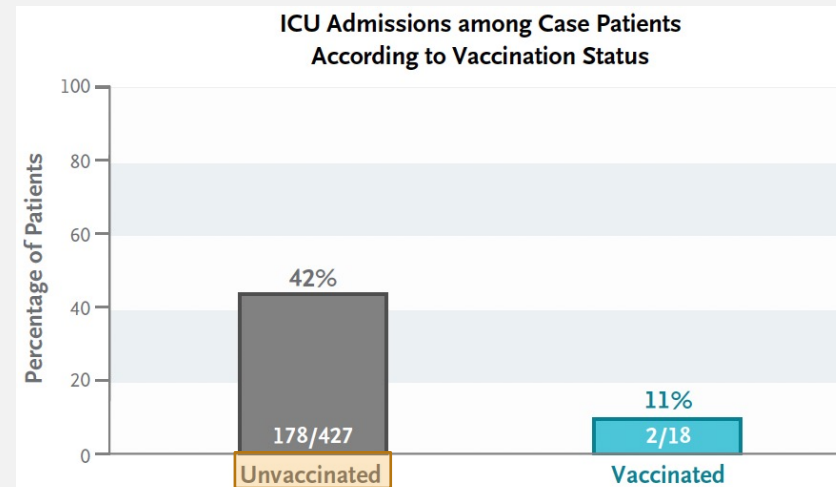
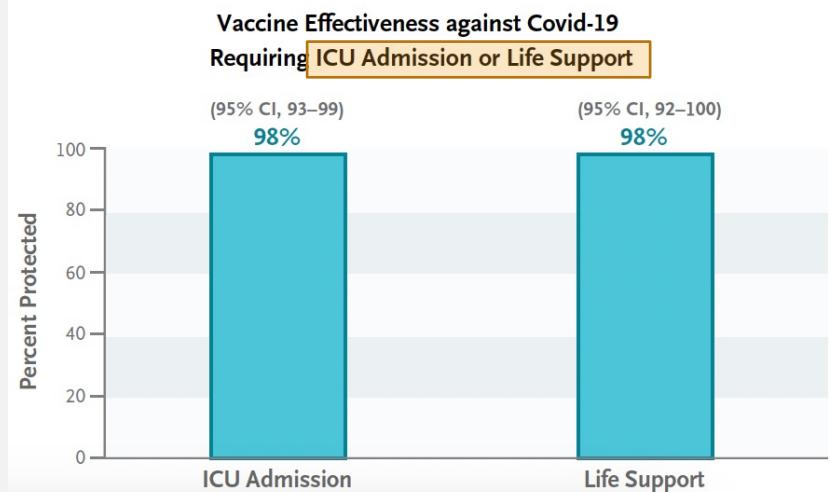
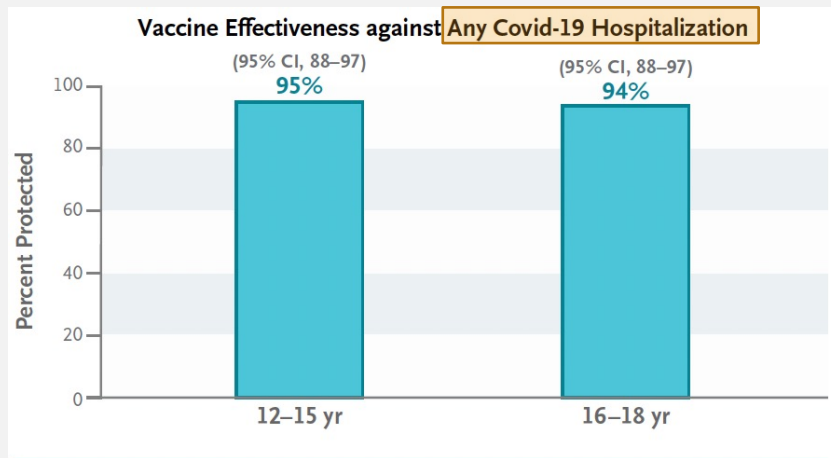
BENEFITS!

- Vaccines prevent hospitalization
- Vaccines prevent ICU admission

RESEARCH SUMMARY

Effectiveness of BNT162b2 Vaccine against Critical Covid-19 in Adolescents

Olson SM et al. DOI: 10.1056/NEJMoa2117995



CONCLUSIONS

Two doses of the BNT162b2 mRNA vaccine were highly effective against Covid-19–related hospitalization and critical illness among U.S. adolescents between 12 and 18 years of age.

COVID-19 VACCINES IN CHILDREN

BENEFITS!

- Vaccines prevent hospitalization
- Vaccines prevent ICU admission
- Vaccines prevent MIS-C!

COVID-19 vaccination protects against multisystem inflammatory syndrome in children (MIS-C) among 12–18 year-olds hospitalized during July–December 2021

01/07/2022

Vaccination reduced likelihood of MIS-C by:



ADOLESCENTS HOSPITALIZED WITH MIS-C

95% unvaccinated



No vaccinated MIS-C patients required life support



COVID-19 VACCINATION IS THE BEST PROTECTION AGAINST MIS-C



* Case-control study, 238 patients in 24 pediatric hospitals—30 U.S. states
† 2 doses of Pfizer-BioNTech vaccine received ≥ 28 days before hospital admission

bit.ly/MMWR7102

MMWR

COVID-19 VACCINES IN CHILDREN

BENEFITS!

- Vaccines prevent hospitalization
- Vaccines prevent ICU admission
- Vaccines prevent MIS-C!
- Vaccination during pregnancy transmits antibodies to fetus and protects against COVID-19 after birth

RISKS

- Vaccine myocarditis risk



COVID-19 vaccination* among pregnant people is associated with



about 60% reduced risk of COVID-19 hospitalization in babies younger than 6 months old

People who are pregnant, may become pregnant, or are breastfeeding should get vaccinated against COVID-19

bit.ly/MMWR7107e3

Test-negative, case-control study among infants at 20 pediatric hospitals in 17 states during July 1, 2021-January 11, 2022

* Completed a 2-dose primary mRNA COVID-19 vaccination series during pregnancy (dose 1 before pregnancy and dose 2 during or both doses during)

MMWR

02/15/2022

COVID-19 VACCINES IN CHILDREN

BENEFITS!

- Vaccines prevent hospitalization
- Vaccines prevent ICU admission
- Vaccines prevent MIS-C!
- Vaccination during pregnancy transmits antibodies to fetus and protects against COVID-19 after birth

RISKS

- Vaccine-induced myocarditis

Myocarditis and Pericarditis After mRNA COVID-19 Vaccination

Updated Sept. 27, 2022

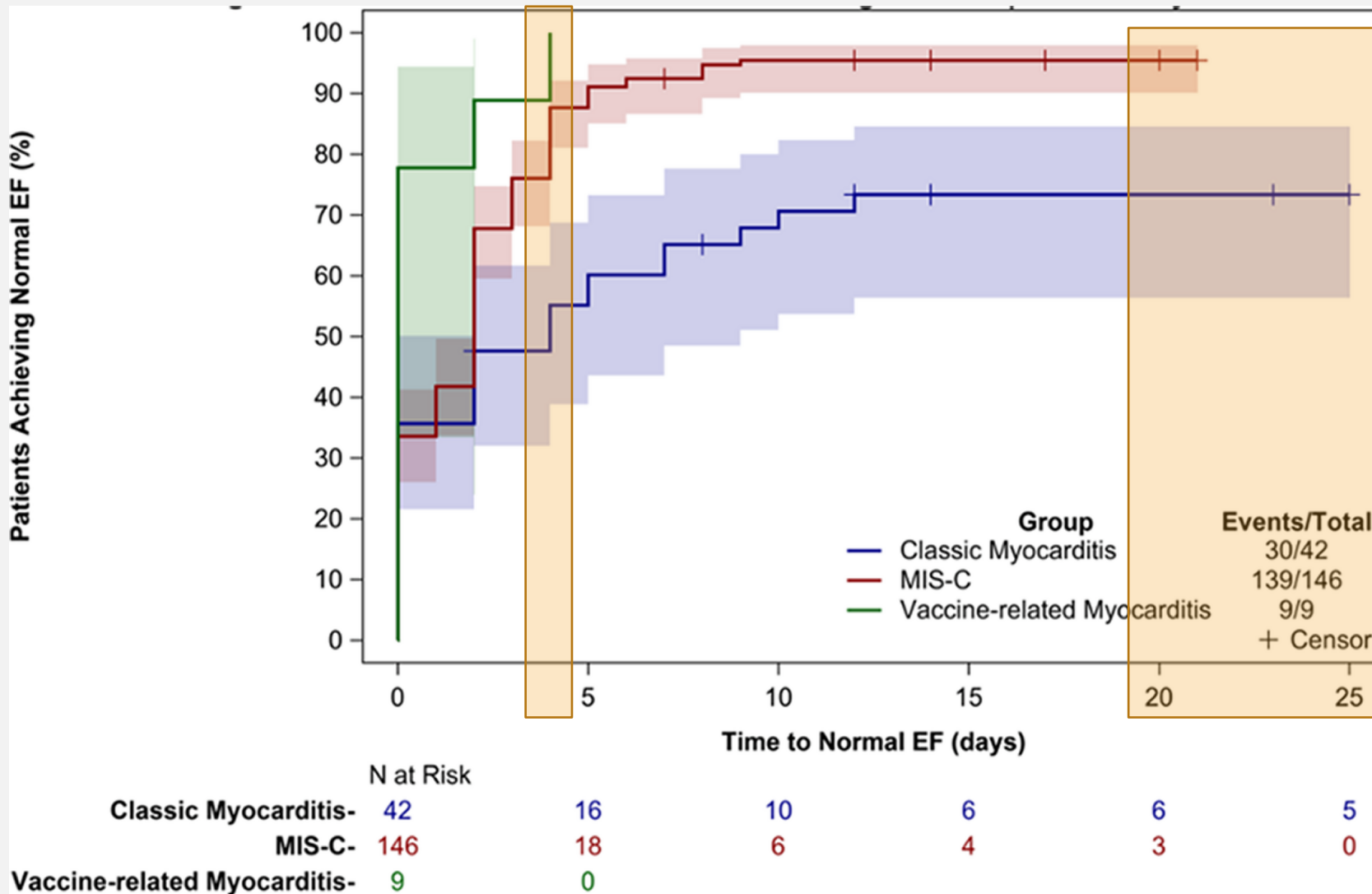
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Myocarditis and pericarditis **have rarely been reported**. When reported, the cases have especially been in **adolescents and young adult males** within several days after mRNA COVID-19 vaccination (Pfizer-BioNTech or Moderna).

- More often after the second dose
- Usually within a week of vaccination
- Most patients with myocarditis or pericarditis who received care responded well to medicine and rest and felt better quickly.
- Patients can usually return to their normal daily activities after their symptoms improve.
- Those who have been diagnosed with myocarditis should consult with their cardiologist (heart doctor) about return to exercise or sports.





Trisha Patel. Journal of the American Heart Association. Comparison of Multisystem Inflammatory Syndrome in Children–Related Myocarditis, Classic Viral Myocarditis, and COVID-19 Vaccine-Related Myocarditis in Children, Volume: 11, Issue: 9, DOI: (10.1161/JAHA.121.024393)

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“Despite the risks of myocarditis associated with vaccination,
the benefits of vaccination likely outweigh risks
in children and adolescents.”

Children and COVID-19 Vaccinations Trends

AAP Analysis of Data Posted by the Centers for Disease Control and Prevention
as of February 15, 2023

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN®



Status of COVID-19 Vaccinations for US Children as of 2.15.2023

Ages 6 months - 4 Years

- ❑ 2.0 million (12%) have received their initial dose of COVID-19 vaccine.
- ❑ At this time about 15.0 million have yet to receive their first vaccine. About 17,000 received their initial COVID-19 vaccine dose during the past week.
- ❑ Vaccination rates vary highly across states: In 19 states, over 12% have received their initial dose; in 18 states, under 10% have received their first vaccine.

Ages 5-11 Years

- ❑ 11.1 million (39%) have received their initial dose of COVID-19 vaccine.
- ❑ 9.1 million (32%) completed the 2-dose vaccination series.
- ❑ At this time about 17.5 million have yet to receive their initial COVID-19 vaccine dose. About 10,000 received their initial COVID-19 vaccine dose during the past week.
- ❑ Vaccination rates vary highly across states: In 10 states, over half have received their initial dose; in 21 states, under a third have received their first vaccine.

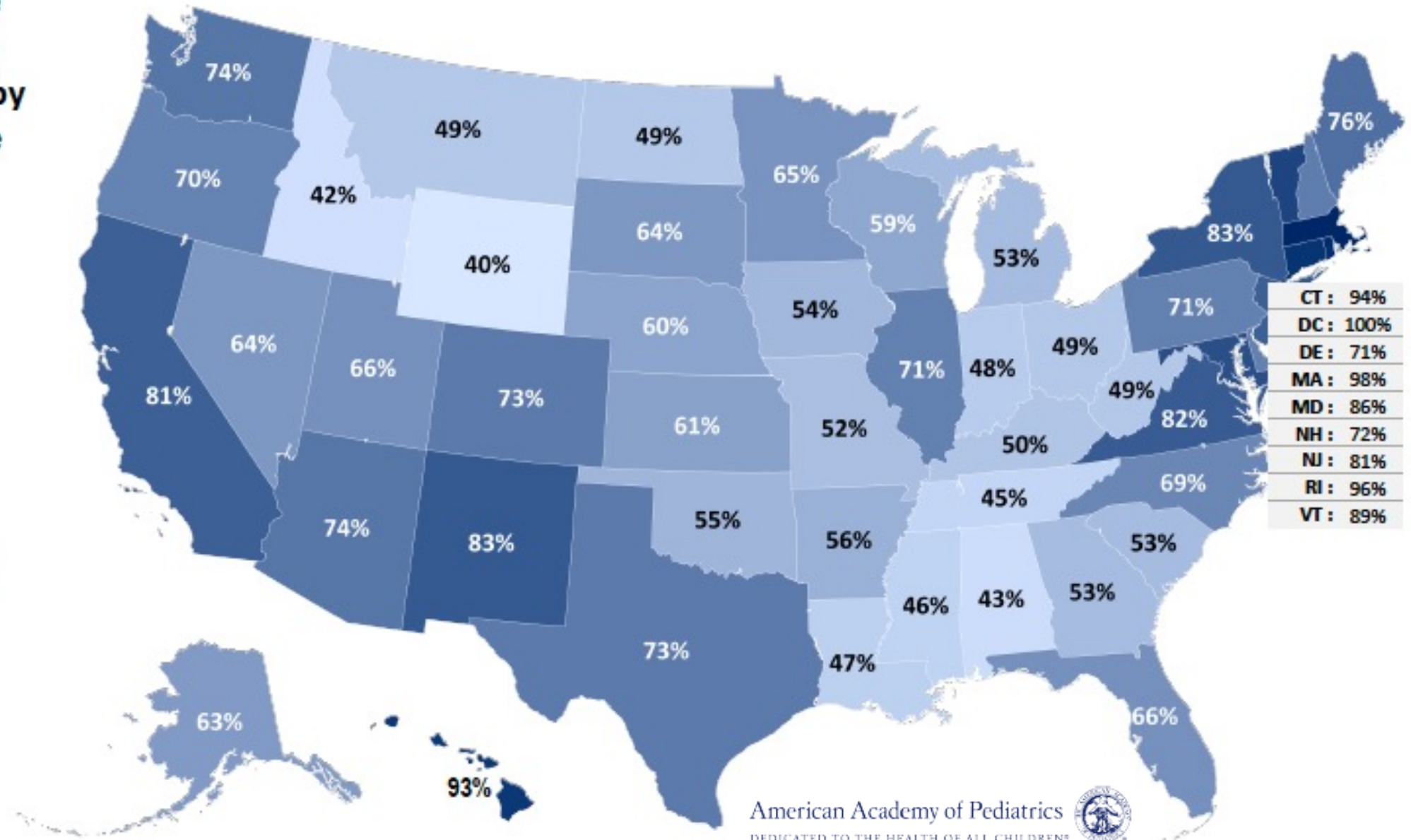
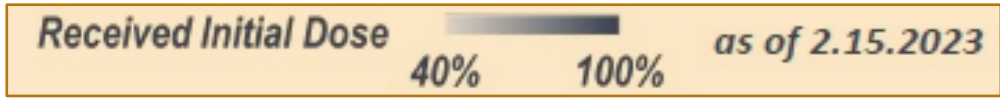
Ages 12-17 Years

- ❑ 17.8 million (68%) have received their initial dose of COVID-19 vaccine.
- ❑ 15.3 million (58%) completed the 2-dose vaccination series.
- ❑ At this time about 8.3 million have yet to receive their initial COVID-19 vaccine dose. About 8,000 received their initial COVID-19 vaccine dose during the past week.
- ❑ Vaccination rates vary highly across states: In 13 states, over 3 quarters have received their initial dose; in 11 states, under half have received their first vaccine.

Source: AAP analysis of data series titled "COVID -19 Vaccinations in the United States, Jurisdiction". CDC COVID -19 Data Tracker (URL: <https://data.cdc.gov/Vaccinations/COVID-19-Vaccinations-in-the-United-States-Jurisdiction/uns-k-b7fc>). Data cover the 50 states & D.C. Check state web sites for additional or more recent information.



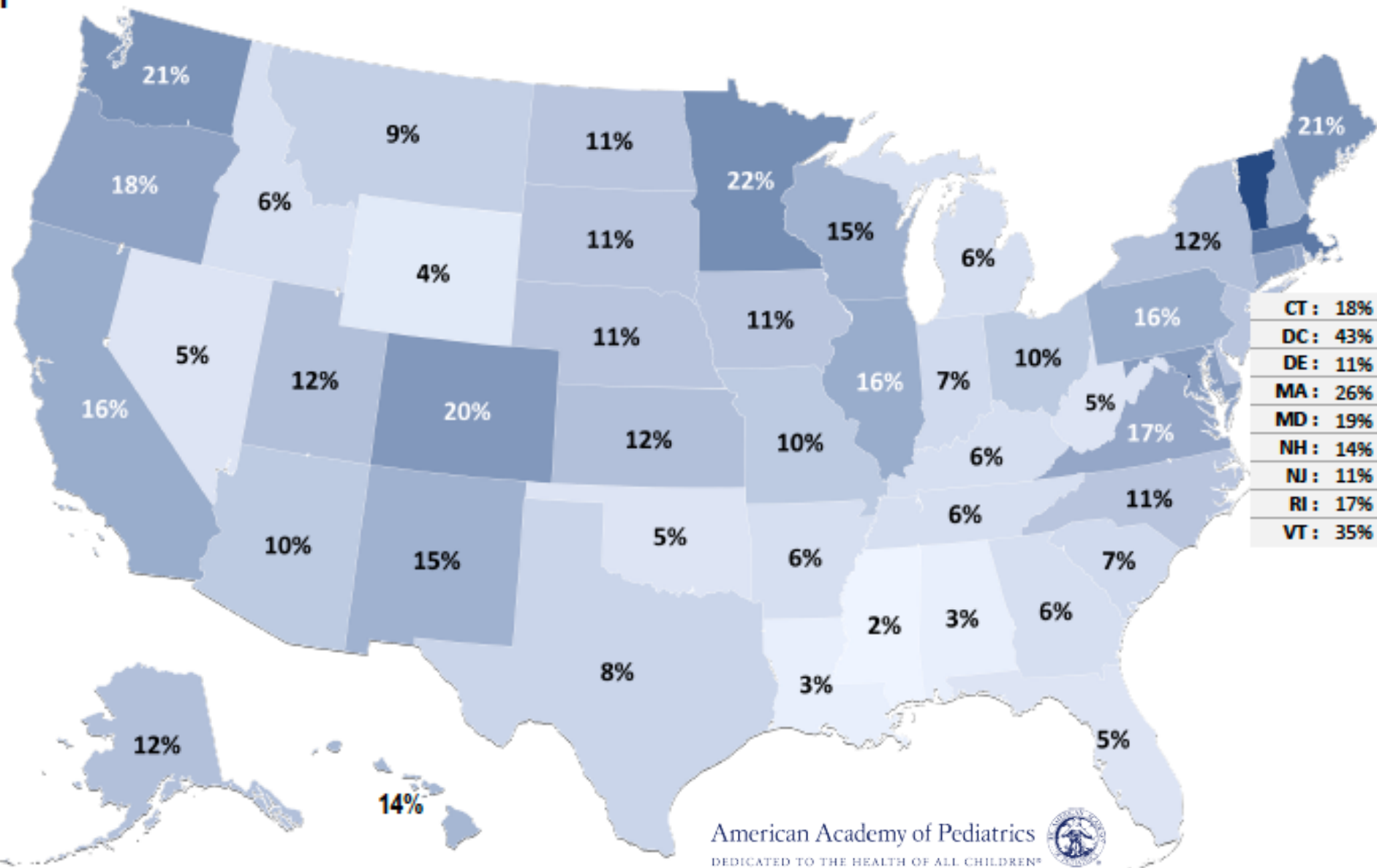
Proportion of US Children Ages 12-17 Who Received the Initial Dose of the COVID-19 Vaccine, by State of Residence



Source: AAP analysis of data series titled "COVID -19 Vaccinations in the United States, Jurisdiction". CDC COVID -19 Data Tracker (URL: <https://data.cdc.gov/Vaccinations/COVID-19-Vaccinations-in-the-United-States-Jurisdiction/unsk-b7fc>). Check state web sites for additional or more recent information.

Proportion of US Children Ages 6 Months - 4 Years Who Received the Initial Dose of the COVID-19 Vaccine, by State of Residence

Received Initial Dose  as of 2.15.2023
2% 43%



Note: Infants 6 months and older are estimated as half of infant population.

Source: AAP analysis of data series titled "COVID-19 Vaccinations in the United States, Jurisdiction". CDC COVID-19 Data Tracker (URL: <https://data.cdc.gov/Vaccinations/C OVID-19-Vaccinations-in-the-United-States-Jurisd/uns-k-b7fc>). Check state web sites for additional or more recent information.



Everyone 6 Months and Older Should Get a COVID-19 Vaccine

[COVID-19 vaccination has many benefits](#) and is an important tool to help protect you from [severe illness, hospitalization, and death](#).

Getting a COVID-19 vaccine after having COVID-19

Even if you or your child have had COVID-19, you should still get yourself or your child vaccinated.

- Getting a COVID-19 vaccine after having COVID-19 provides added protection against the virus that causes COVID-19.
- People who already had COVID-19 and do not get vaccinated after their recovery are more likely to get COVID-19 again than those who get vaccinated after their recovery.
- If you were given monoclonal antibodies or convalescent plasma while sick with COVID-19 you **do not** need to wait to get vaccinated.

Get a COVID-19 vaccine with your routine medical procedures and screenings

You can combine most procedures, screenings, and vaccinations at the same appointment when you get your COVID-19 vaccination. Talk to your healthcare provider if you have questions.

Children, teens, and adults **may get a COVID-19 vaccine and other vaccines, including a flu vaccine, at the same time.**

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PEDIATRIC COVID-19 VACCINES: WHERE ARE WE NOW?

Rachel La Costa, PA-C, DMSc
rachelmlacosta@gmail.com

Thank you!

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