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PEDIATRIC RESPIRATORY VIRUS UPDATE:

COVID-19, RSV, & FLU

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Disclosure

Dr. Tracie Newman has no relevant financial relationships with ineligible companies to disclose.

Objectives

01

Review pediatric virus trends, focusing on the range of severity, morbidity, and mortality of COVID-19 in children.

02

Review morbidity, mortality, and comparative epidemiologic burden of RSV and influenza in children.

03

Outline available evidence of prevention and treatment measures for COVID-19, RSV, and flu including recommended pediatric vaccine / medication schedules.

Fall and Winter Immunization Guide

COVID-19 and Flu Updated 2024-25 Vaccines

Everyone 6 months and older

RSV Immunization to Protect Babies

Vaccine

Pregnant women during weeks 32-36 of pregnancy during RSV season

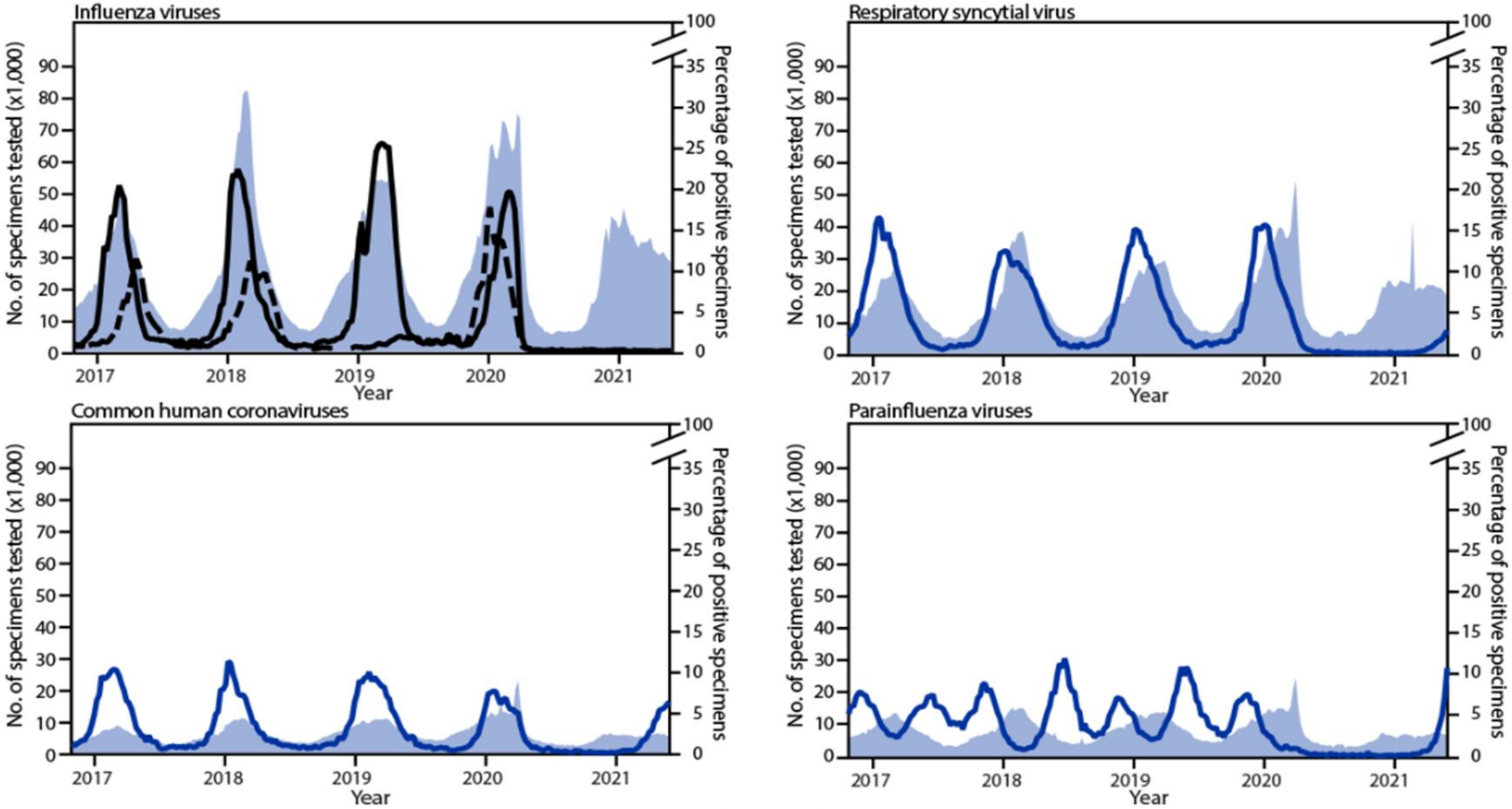
OR

Monoclonal Antibodies

Babies entering or born during the RSV season

CDC.gov

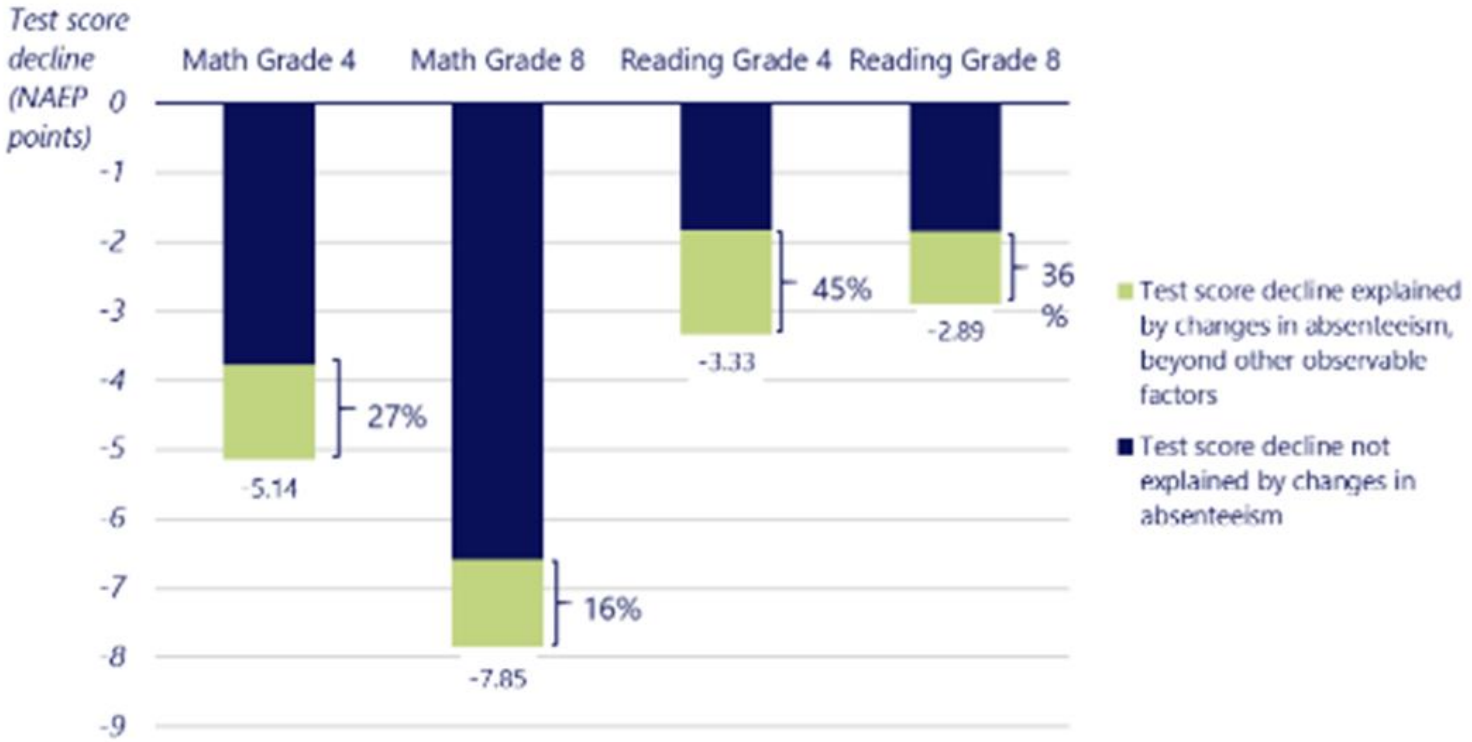
COVID-19 disrupted normal seasonality in ped resp virus infx



Chronic absences doubled from 2018-19 school year to 2021-22 school year

- Increases risk of:
  - Lower grades & standardized test scores
  - Dropping out of high school -> poor labor market prospects, diminished health, increased criminality

Figure 1. Role of Absenteeism in Test Score Declines 2019-2022



Council of Economic Advisers

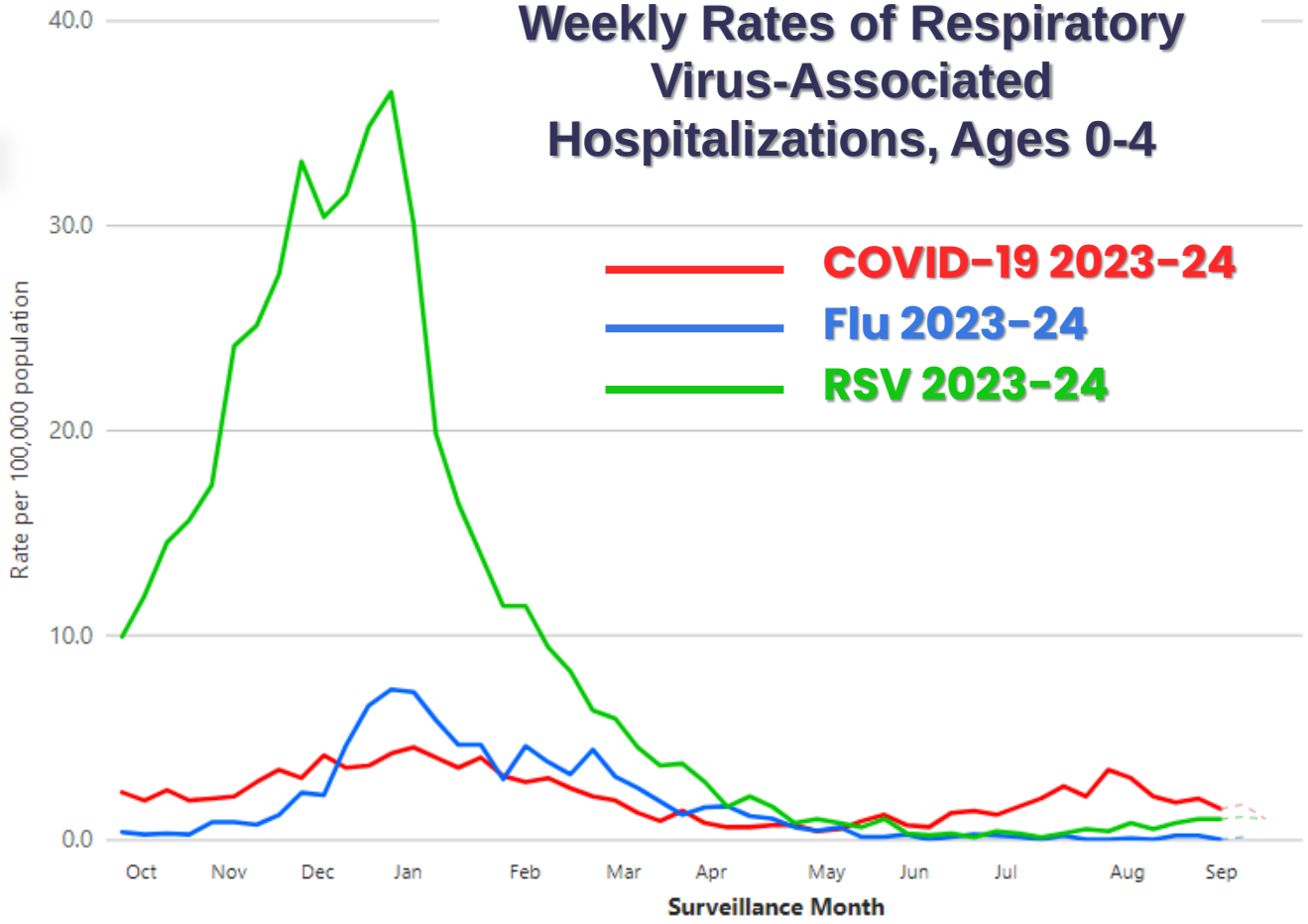
Source: CEA and NCES calculations in NAEP score points.

Note: Control variables include race/ethnicity, gender, English language proficiency, free and reduced price lunch status, number of books at home, and disability status. Students self-report days absent over the past month.

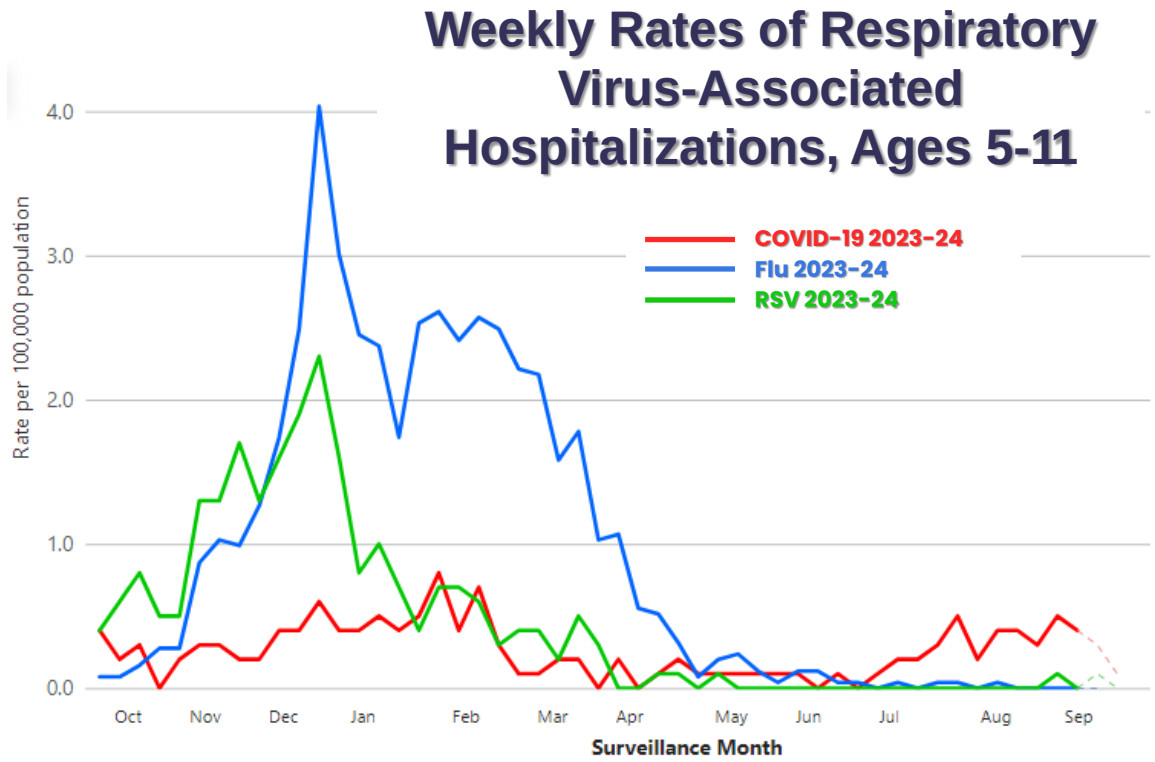
As of September 1, 2023 at 3:44pm.

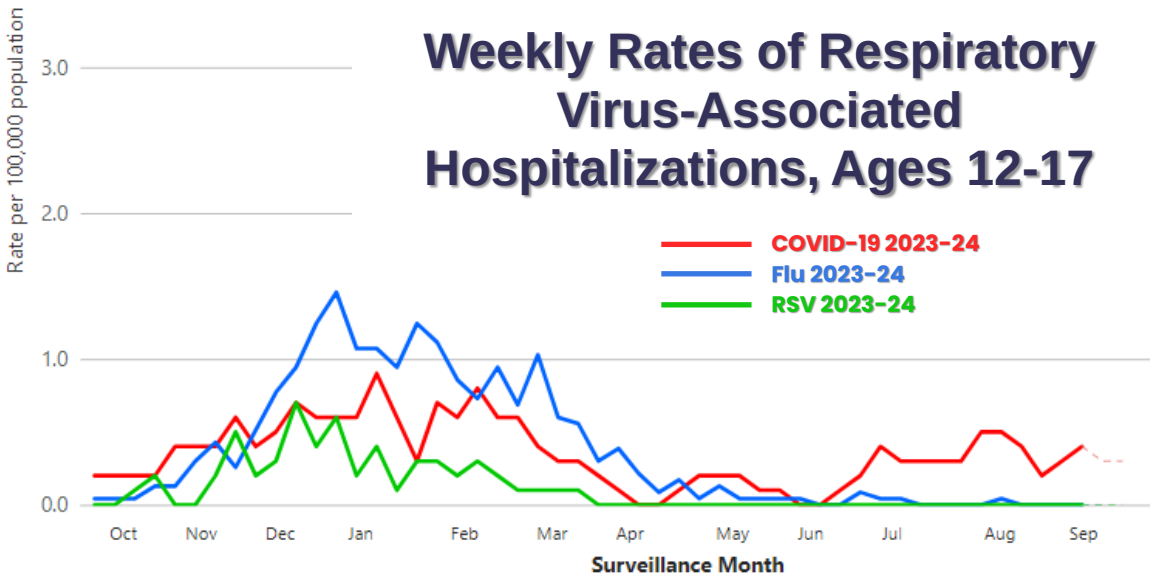
White House – CEA, Written Materials, Published 9/13/2023

Greatest threat of hospitalization varies by age group and time



*NOTE: Scale changes on 0-4 graph.





CDC RESP-NET Interactive Dashboard, updated 10/4/2024

Concerning Trends in Americans Vaccine Attitudes and Beliefs

Only 40%

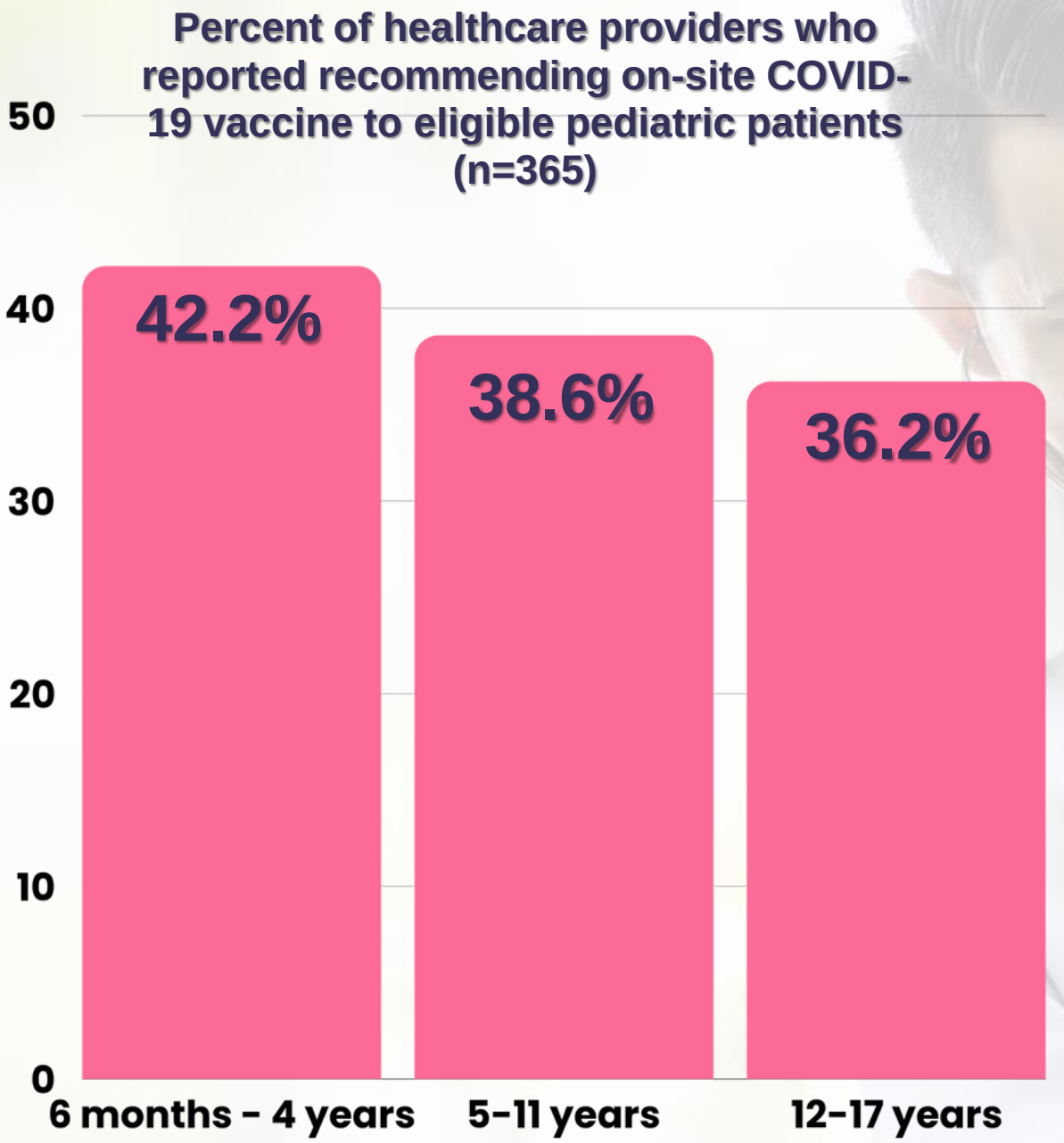
Of Americans consider it extremely important for parents to have their children vaccinated – *down from 58% in 2019 and 64% in 2001*

1 in 5 Americans say vaccines are more dangerous than the diseases they are designed to prevent – *up from 11% in 2019 and 6% in 2001.*

Jones, Gallup, 2024

THE GOOD NEWS.

As a healthcare provider, YOU are patients most trusted source of vaccine information.

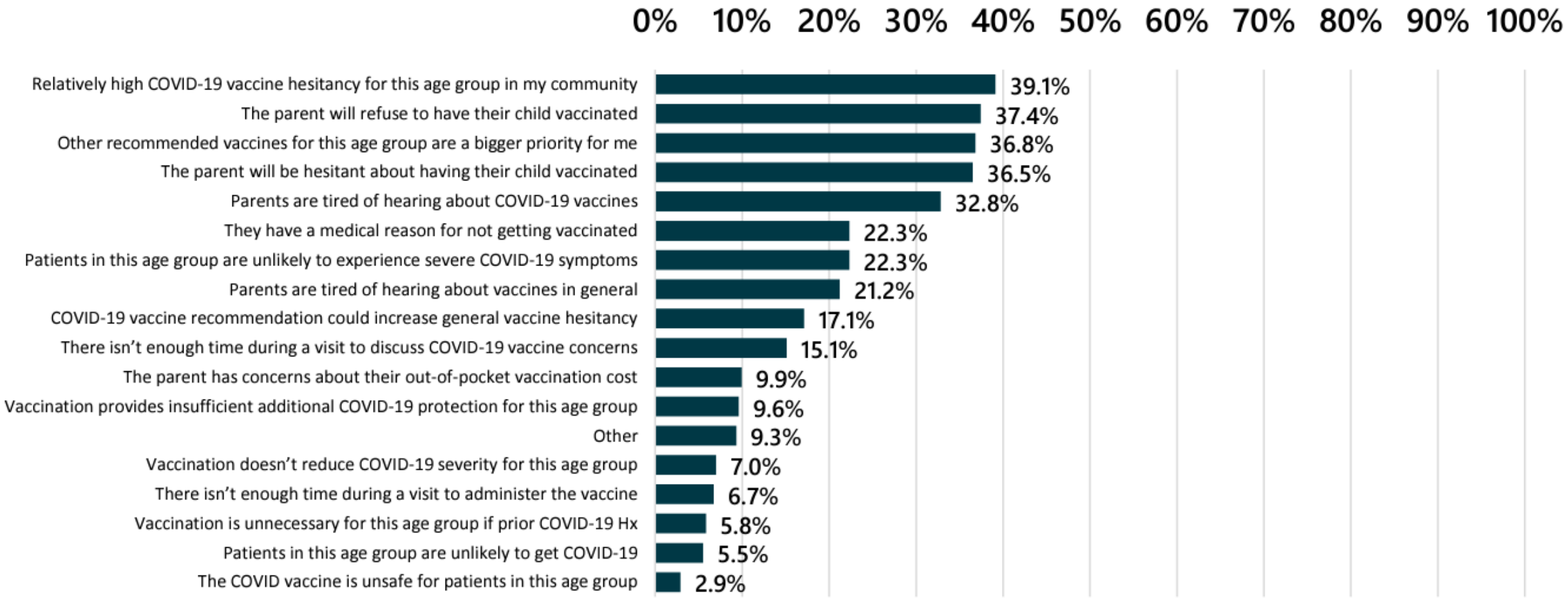


Around 40% of healthcare providers never or only sometimes recommended the COVID-19 vaccine to eligible pediatric patients.

HaPPI Survey Collaborative, University of Iowa; RAND Corporation; CDC

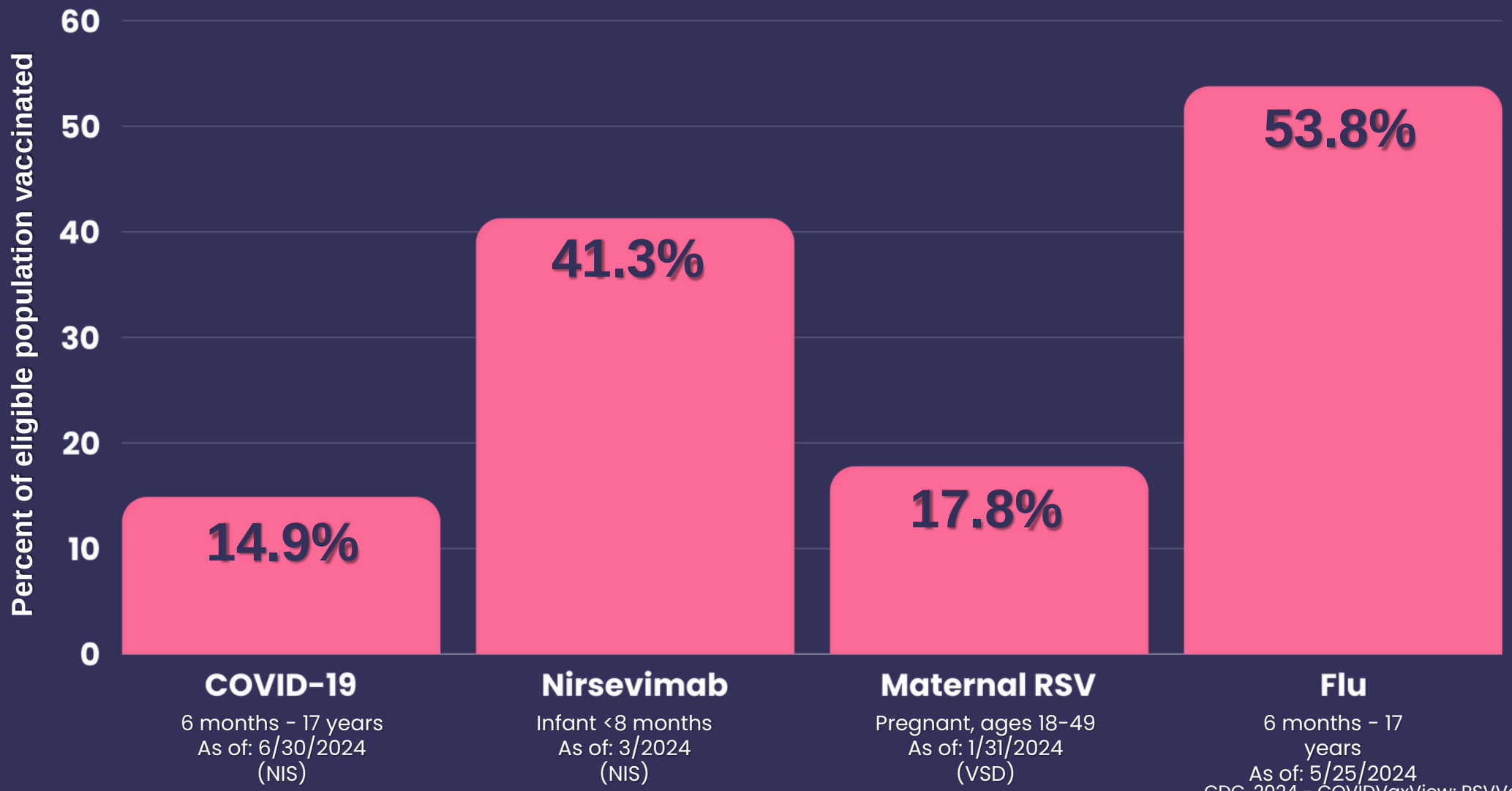
Healthcare providers report anticipated vaccine hesitancy or refusal as top reasons for not recommending COVID-19 vaccine

Reasons reported for NOT recommending COVID-19 vaccine to eligible pediatric patients (n=345)



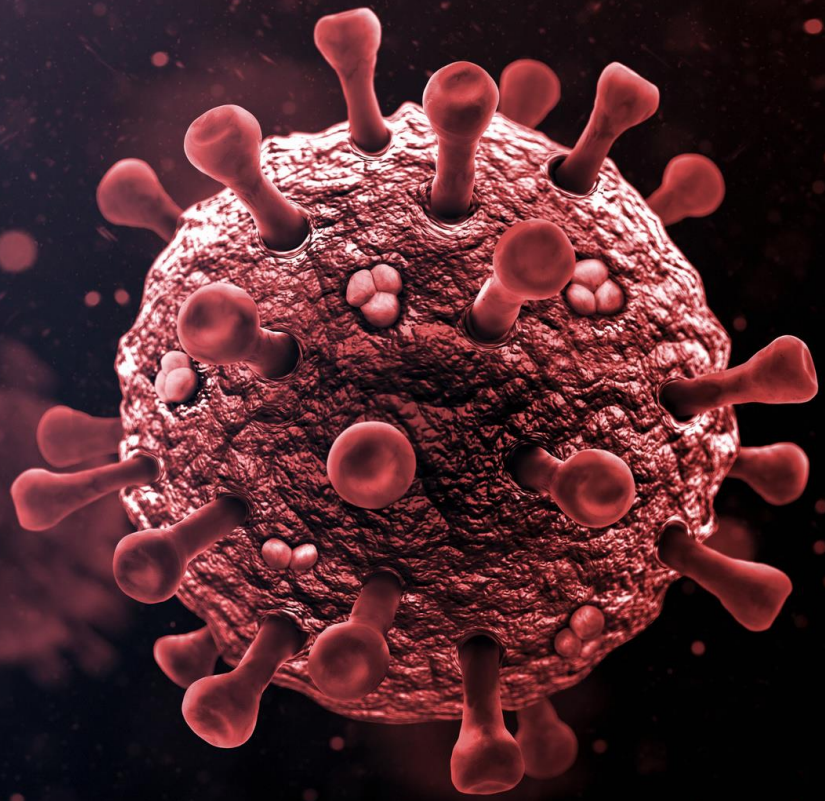
HaPPI Survey Collaborative, University of Iowa; RAND Corporation; CDC

How did we do last season in the U.S.?



CDC, 2024 - COVIDVaxView; RSVVaxView; FluVaxView

COVID-19



Polling Question

True or False?

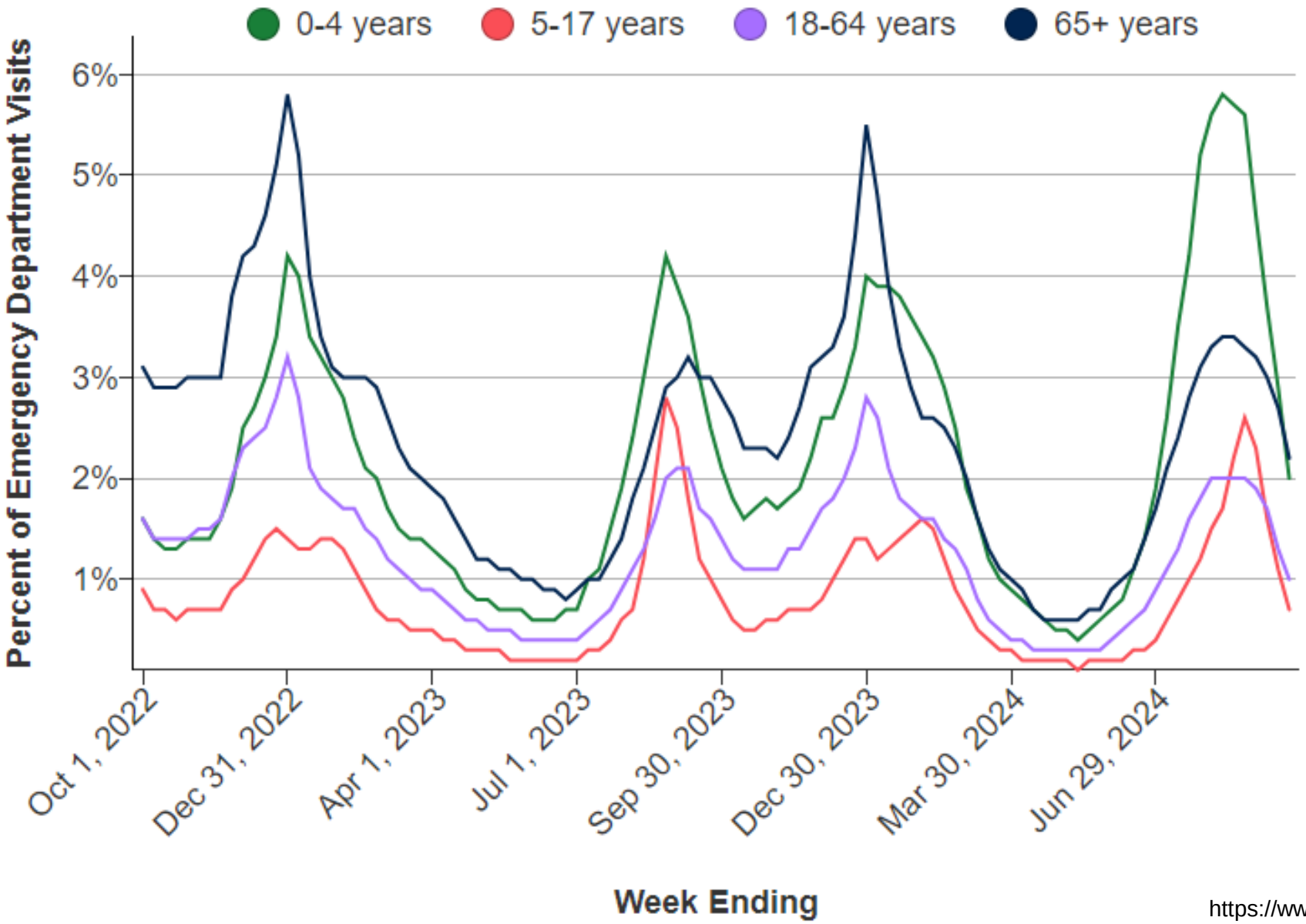
From July 2023 to March 2024, the vast majority of children hospitalized for COVID-19 in the U.S. had an underlying medical condition.

Polling Question

True or False?

From July 2023 to March 2024, the vast majority of children hospitalized for COVID-19 in the U.S. had an underlying medical condition.

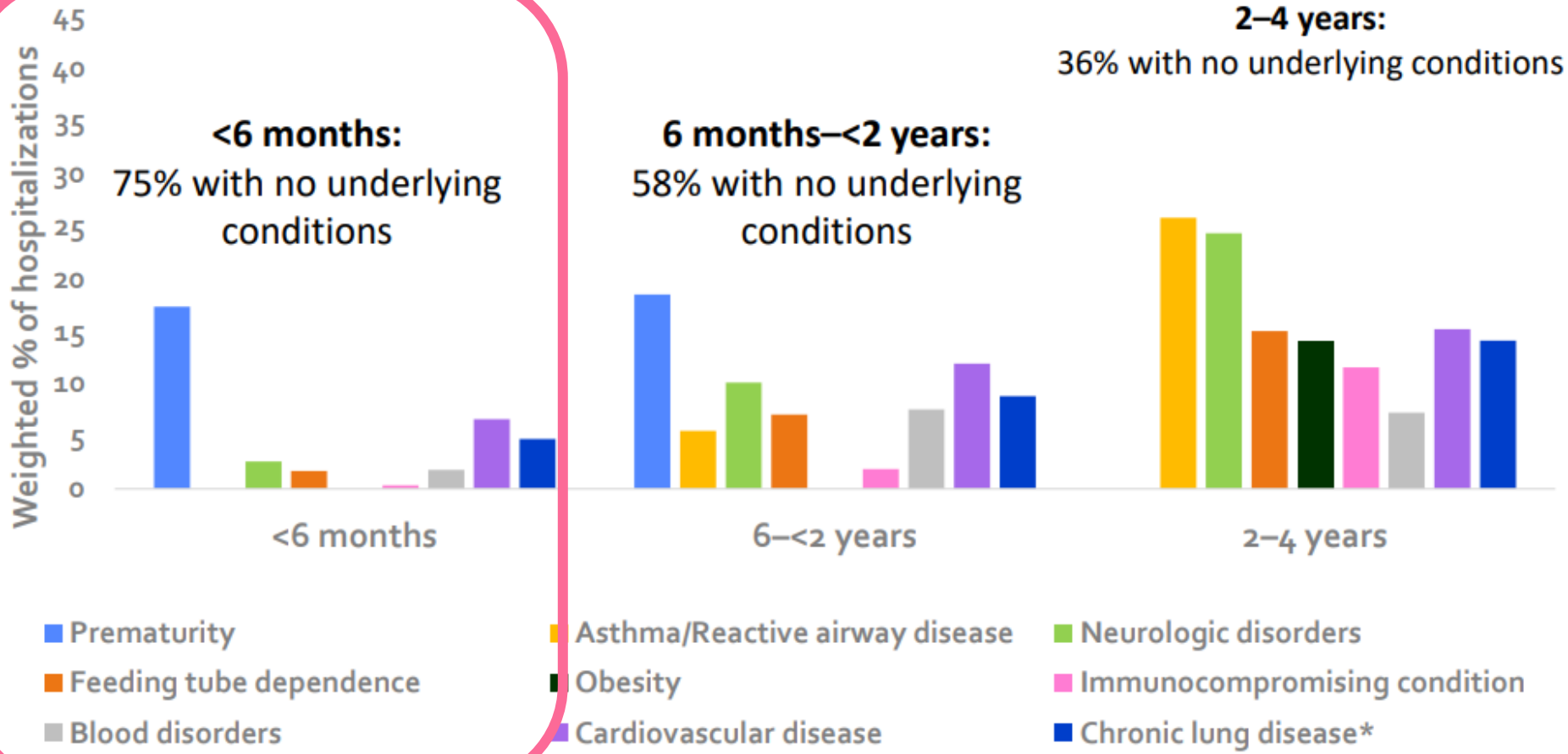
Highest percent of ED visits for COVID-19: Kids 0-4 years



COVID-19 sent kids under 4 to the ED more than any other age group, including the elderly.

https://www.cdc.gov/respiratory-viruses/data/most-impacted.html

Underlying Medical Conditions among Infants and Children Ages ≤4 Years with COVID-19-associated Hospitalization, by Age Group — COVID-NET, July 2023–March 2024



50%
of children who were *hospitalized* for COVID

40%
of children who were *admitted to the ICU* for COVID

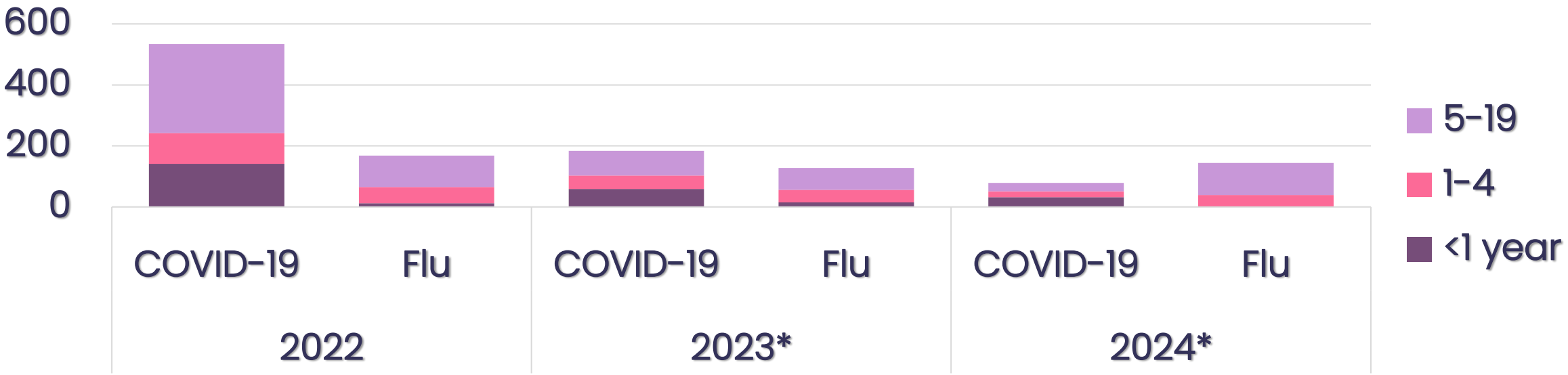
had no underlying medical conditions

Data are limited to hospitalizations where COVID-19 is a likely primary reason for admission.

** Not including not asthma or reactive airway disease. Among children <2 years old, chronic lung disease includes bronchopulmonary dysplasia and chronic lung disease of prematurity.*

Pediatric COVID-19 deaths have decreased since 2022; however, influenza deaths may be on the rise

Total number of COVID-19 and influenza-associated deaths by year and age group, 2022-2024



CDC Wonder Online Database, accessed 10/9/2024.

***2023 data is provisional; 2024 data is provisional and partial.**

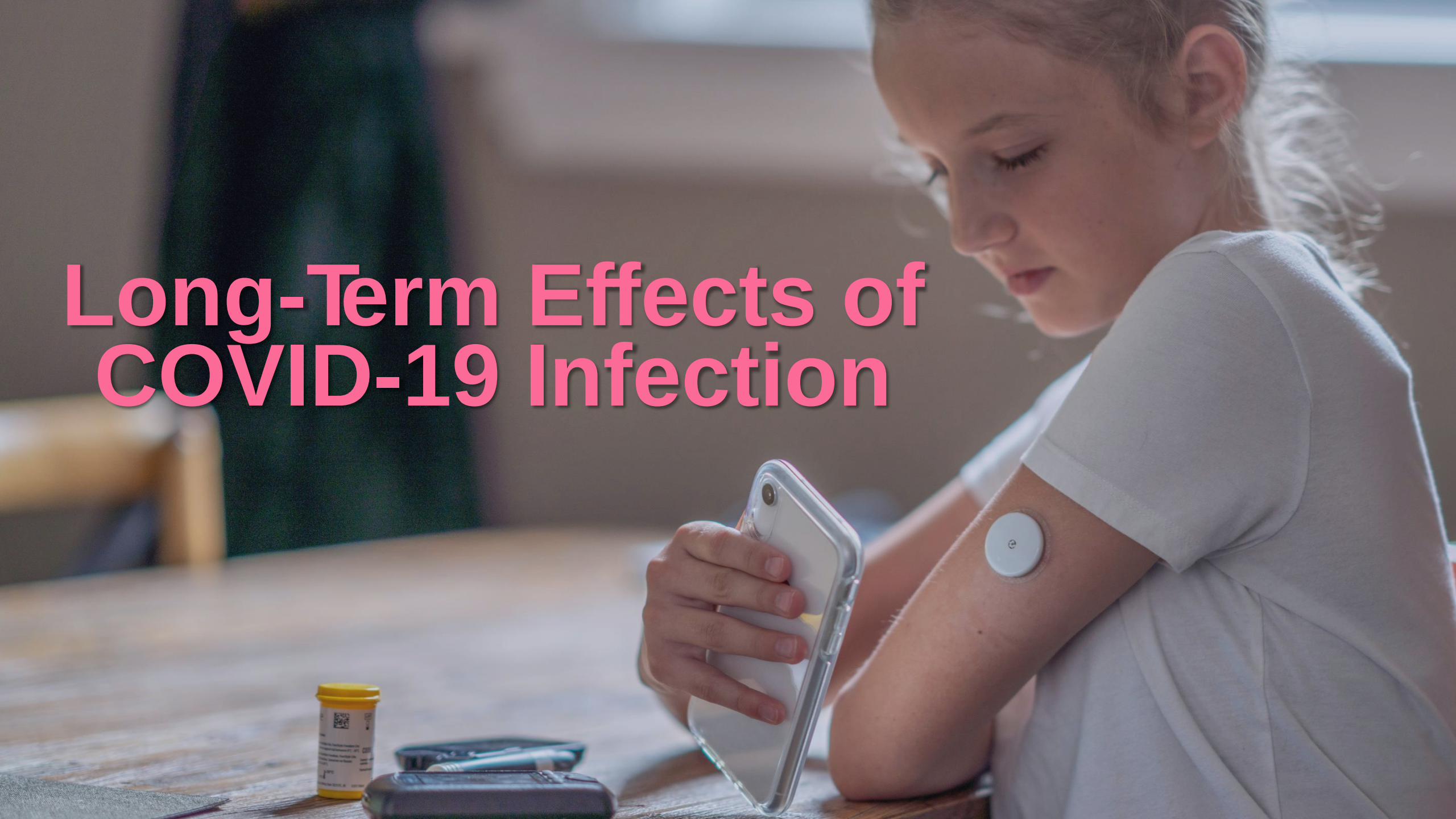
Pediatric Vaccine Preventable Diseases

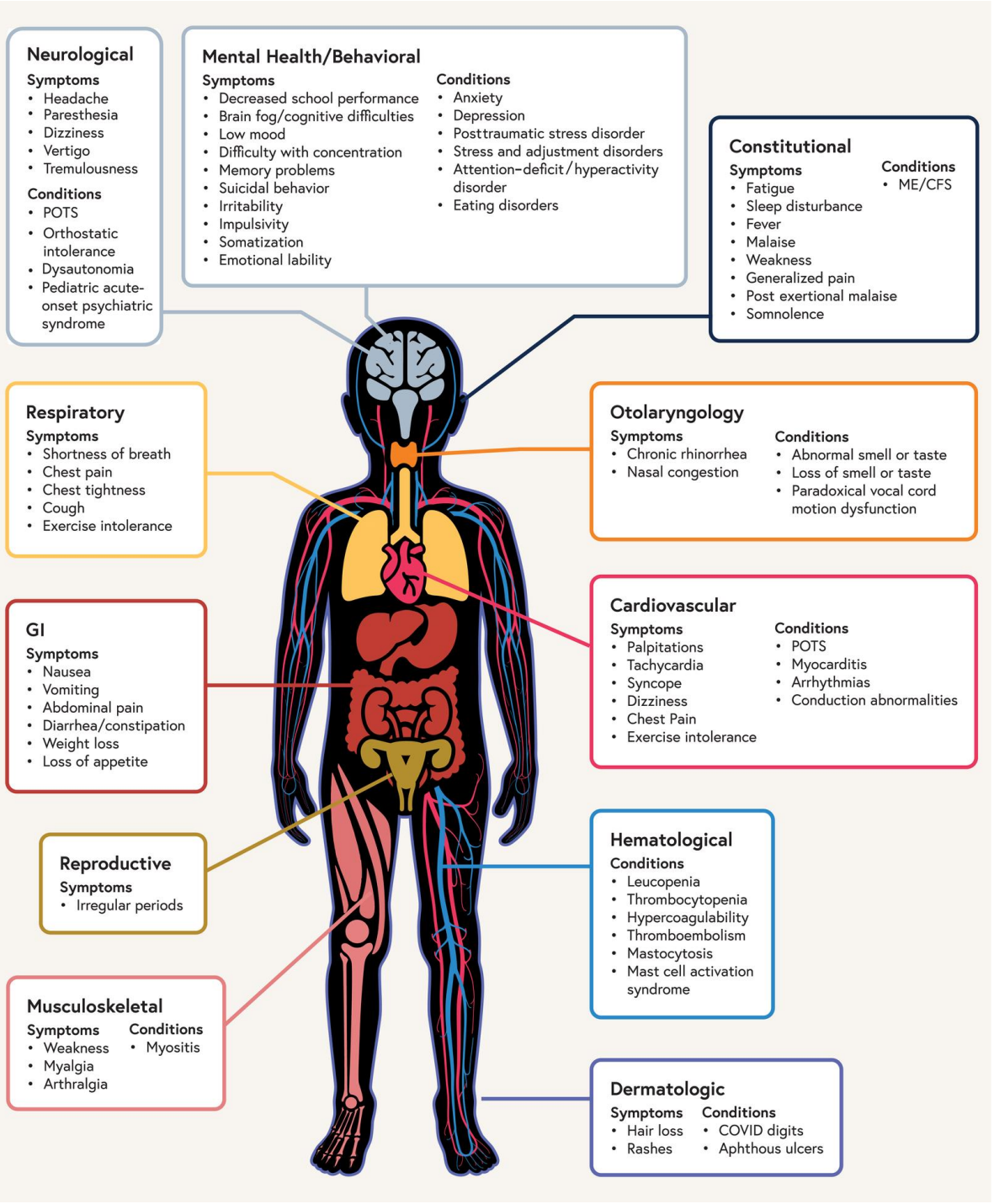
Deaths per year in the U.S. prior to recommended vaccines

	COVID-19	Rotavirus	Rubella	Varicella	Meningococcal	Hepatitis A
Age	6 mos-19 yrs	<5 yrs	All ages	5-9 yrs	11-18 yrs	<20 yrs
Time period	2023	1985-1991	1966-1968	1990-1994	2000-2004	1990-1995
Average Deaths per year	1-4 yoa: 44 5-19 yoa: 81	20	17	16	8	3

Hospitalizations per year in the U.S. prior to recommended vaccines

	COVID-19		Vaccine-type Invasive Pneumococcal Disease	Varicella (Chickenpox)	Hepatitis A
Age	6 mo - 18 yoa		0-4 years	0-4 years	5-14 years
Time period	2022-2023	2023-2024	1998-1999	1993-1995	2005
Hospitalization Burden (annual rate per 100,000 population)	6 mo-4 yoa: 64 5-11 yoa: 17 12-17 yoa: 24	6 mo-4 yoa: 50 5-11 yoa: 10 12-17 yoa: 13	40	29-42	<1


Long-Term Effects of
COVID-19 Infection



Long COVID in Kids

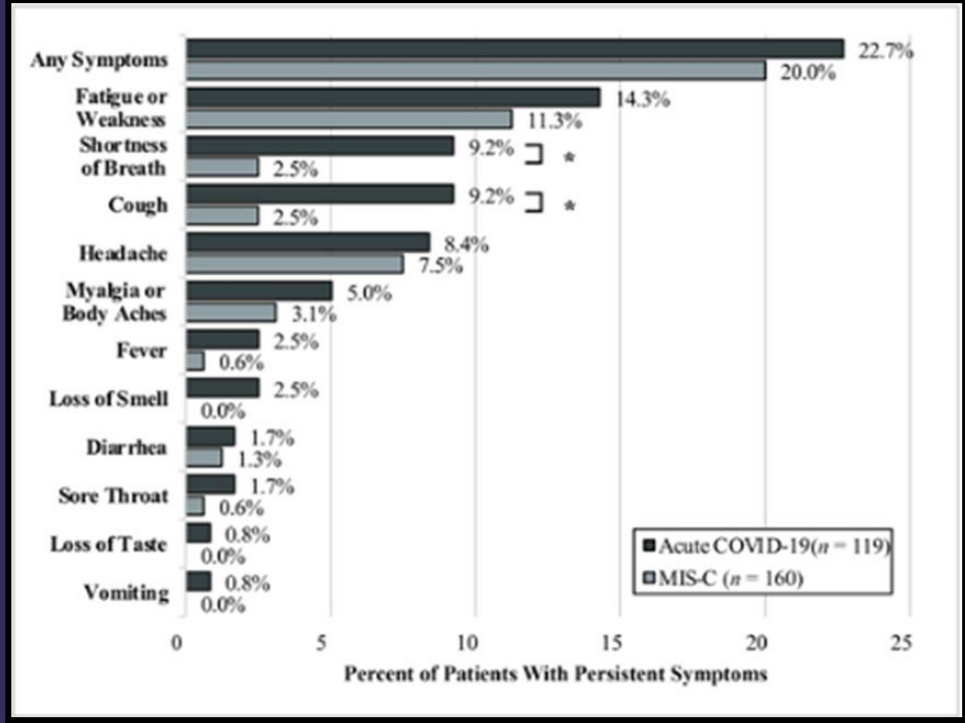
- Difficult to define
  - Inconsistent symptom manifestation
  - Absence of diagnostic testing
  - Kids unable to verbalize
  - Minimal quality studies
    - Lack of control group
    - Small sample size

Rao, Suchitra et al. *Pediatrics*, Feb 2024.

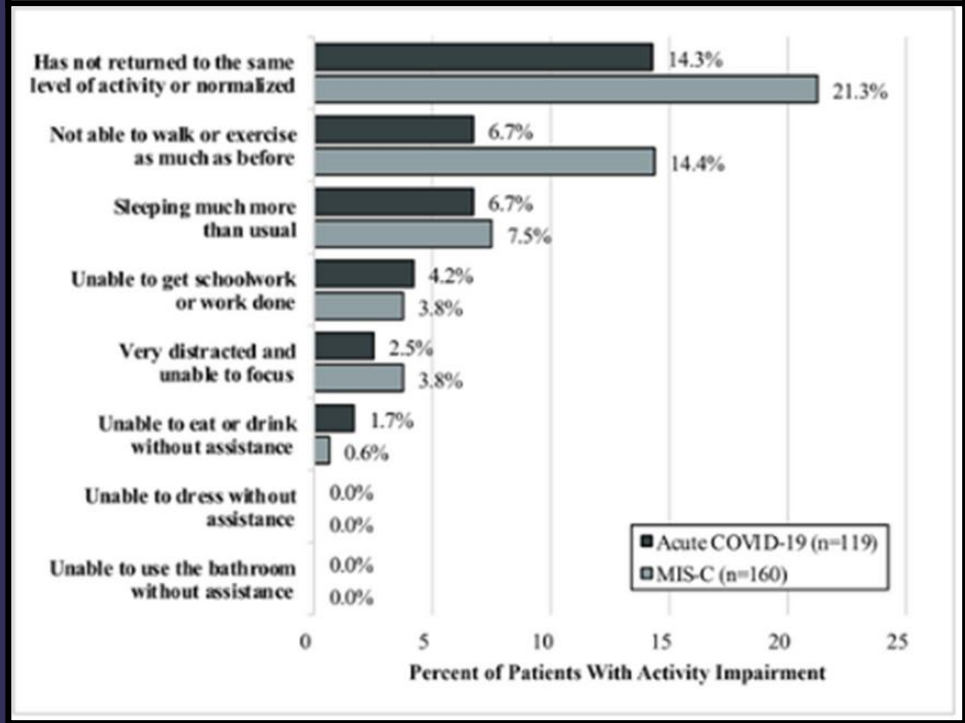
Prevalence of Long COVID in kids varies based on study design and definitions

Source	Study Design	Outcome
Israel Ministry of Health, 2021	Prevalence Survey N = 13,834	11.2% children with Long COVID
Radtke T, JAMA 2021	Retrospective Cohort N = 1,355	No difference in outcomes; low prevalence of Long COVID
Borch L, Eur J Pediatrics 2022	Retrospective Cohort N = 37,522	0.8% SARS-CoV-2 + children had symptoms >4 weeks (Long COVID)
Vahratian A, NCHS Data Brief 2023	National Survey N = 7,464	1.3% U.S. kids had Long COVID
Funk AL, JAMA Netw Open 2022	Prospective Cohort N = 1,884	5.8% SARS-CoV-2 patients with PCCs
Dun-Dery F, JAMA Netw Open 2023	Prospective Cohort N = 1,026	At 6 months: 0.52% of SARS-CoV-2 + kids had Long COVID; 0.67% at 12 months
Camporesi A, eClinicalMedicine 2024	Prospective Cohort N = 1,296	23% Long COVID at 3 months; 7% at 24 months
Rao S, Pediatrics 2024	State-of-the-art Review	Range from 4 to 62% children with Long COVID

Children hospitalized for **COVID-19** reported higher rates of **persistent symptoms**.



Children hospitalized for **MIS-C** reported higher rates of **activity impairment**.



Maddux, Berbert, et al. *Pediatrics*, August 2022

Infectious Agent	Chronic Condition
RSV	Asthma
HPV	Cervical cancer
Influenza A	Neurologic problems (e.g., seizures)
Enteroviruses (e.g., rotavirus, mumps)	Type I diabetes
COVID-19	Diabetes

Many viruses have been linked to chronic conditions.

CDC, 2024

During the COVID-19 pandemic, new diabetes diagnoses were

166%

(IQVIA)

31

(HealthVerity)

%

***more likely* in patients with COVID-19 compared to those without.**

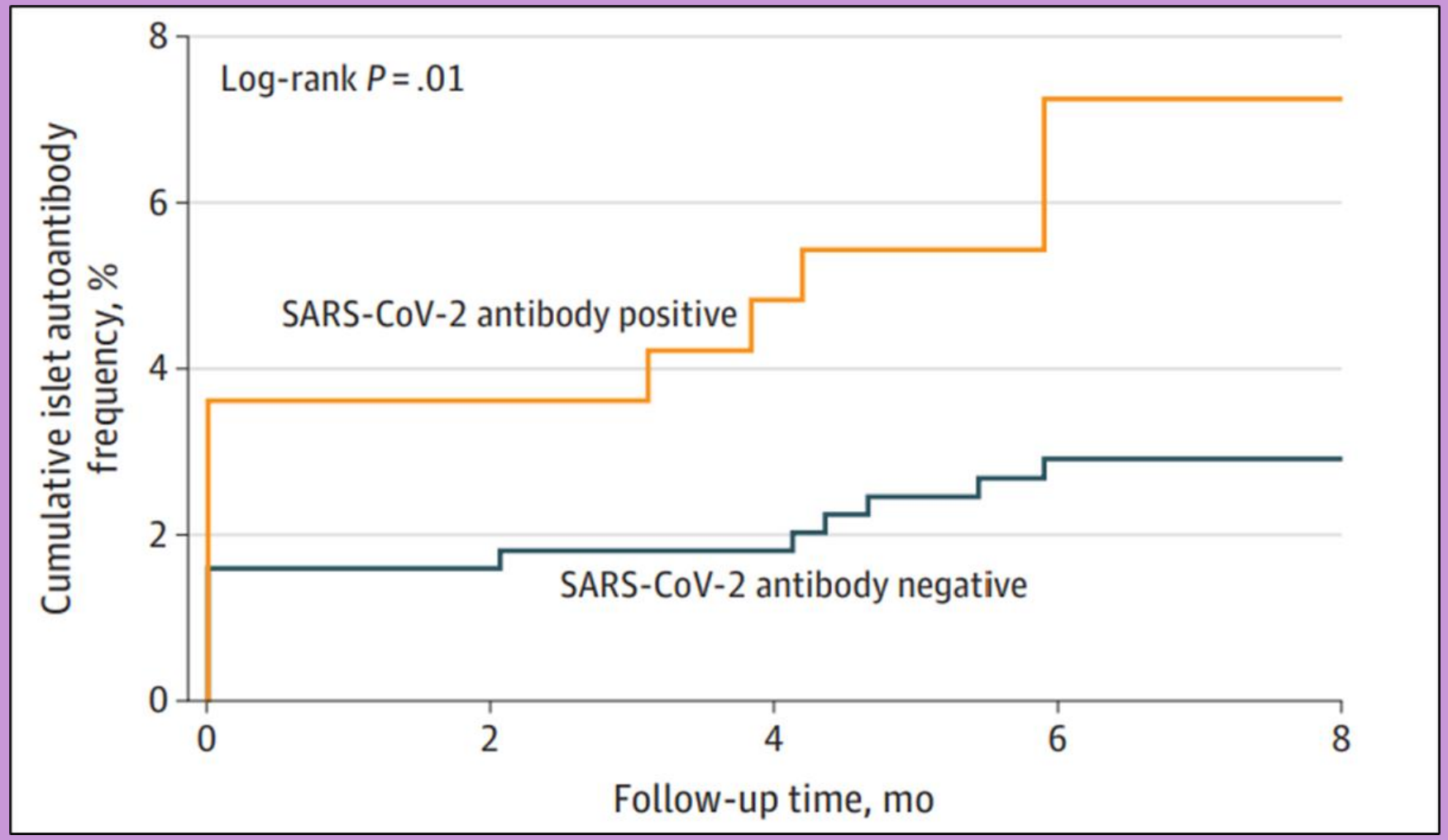
Barrett, Koyama, et al. MMWR, January 2022

Increased risk of diabetes-related auto-antibodies in children after COVID-19 infection

Islet cell auto-antibody development

3.5 - 5.3x

higher post COVID-19 infection.



Lugar M. *JAMA*, Sept 8, 2023

COVID-19 VACCINES FOR KIDS

Everyone ages 6 months and older should get a 2024-2025 COVID-19 vaccine

Ages 6 months - 4 years

If your child previously had:	Your child should get:
0 doses (never vaccinated)	2 doses of the 2024-2025 Moderna vaccine OR 3 doses of the 2024-2025 Pfizer-BioNTech vaccine
1+ doses of Moderna vaccine	1 dose of the 2024-2025 Moderna vaccine
1 dose of Pfizer-BioNTech vaccine	2 doses of the 2024-2025 Pfizer-BioNTech vaccine
2+ doses of Pfizer-	1 dose of the 2024-2025

Ages 5-11 years (regardless of previous vaccine status)

1 dose 2024-2025 Moderna OR **1 dose 2024-2025 Pfizer-BioNTech**

Ages 12+ (regardless of previous vaccine status)

1 dose 2024-2025 Moderna OR **1 dose 2024-2025 Pfizer-BioNTech**

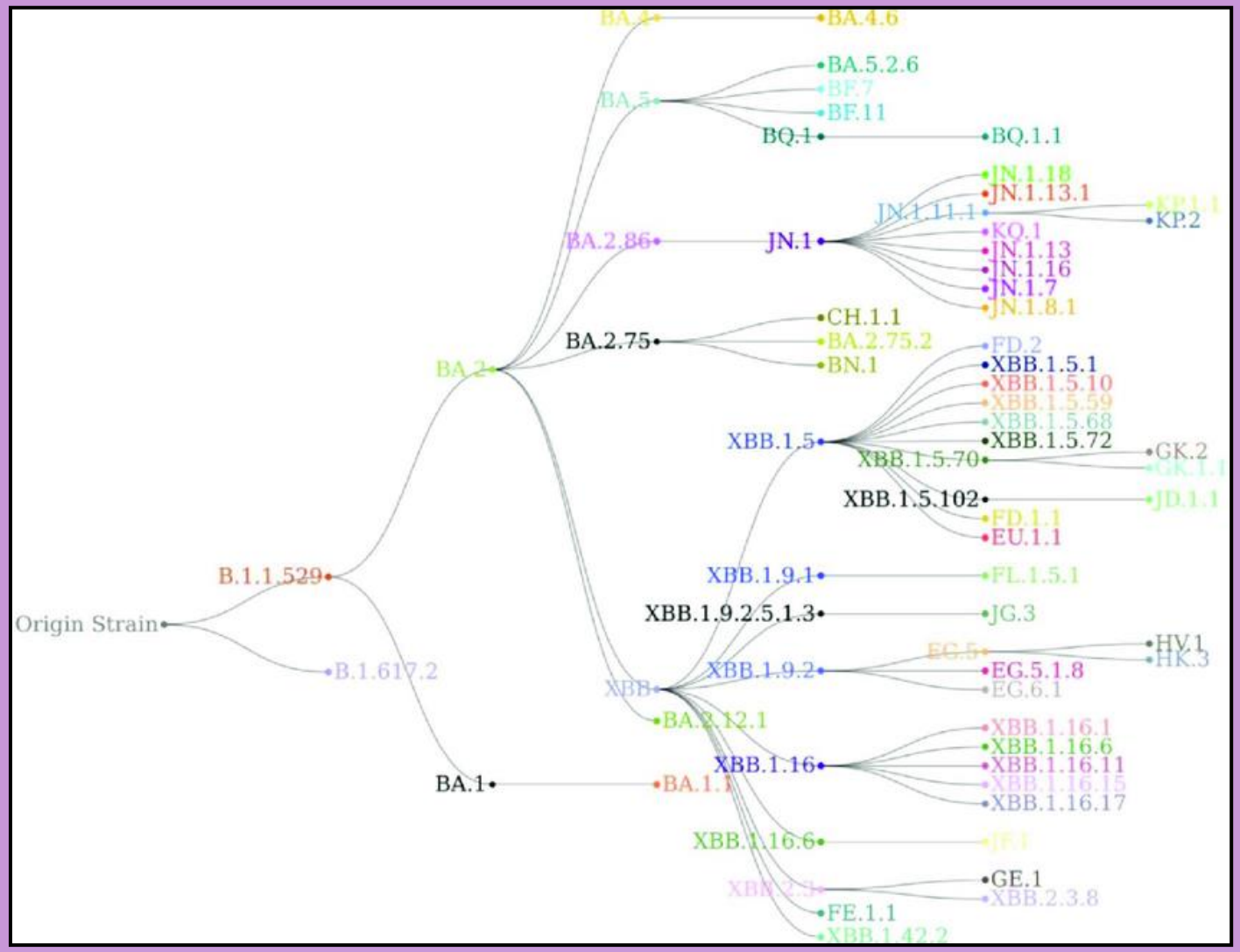
OR

1 dose 2024-2025 Novavax*

*If this is the first COVID-19 vaccine, 2 doses of 2024-2025 Novavax are needed to be up to date.

https://www.cdc.gov/covid/vaccines/stay-up-to-date.html

2024-2025 Season Updates

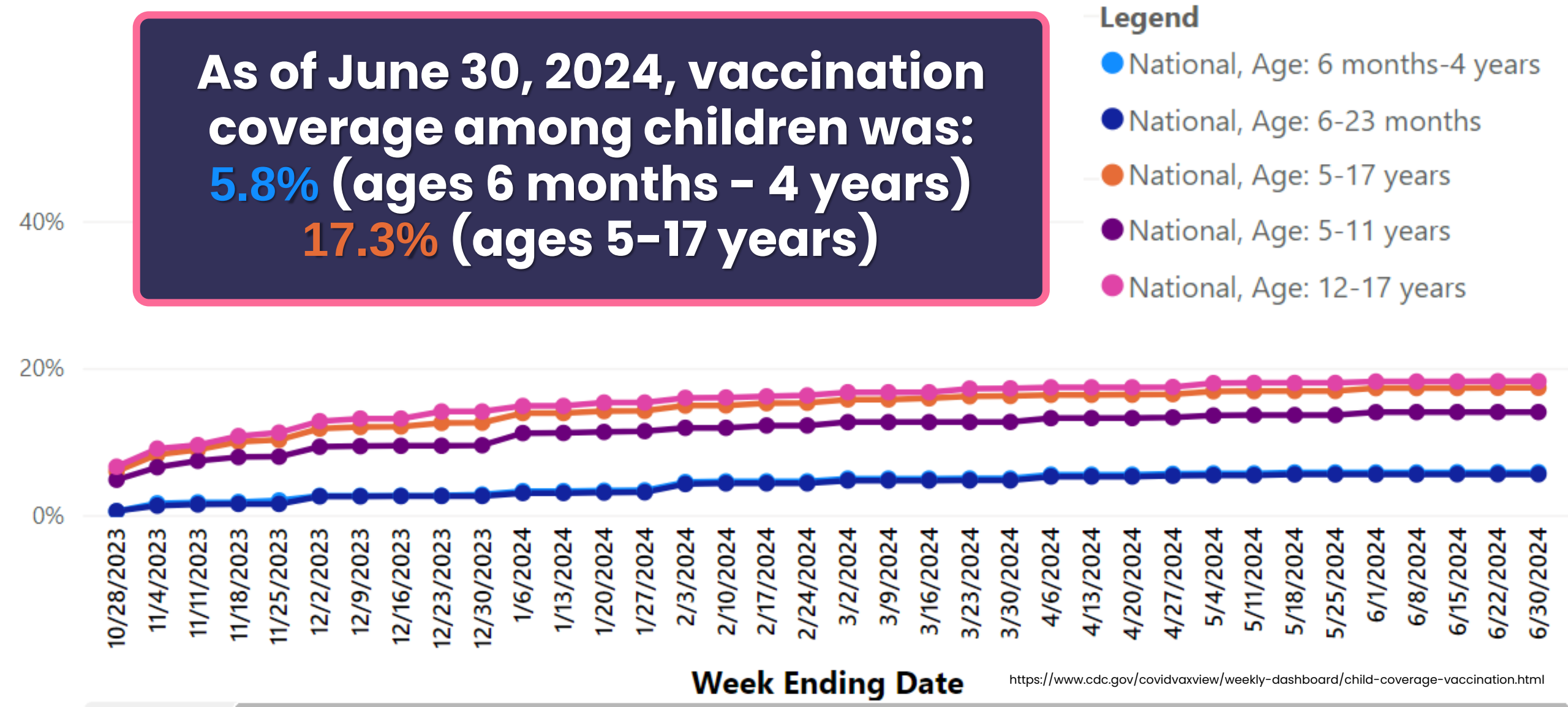


- Updated formulas (monovalent)
- Inconclusive data which vaccine type is superior
- Pfizer and Moderna (mRNA vaccines) target KP.2 subvariant
  - Most current subvariant circulating (could be more effective at infection prevention)
  - Pfizer > Moderna for high-risk myocarditis patients
- Novavax (protein-based) targets JN.1 subvariant
  - Older subvariant but likely induces adequate immune response
  - Less intense side effects than mRNA vaccines

https://www.cdc.gov/vaccines/covid-19/clinical-considerations/interim-considerations-us.html

Cumulative percentage of children 6 months - 17 years with an updated 2023-24 COVID-19 vaccine

As of June 30, 2024, vaccination coverage among children was:
5.8% (ages 6 months – 4 years)
17.3% (ages 5–17 years)

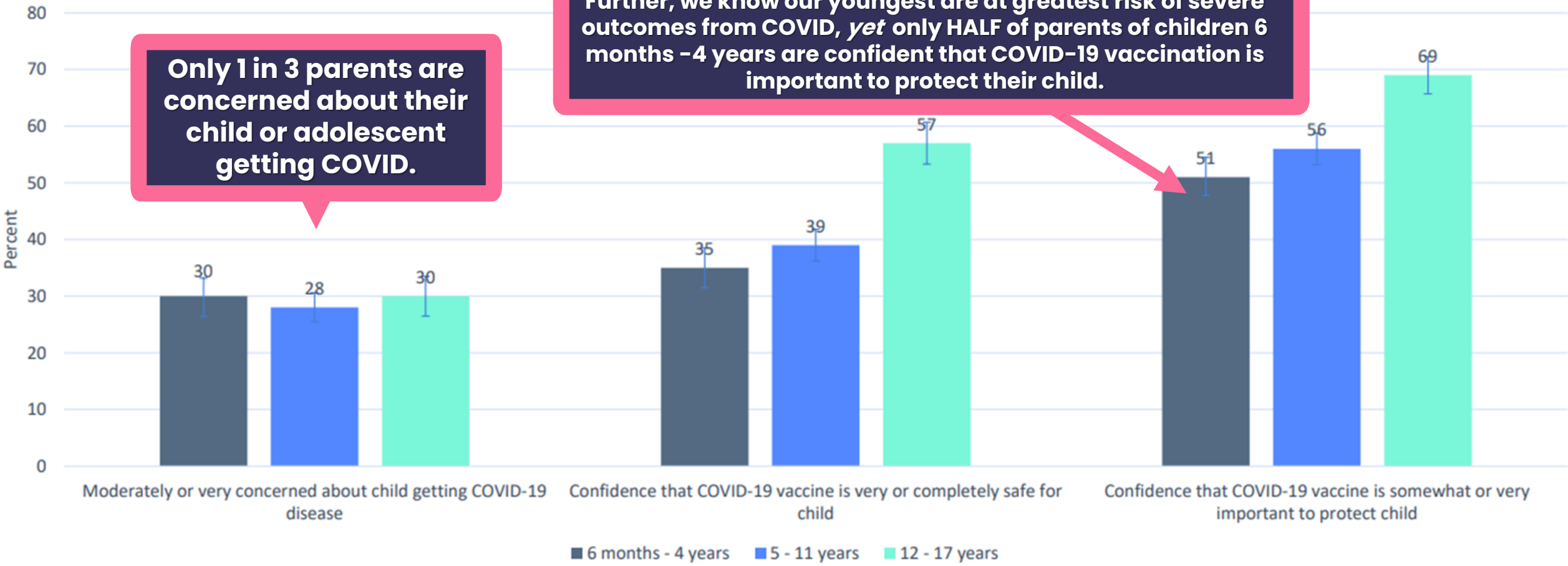


https://www.cdc.gov/covidvaxview/weekly-dashboard/child-coverage-vaccination.html

COVID-19 Vaccination Key Attitudes and Experiences by Age Group Among Parents of Children Ages 6 Months-17 Years, NIS-CCM, December 2023

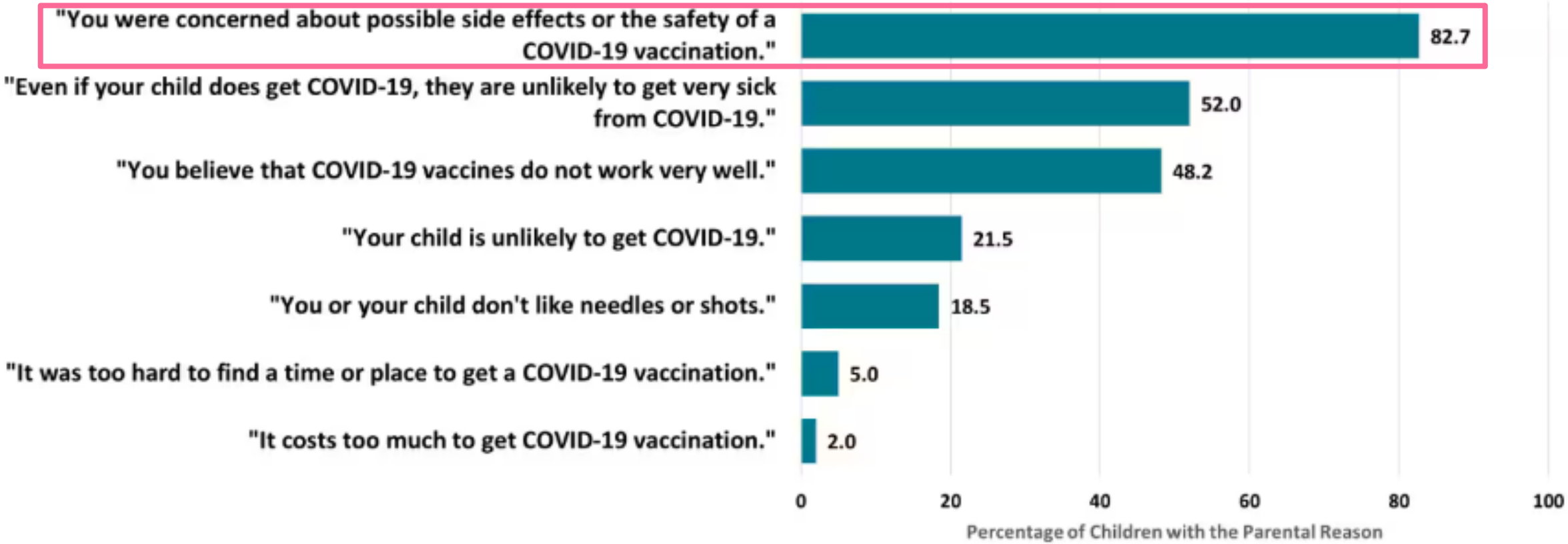
Only 1 in 3 parents are concerned about their child or adolescent getting COVID.

Further, we know our youngest are at greatest risk of severe outcomes from COVID, *yet* only HALF of parents of children 6 months -4 years are confident that COVID-19 vaccination is important to protect their child.



https://www.cdc.gov/acip/downloads/slides-2024-06-26-28/06-COVID-Panagiotakopoulos-508.pdf

Concern about side effects is the primary reason for not getting children the COVID-19 vaccine



Graph ordered from most to least frequently reported reason and not the order in the questionnaire.

https://www.cdc.gov/vaccines/imz-managers/coverage/covidvaxview/pubs-resources/reasons-no-covid19-vaccation-2023.html.

Possible Side Effects After COVID-19 Vaccine

Vary person to person, but generally self-limiting.

Common:

- Pain, swelling, and redness at the injection site
- Tiredness, headache, muscle pain
- Chills
- Nausea
- Fever

https://www.cdc.gov/coronavirus/2019-ncov/vaccines/vaccine-safety-children-teens.html

COVID-19 vaccination for children is safe.

COVID-19 vaccines have undergone the most extensive safety analysis in U.S. history.

While adverse reactions are rare, the benefits of COVID-19 vaccination outweigh the known risks of COVID-19 and possible severe complications.

https://www.cdc.gov/coronavirus/2019-ncov/vaccines/vaccine-safety-children-teens.html

Data supporting safety of COVID-19 vaccination

nature communications

Article

Safety outcomes following COVID-19 vaccination and infection in 5.1 million children in England

Received: 17 June 2023

Accepted: 11 April 2024

Published online: 27 May 2024

Emma Copland[1], Ma
Jennifer Hirst[1], David P
Aziz Sheikh[1,6], Carol
Chris Robertson[9] &

SARS-CoV-2 infection was associated with increased risks of hospitalisation from seven outcomes including multisystem inflammatory syndrome and myocarditis, but these risks were largely absent in those vaccinated prior to infection. We report a favourable safety profile of COVID-19 vaccination in under-18s.

PEDIATRICS®

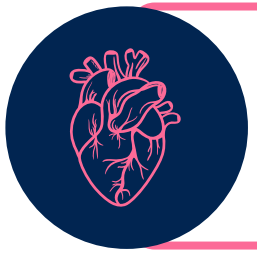
Pediatrics (2023) 152 (1): e2023061894.

Safety of COVID-19 mRNA Vaccination Among Young Children in the Vaccine Safety Datalink

James G. Donahue, DVM, PhD,[b] Ned Lewis, MPH,[a] Kayla E. Hanson, MPH,[b] Eric S. Weintraub, MPH,[c]
P. Klein, MD, PhD[a]

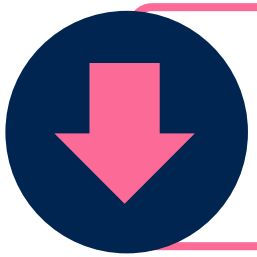
In this interim analysis of children aged 5 years and younger, safety surveillance of more than 245 000 COVID-19 mRNA vaccine doses over 9 months did not detect a safety signal for any outcome during the 21 days after vaccination. Importantly, no cases of myocarditis or pericarditis occurred after vaccination. This safety profile is consistent with results from phase 3 clinical trials and other vaccine safety monitoring systems.[4]

Benefits outweigh risks in the age groups for which the risk of myocarditis is the highest



From available data, myocarditis risk in younger males after booster dose is lower than rates seen with primary series.

https://www.cdc.gov/acip/downloads/slides-2023-02-22-24/COVID-02-Shimabukuro-508.pdf



Myocarditis risk **lower** with *longer interval between doses.*

https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2022-02-04/11-COVID-Moulia-508.pdf

Most myocarditis/pericarditis cases fully recover - Severity of disease and length of recovery are greater post-COVID vs. transient experience of inflammation after vaccination.

https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2022-02-04/04-COVID-Kracalic-508.pdf

In 12-17-year-old males, adverse cardiac outcome risk **1.8 – 5.6x higher** following SARS-CoV-2 infection than Covid vaccine.

https://www.cdc.gov/mmwr/volumes/71/wR/mm7114e1.htm?s_cid=mm7114e1_w

Putting Risk in Perspective

https://covid19.nih.gov/news-and-stories/covid-19-vaccines-myocarditis

COVID-19 vaccine effectiveness data continues to support seasonal vaccines for everyone ages 6 months and older

Vaccine Effectiveness (VE) of 2023-2024 COVID-19 vaccine against ED/UC encounters

	Dose received 7-59 days earlier	Dose received 60-179 days earlier
9 months - 4 years	66%	24%
5-17 years	71%	50%

https://www.acpjournals.org/doi/10.7326/M23-1754

https://publications.aap.org/pediatrics/article/153/4/e2023064440/196413/Vaccine-Effectiveness-Against-Long-COVID-in?autologincheck=redirected

https://www.cdc.gov/acip/downloads/slides-2024-06-26-28/03-COVID-Link-Gelles-508.pdf

COVID-19 vaccination reduced occurrence of Post-COVID Conditions (PCC) following SARS-COV-2 infection among children 5-17 years old:

Multi-stie cohort

- **34%** For 1+ PCC symptom
- **47%** For respiratory PCC symptom
- **48%** For 2+ PCC symptom

COVID-19 vaccination in children 5-17 years old:

Retrospective Cohort

- **35%** Effectiveness against probable long COVID
- **42%** Protection against diagnosed long COVID within a year of vaccination

Panagiotakopoulos, 2024 – Presented at ACIP on 6/27/2024; Yousaf et al, Open Forum Infect Dis, 2023; Razzaghi et al, Pedatrics, 2024

MIS-C and Vaccination

Numerous studies have found that COVID-19 vaccination is effective at reducing risk of MIS-C:

90% A CDC study found that 2 doses of Pfizer's COVID-19 vaccine had a >90% effectiveness at preventing MIS-C.

A majority of cases of MIS-C in 2023 occurred in healthy and un/under-vaccinated children:

18% 96% of patients were age-eligible for COVID-19 vaccination, yet only 18% had documented receipt of any COVID-19 vaccine.

58% Over half (58%) of MIS-C cases were among previously health children with no underlying medical conditions – 50% required care in the ICU.

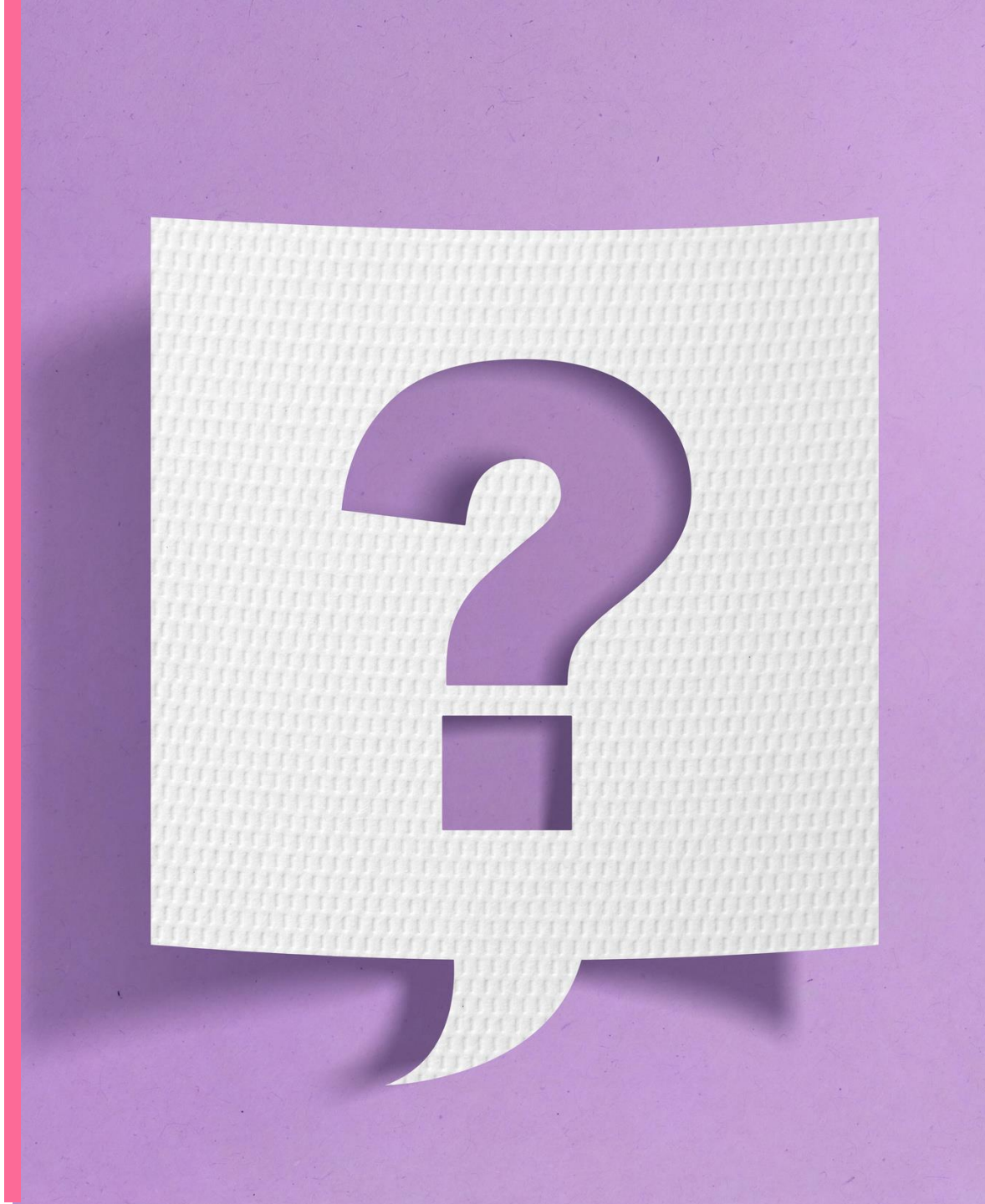
https://www.cdc.gov/mmwr/volumes/73/wr/mm7310a2.htm
https://www.cdc.gov/mis/hcp/clinical-overview/index.html

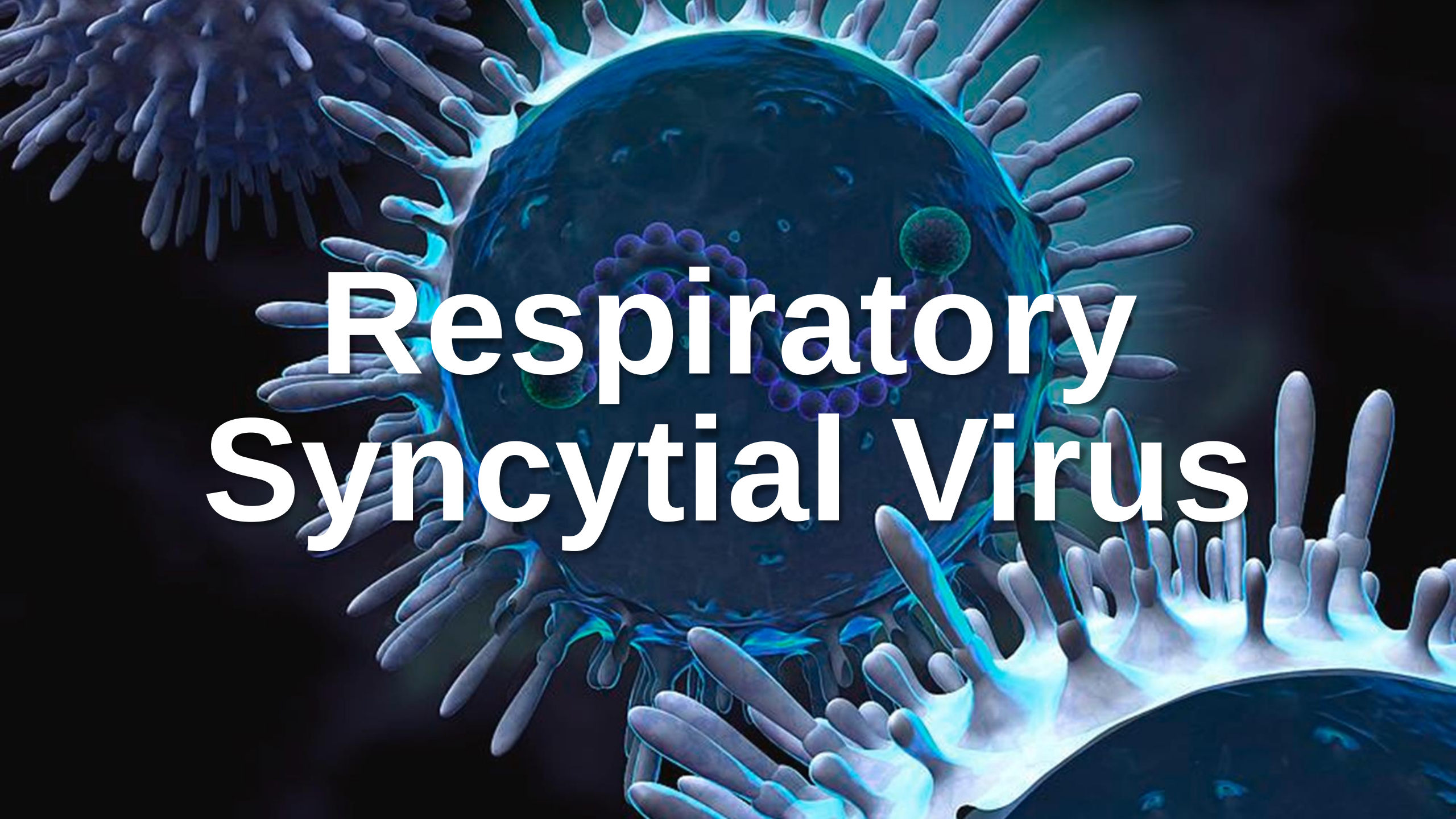
When a patient has recently had COVID-19, when should they receive an updated COVID-19 vaccine?

In general, it is recommended to wait at least 3 months after a COVID-19 infection before receiving a COVID-19 vaccine dose.

However, timing decisions for patients who are severely immunocompromised or have other medical issues should be addressed on a case-by-case basis.

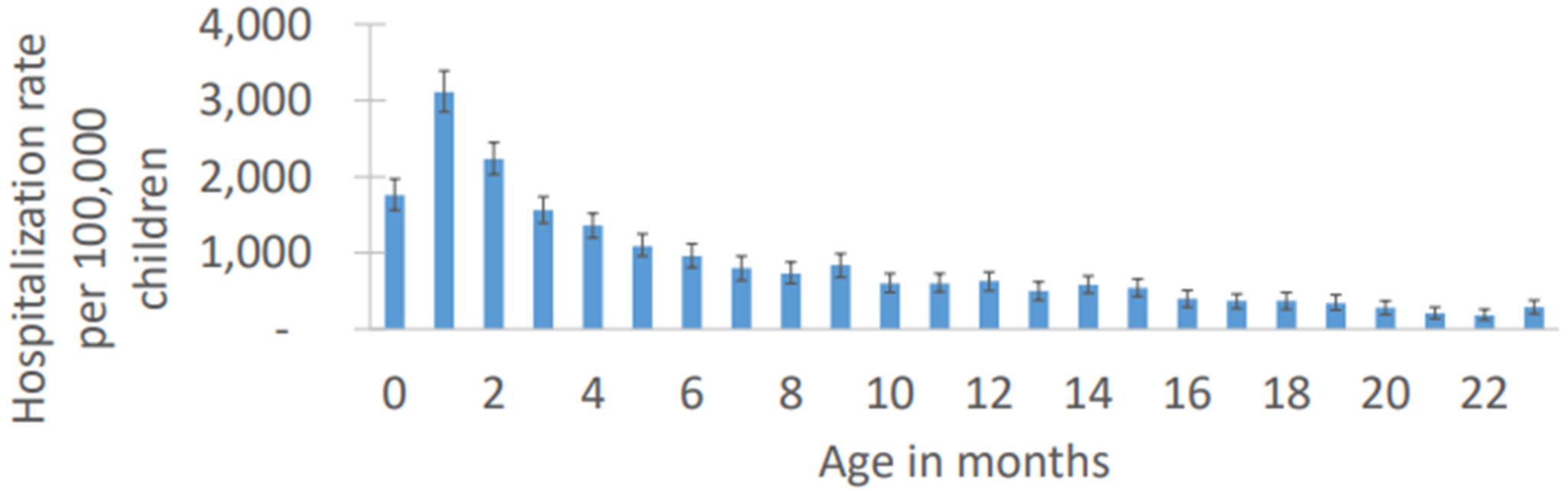
https://www.cdc.gov/covid/vaccines/stay-up-to-date.html




Respiratory
Syncytial Virus

RSV Epidemiology

- Most infants (68%) infected during the 1st year of life; nearly all (97%) by age 2
- Most common cause of hospitalization in U.S. infants (2–3% of young infants)
  - Prematurity/chronic disease increases risk, but most (79%) are in healthy, term infants
  - Risk of hospitalization higher in younger infants



Source: Nirsevimab: proposed recommendation, updated nirsevimab EtR, and clinical considerations; EtR summary; 2nd season (Update on risk factors for severe disease) (cdc.gov; Source: 01-RSV-Mat-Ped-Long-508.pdf

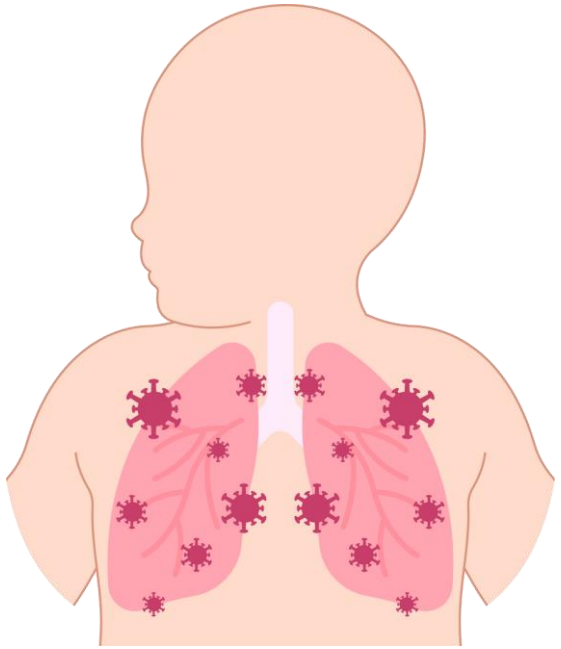
RSV is the #1 cause of hospitalization among U.S. infants

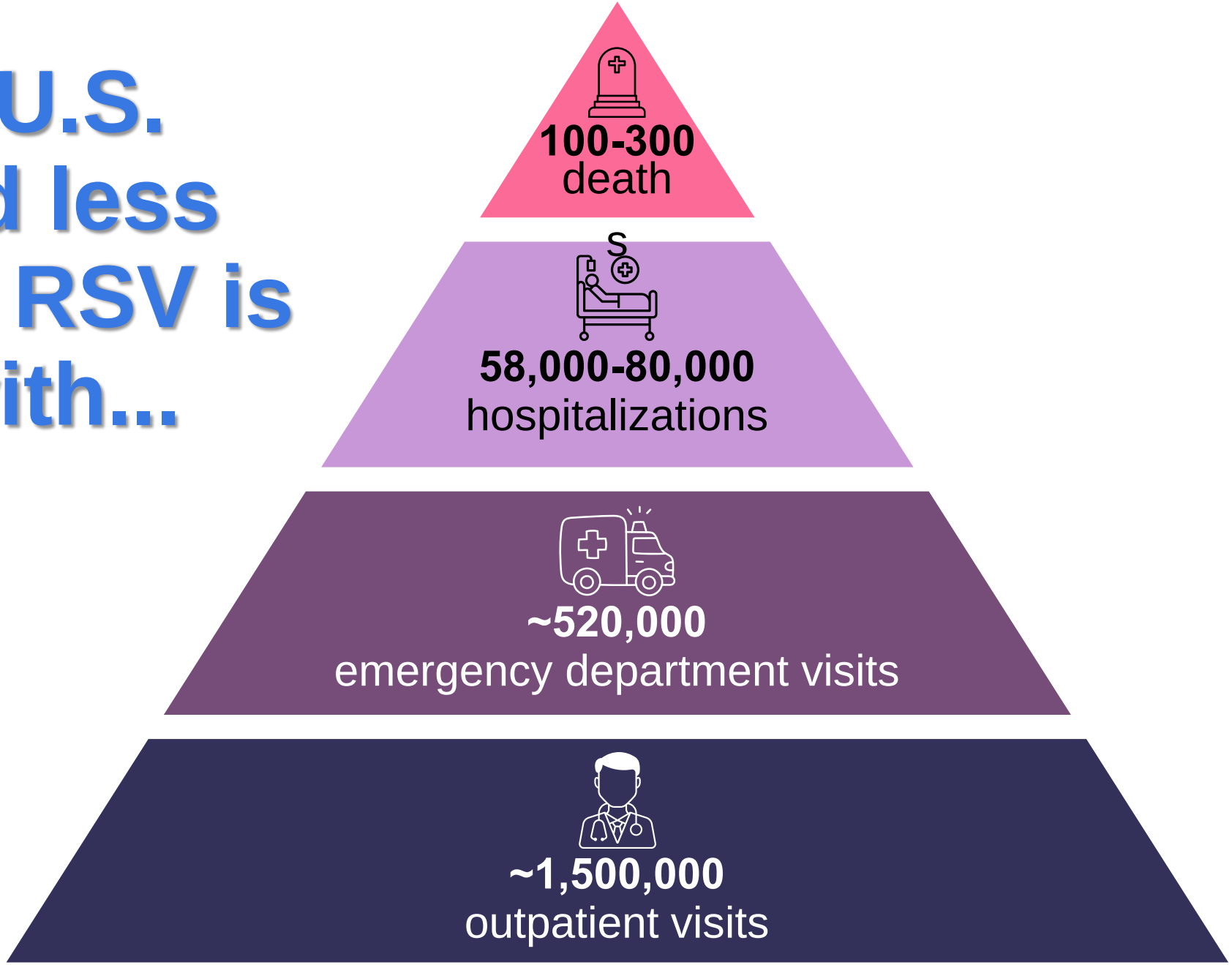
79%

of children <2 years old hospitalized with RSV have NO underlying medical conditions

https://www.cdc.gov/mmwr/volumes/72/wr/mm7234a4.htm

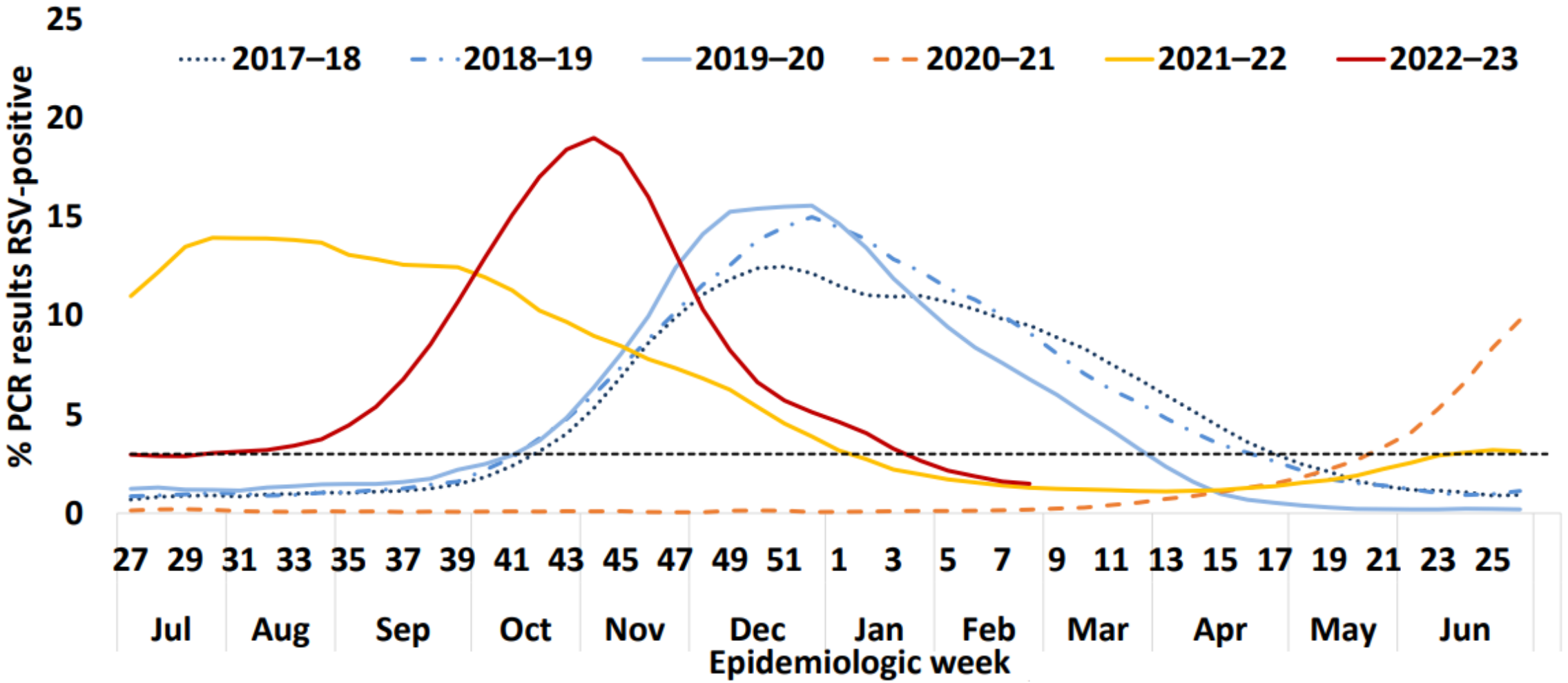
Each year in U.S. children aged less than 5 years, RSV is associated with...





Thompson et al, JAMA, 2003; Hansen et al, JAMA Network Open, 2022; Hall et al, NEJM, 2009; McLaughlin et al, J Infect Dis, 2022
(* Estimate 80,000 hospitalization in infants <1 yrs)

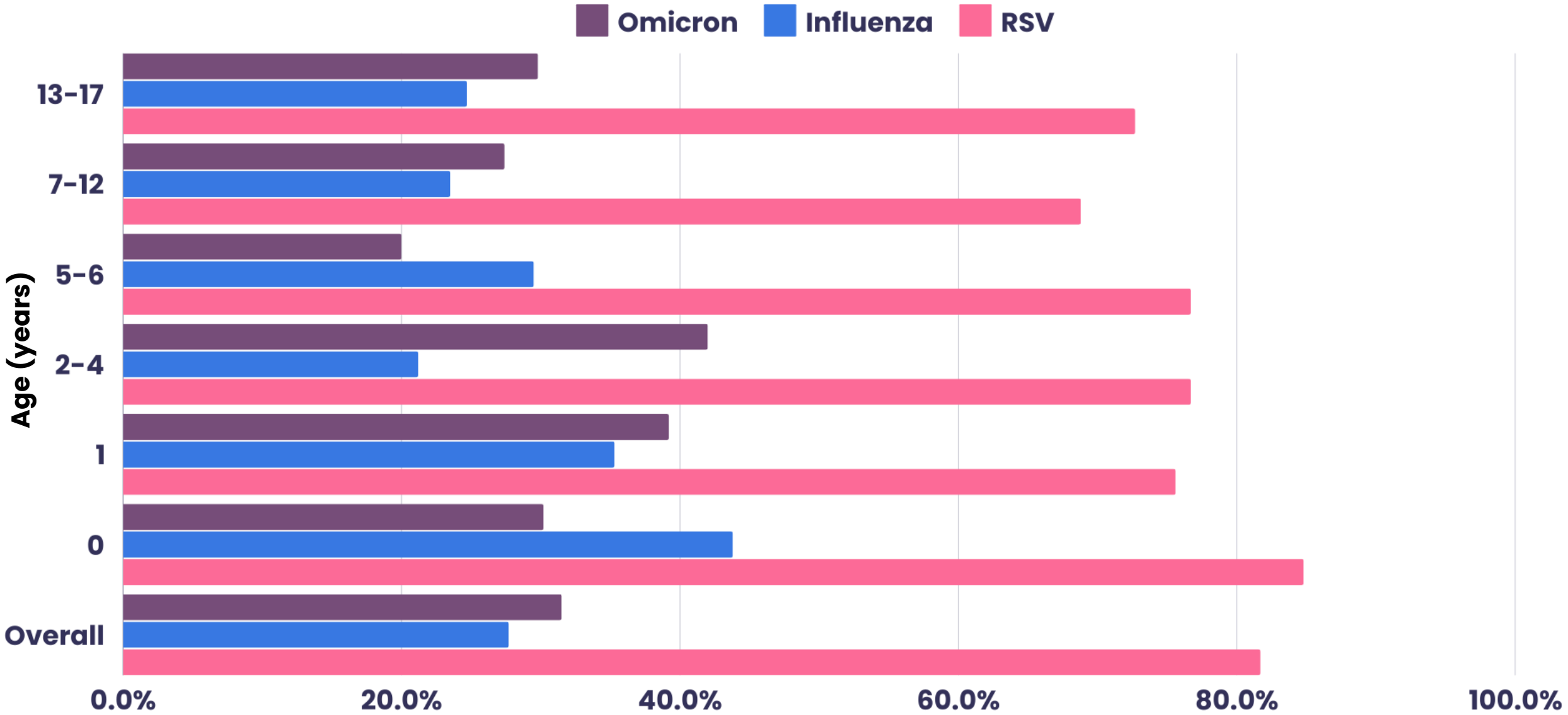
Change in seasonality of RSV transmission following SARS-CoV-2 introduction - REVSS, 2017-2023



* 3-week centered moving averages of percentage of RSV-positive PCR results nationwide. The black dotted line represents the threshold for a seasonal epidemic (3% RSV-positive laboratory PCR results).

Jones, ACIP Meeting, 2024; Hamid et al, MMWR, 2023

Age-Stratified Hospital Admission Rates in Cohorts With SARS-CoV-2 Omicron, Influenza A/B, or RSV Infection



Hedberg et al, *JAMA*, 2023

RSV PREVENTION FOR KIDS

Polling Question

All of the following are examples of passive immunization (i.e. when a person receives antibodies from an external source) **EXCEPT**:

a) Transplacental
b) Mother to baby through breastmilk
c) A child receiving a COVID-19 vaccination
d) An infant receiving nirsevimab

Polling Question

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c) A child receiving a COVID-19 vaccination
d) An infant receiving nirsevimab

Nirsevimab

- Long-acting monoclonal antibody (mAB) using passive immunization
  - Passive immunization results from a person receiving antibodies from an external source
    - Transplacental
    - Breastmilk
    - IVIG
    - Monoclonal antibodies
  - Active immunization results from infection or vaccination, which triggers an immune response

Infant RSV Immunization

Nirsevimab: All infants <8 months of age born during RSV season or entering their first RSV season; AND children 8-19 months at increased risk of severe RSV entering their second RSV season.

Except in rare circumstances, most infants <8 months of age do not need nirsevimab if they were born 14+ days after their mother got an RSV vaccine.

In clinical trials, the RSV vaccines and passive immunization (monoclonal antibody product) were shown to be safe and effective at preventing RSV-associated lower respiratory tract disease (LRTD).

1st season effectiveness: Oct 2023 - March 2024

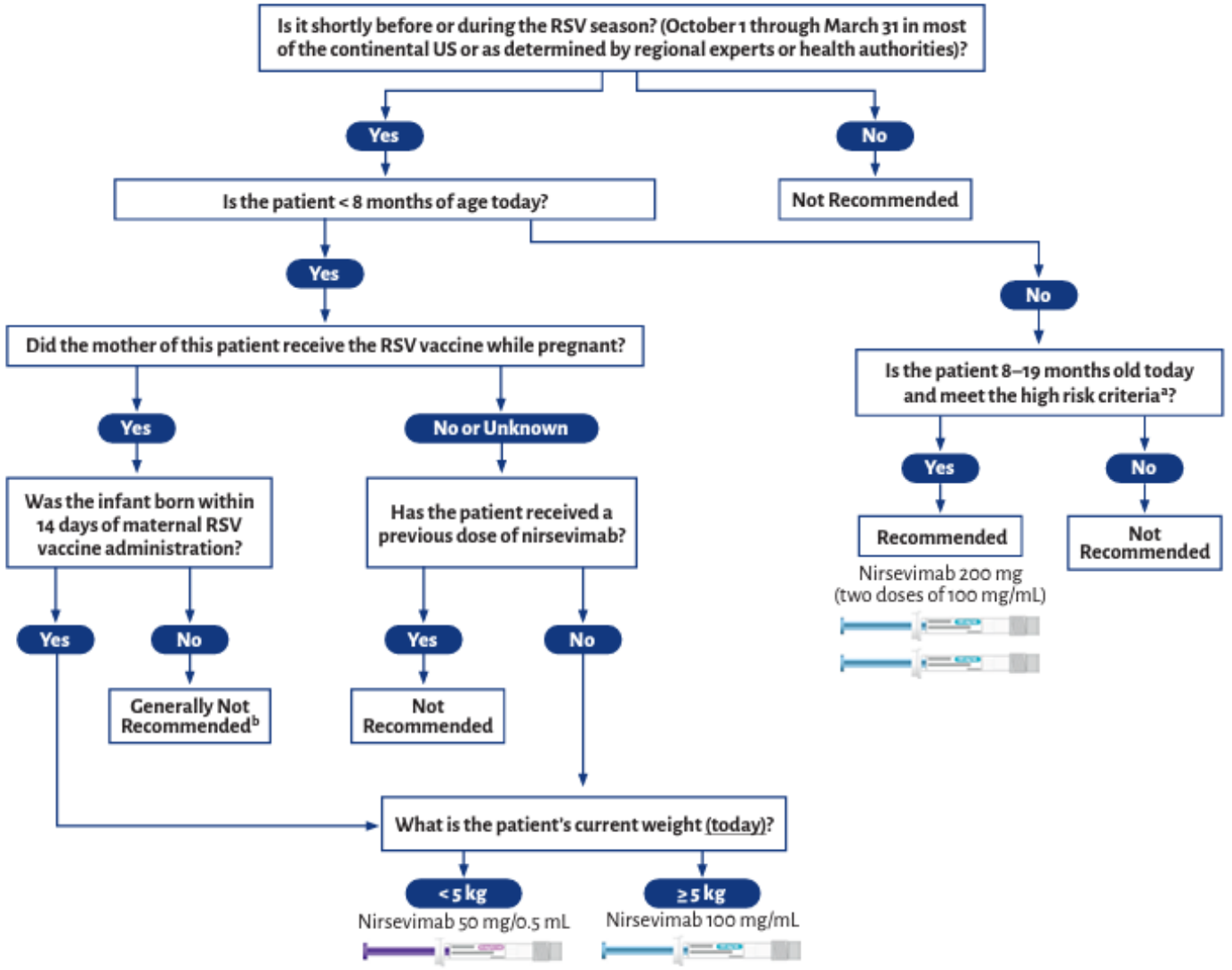
89% Medically attended RSV-associated acute respiratory illness

91% RSV-associated hospitalization

Moline, MMWR, 2024; Payne, ACIP, June 28, 2024; CDC, 2024

Nirsevimab Administration

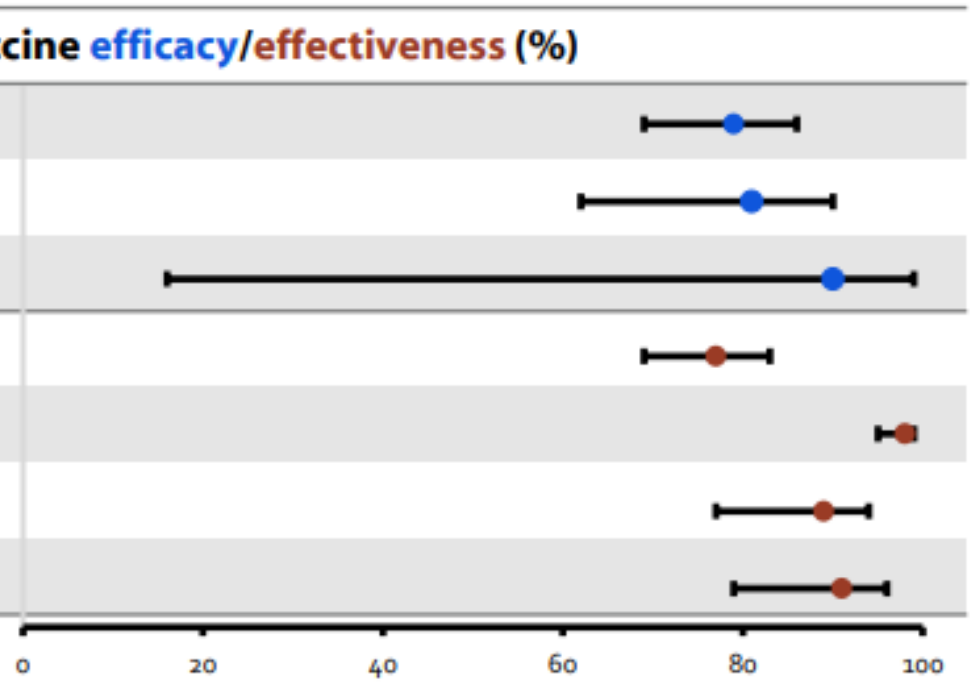
- Ideally administered to babies born during October through March during their birth hospitalization, or within 1 week of birth
- Due to high product cost, insurance coverage challenges, and workflow concerns, many local birthing hospitals are not offering nirsevimab



CDC, 2024 – RSV Immunization Guidance for Infants and Young Children, Updated 8/30/2024;
AAP, 2024 – Nirsevimab Frequently Asked Questions, Updated 9/13/2024

Observational data indicate nirsevimab is working as expected (vs. RCT results) during the first RSV season after approval among infants in their first RSV season

Outcome/Analysis	Vaccine efficacy/effectiveness (%)
Clinical trial, RSV-associated LRTI	79 (69-86)
Clinical trial, RSV-associated LTRI with hospitalization	81 (62-90)
Clinical trial, RSV-associated LRTI with ICU admission	90 (16-99)
VISION, RSV-associated emergency department visits	77 (69-83)
VISION, RSV-associated hospitalization	98 (95-99)
NVSN, medically attended RSV-associated ARI episode	89 (77-94)
NVSN, RSV-associated hospitalization	91 (79-96)



RCT = randomized clinical trial | ARI = acute respiratory illness

Results may not be comparable across studies due to differences in outcome definitions, timing, and other factors.

Jones et al, MMWR, 2024

Infant who received nirsevimab in the 2023-24 season:

~76%

less likely to visit a health care provider because of RSV.

70 - 90%

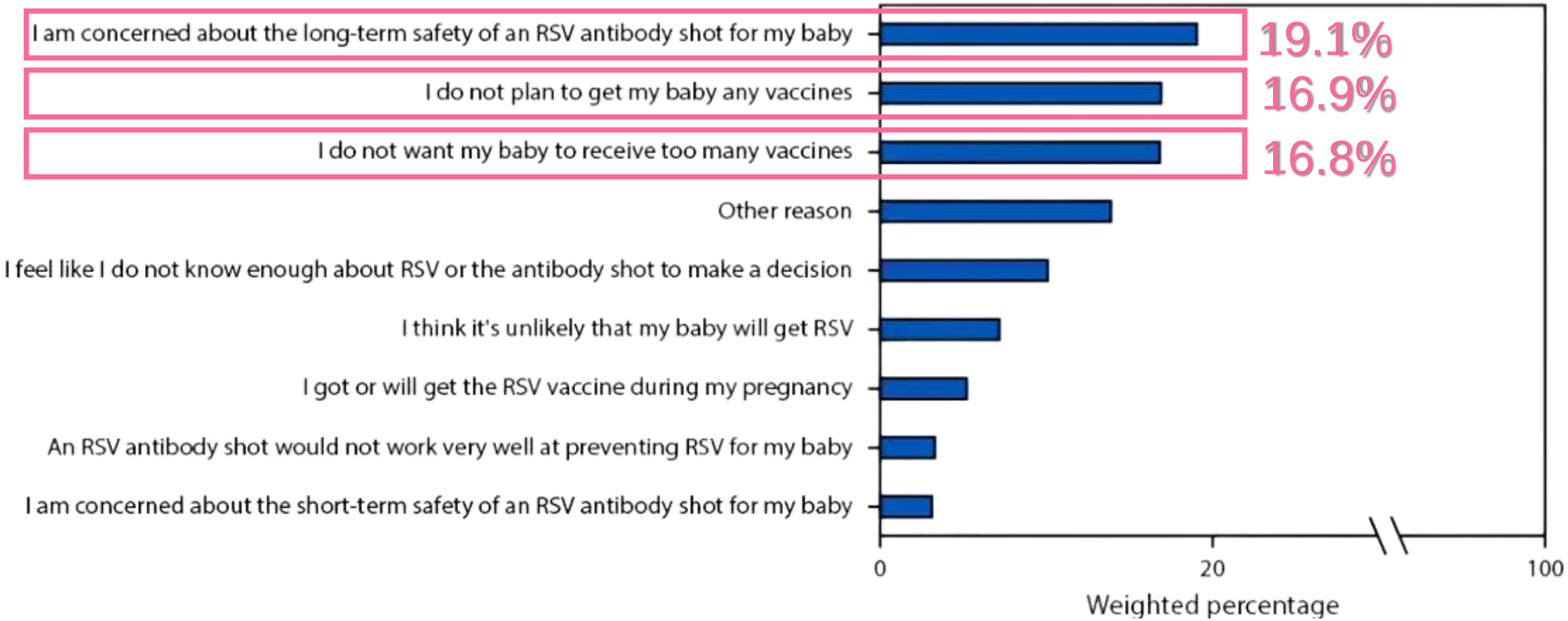
less likely to be hospitalized with RSV.

80%

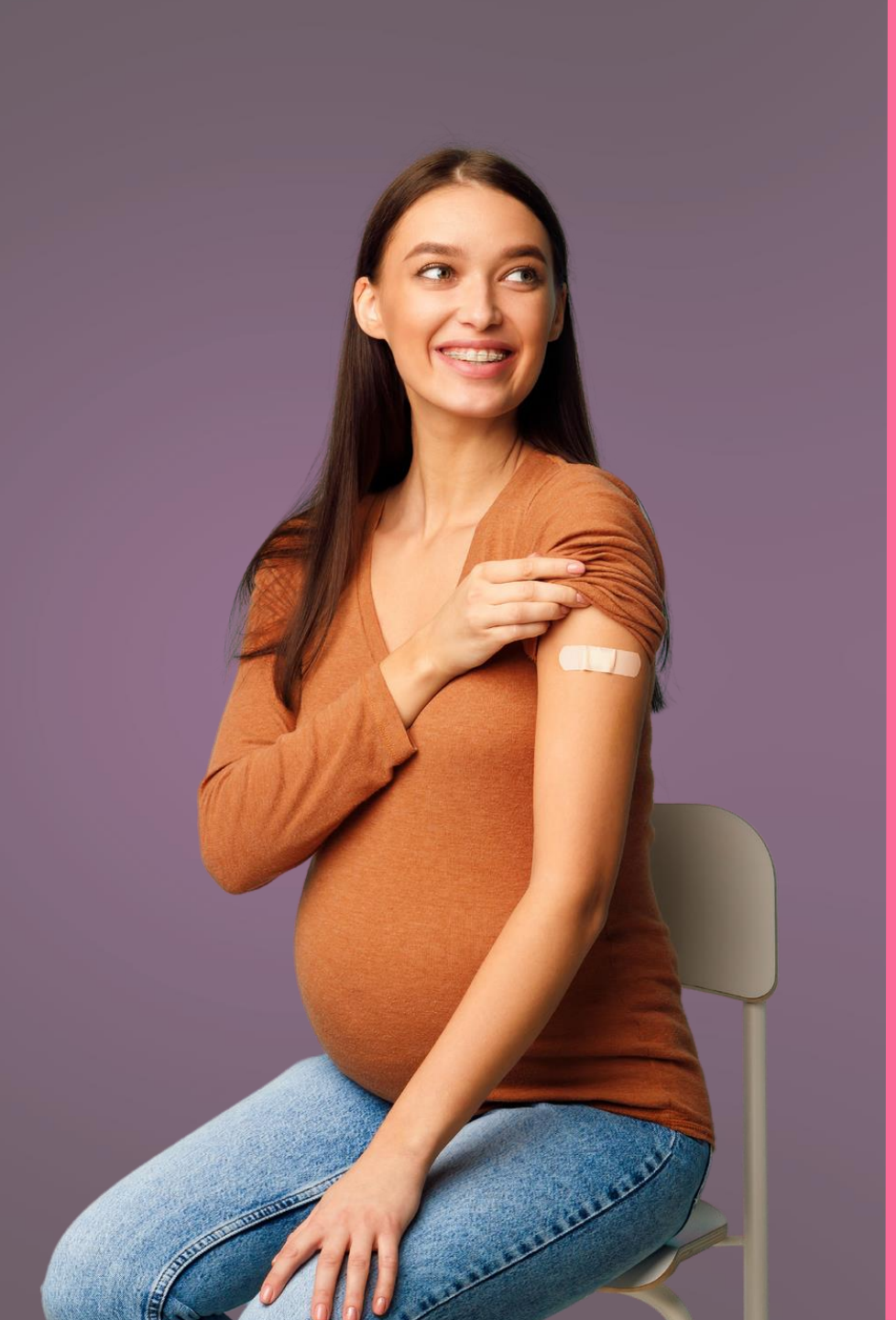
less likely to be admitted to the PICU for RSV.

Moline, et al. MMWR, 2024; Lopez-Lacort, et al. Eurosurveillance, 2024; Assad, et al. *NEJM*, 2024; Lopez-Lacort, et al. *Pediatrics*, 2024; Payne, Presentation at ACIP 6/28/2024

Main reason for not receiving respiratory syncytial virus antibody (nirsevimab) for unprotected infants - U.S. April 2024 (N = 240)



Razzaghi, et al. MMWR, 2024



Maternal RSV Vaccine

Abrysvo: 1st RSV vaccine for pregnancy to prevent RSV in infants birth – 6 months

FDA approved for use at 32 – 36 weeks gestation

Safety and effectiveness evaluation ongoing in randomized, placebo-controlled international clinic trials

Preliminary data shows:

- **81.8%** Reduced risk of severe LRTD within 90 days of birth
- **69.4%** Reduced risk of severe LRTD within 180 days of birth

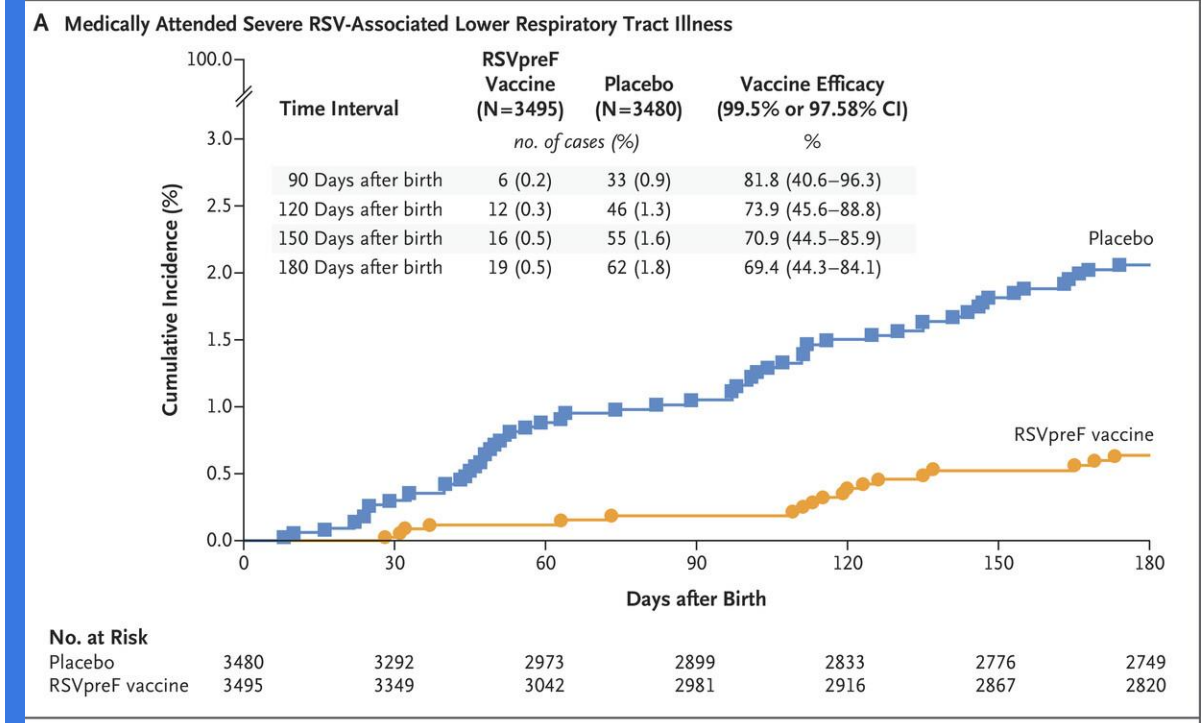
https://www.fda.gov/news-events/press-announcements/fda-approves-first-vaccine-pregnant-individuals-prevent-rsv-infants#

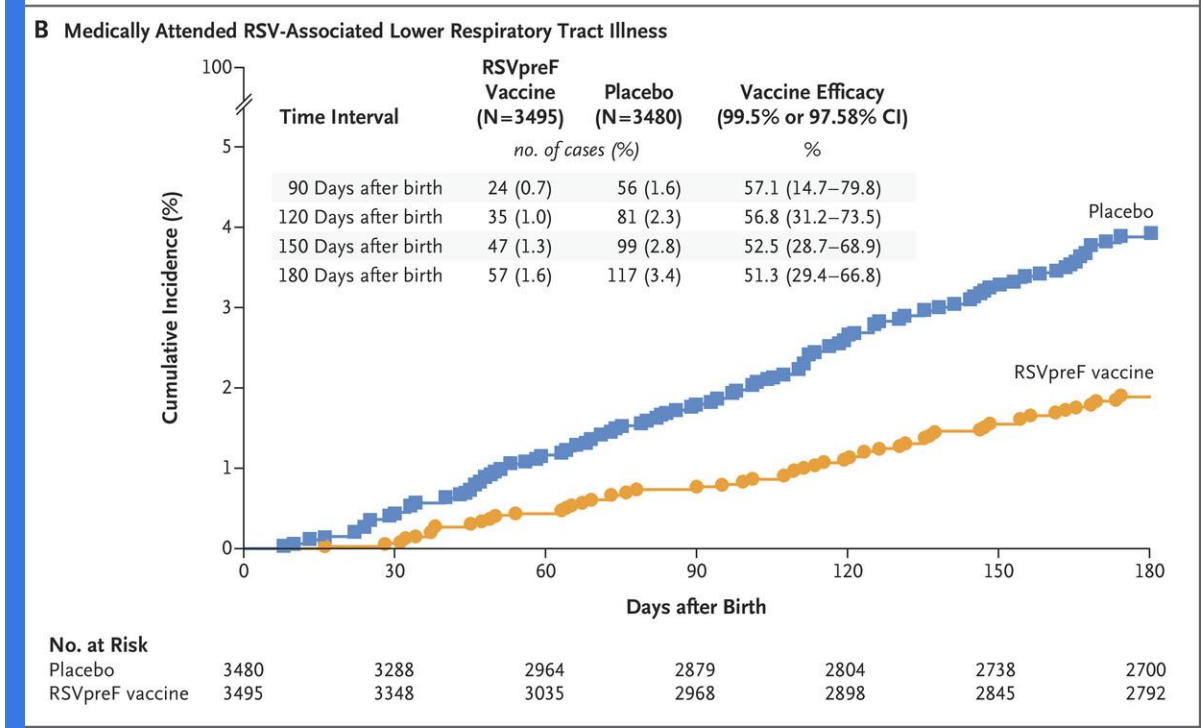
Maternal RSV Vaccine Efficacy

- In clinical trials, maternal RSV vaccine was effective at reducing hospitalizations and healthcare visits
- Maternal RSV vaccine efficacy remained high at 6 months

% Reduced Risk After Birth	3 months	6 months
Hospitalization	68%	57%
Healthcare visit	57%	51%

https://www.nejm.org/doi/full/10.1056/NEJMoa2216480





Maternal RSV Vaccine Safety

- Most common side effects: pain at injection site, headache, myalgia, nausea

- Preterm birth
  - Pre-licensure trial initially included pregnant persons at weeks 24-36 gestation
  - More preterm births were seen in vaccine recipients vs. placebo (not statistically significant)
  - In pregnant women 32-36 weeks gestation who received vaccine, 4.2% had preterm birth compared to 3.7% placebo
  - ***Available data were insufficient to establish or exclude causal relationship***

Fleming-Dutra et al., MMWR, 2024

Maternal RSV Vaccination Showed No Significant Differences in Pre-term Births

***5.9%** in vaccinated group*
vs
***6.7%** in unvaccinated group*

Table 2. Pregnancy Outcomes Between Patients Who Had RSV Vaccination During Pr… Did Not

Pregnancy outcome	Patients, No. (%)				
	RSV vaccine (n = 1011)	No RSV vaccine (n = 1962)			
Primary outcome					
Preterm birth <37 weeks' gestation	60 (5.9)	131 (6.7)	0.88 (0.64-1.20)	0.87 (0.62-1.20)	0.93 (0.64-1.34)
Secondary outcomes					
Hypertensive disorders of pregnancy	203 (20.1)	355 (18.1)	1.14 (0.94-1.38)	1.10 (0.90-1.35)	1.43 (1.16-1.77)
Gestational hypertension[c]	153 (15.1)	273 (13.9)	NA	NA	NA
Preeclampsia	67 (6.6)	130 (6.6)	NA	NA	NA
Eclampsia	1 (0.1)	1 (0.1)	NA	NA	NA
HELLP syndrome	2 (0.2)	2 (0.1)	NA	NA	NA
Small-for-gestational age birth weight[d]	107 (10.6)	178 (9.1)	1.19 (0.92-1.52)	1.16 (0.89-1.50)	1.31 (0.97-1.77)
Stillbirth	2 (0.2)	3 (0.2)	1.29 (0.17-7.82)	NA	NA

Son, Riley, & Staniczenko, *JAMA*, 2024

GSK halts prenatal RSV vaccine trial

- Preterm births in vaccine group higher than in placebo (6.8% vs 4.9%)
- Of preterm births, 5.5% in vaccine group were very (<32 weeks) or extremely (<28 weeks) preterm vs. 2.3% in placebo group
- Neonatal death risk higher in vaccine group (due to extreme prematurity)

Dieussaert et al, *NEJM*, 2024

Follow up on GSK Clinical Trial

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

RSV Prefusion F Protein–Based Maternal Vaccine — Preterm Birth and Other Outcomes

Ilse Dieus
Claudia Seic
Ge

CONCLUSIONS

The results of this trial, in which enrollment was stopped early because of safety concerns, suggest that the risks of any and severe medically assessed RSV-associated lower respiratory tract disease among infants were lower with the candidate maternal RSV vaccine than with placebo but that the risk of preterm birth was higher with the candidate vaccine.

For every 54 infants born to vaccine recipients, 1 additional preterm birth occurred; timing of preterm birth from vaccination varied from weeks to months. ***Mechanism of increased risk and whether or not it was a true risk remains unknown.***

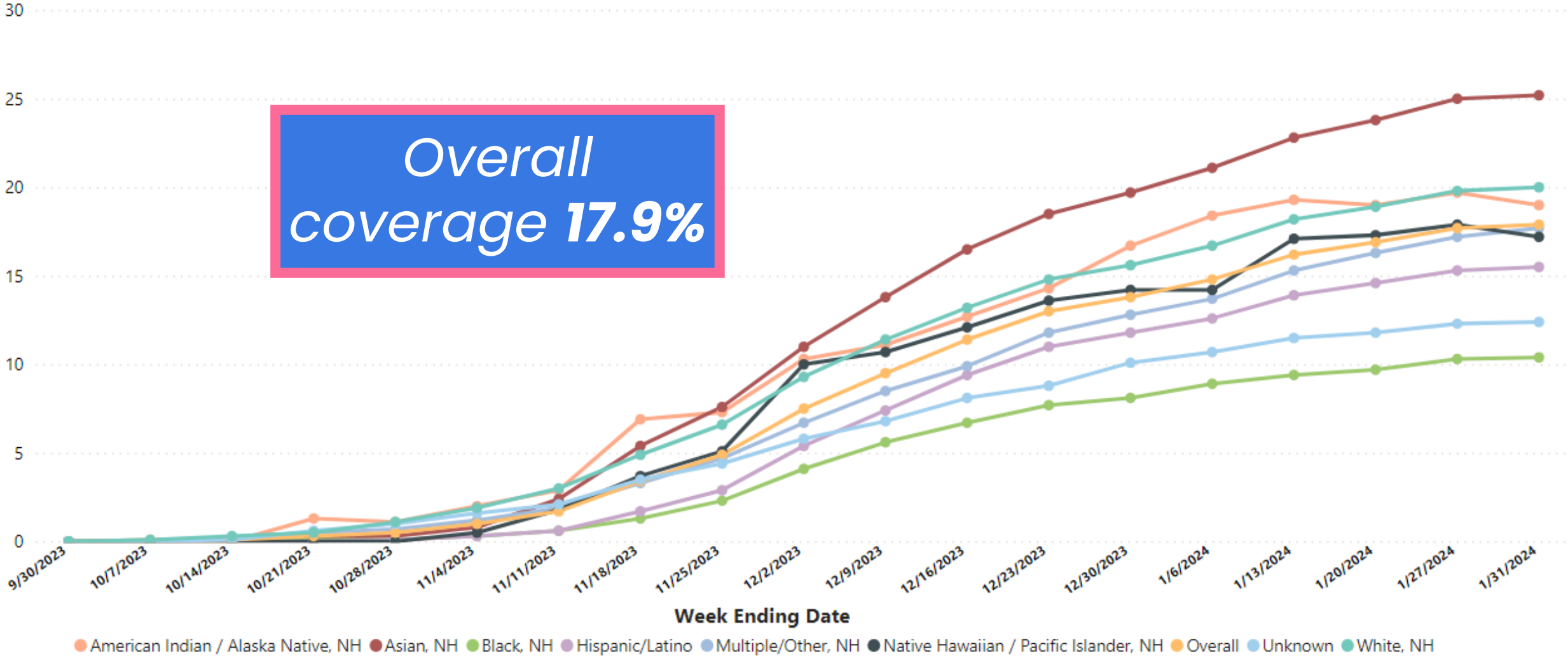
Dieussaert et al, *NEJM*, 2024

Other Vaccine Safety Outcomes

- Overall uncommon, but hypertensive disorders of pregnancy occurred in 1.8% of maternal vaccine recipients vs 1.4% placebo
- The following conditions (often associated with preterm birth) occurred more frequently in infants born to mothers who received the RSV vaccine compared to placebo:
  - Pre-eclampsia
  - Low birth weight (< 5.5 lbs)
  - Jaundice

CDC, 2024 – Respiratory Syncytial Virus (RSV) Vaccine Safety, Updated 10/3/2024

% of pregnant persons ages 18-49 years vaccinated with RSV vaccine overall and by race and ethnicity - VSD



CDC RSVVaxView - Data Source: Vaccine Safety Datalink

1,373

doses of Abrysvo were administered to women <50 years (it is likely these were pregnant women) in the 2023-2024 season

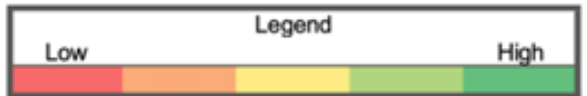
NDHHS has an internal dashboard that tracks additional RSV immunization data

NDHSS Internal Data

RSV Vaccination Intention Among People Who Are or Plan to Become Pregnant

Vaccination intention was lowest among those who thought RSV illness was not serious and those who did not receive vaccines during past pregnancies.

Predicted proportions	Overall	With child at home	Without child at home
Currently pregnant			
Yes, currently pregnant	54%	57%	46%
No, planning to get pregnant	57%	58%	55%
Heard of RSV			
In 2022	54%	58%	50%
In 2021	51%	51%	55%
In 2020 or earlier	58%	60%	53%
Never	55%	58%	50%
Vaccines during past pregnancies			
Yes, received some or all vaccines	62%	62%	
No, did not receive past pregnancy vaccines	33%	33%	
No previous pregnancy	52%		52%
Seriousness and likelihood of RSV			
Serious and likely	63%	63%	63%
Serious and not likely	55%	59%	49%
Not serious (likely or not likely)	35%	37%	32%
Race and ethnicity			
American Indian/ Alaskan Native	70%	72%	56%
Asian	55%	49%	60%
Black, non-Hispanic	58%	53%	64%
Native Hawaiian/ Pacific Islander	47%	46%	48%
Hispanic	59%	63%	53%
Multirace/Other	54%	59%	44%
White, non-Hispanic	53%	57%	48%
Insurance type			
Commerical	52%	55%	46%
Public	60%	61%	60%
No Insurance	46%	58%	30%
Maternal age			
18–24 y	53%	52%	51%
25–29 y	56%	61%	51%
30–34 y	58%	61%	52%
35–39 y	52%	53%	54%
40–45 y	60%	63%	52%
Census region			
Northeast	54%	58%	48%
South	55%	56%	53%
Midwest	55%	57%	52%
West	58%	60%	54%

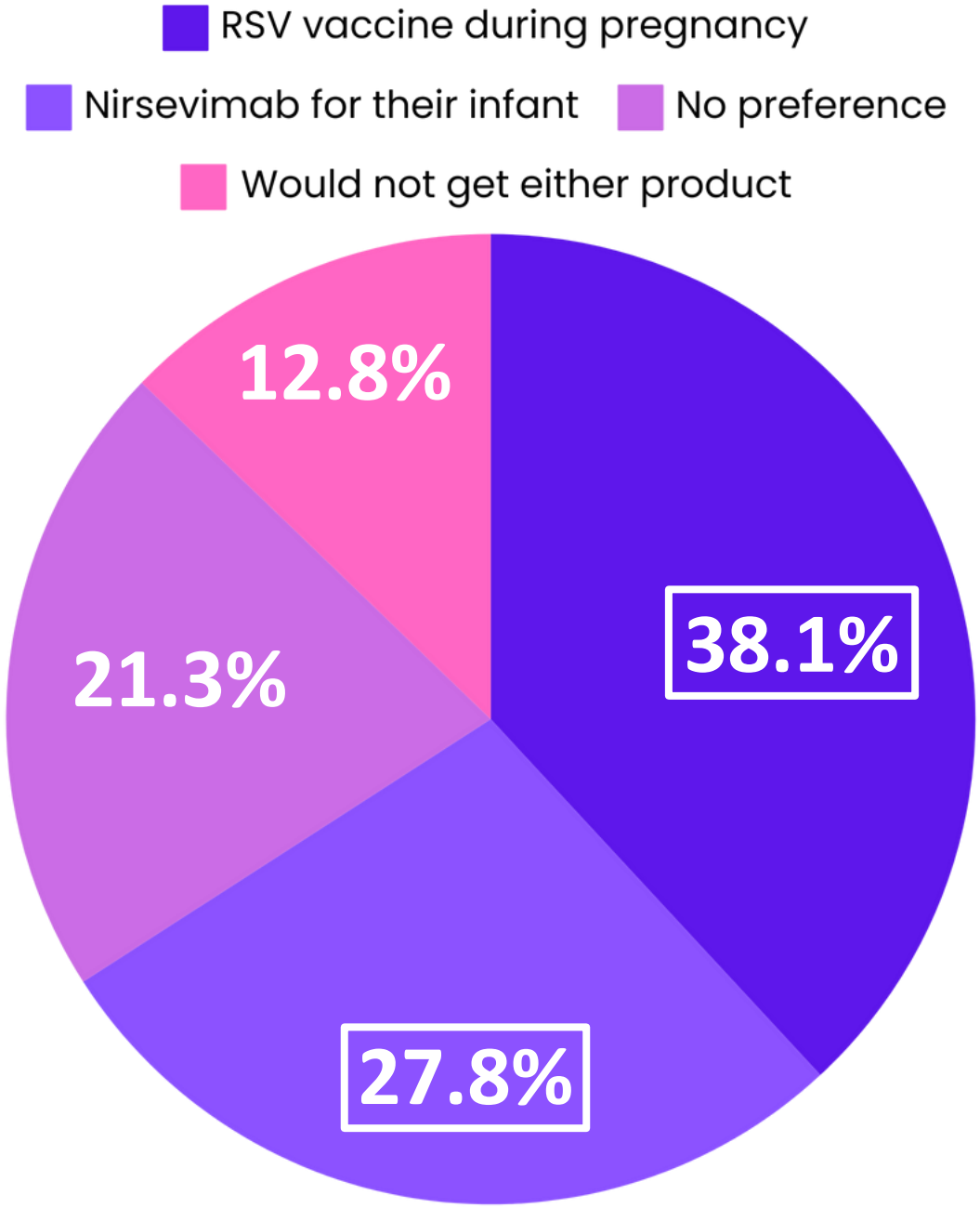


Saper et al., *Pediatrics,* 2024.

Maternal Product Preference

Among those who preferred the maternal RSV vaccine, 47.8% believed that maternal vaccination would be safer, 30.2% were worried about their infant getting too many shots, and 30% believed that maternal vaccination would be more effective.

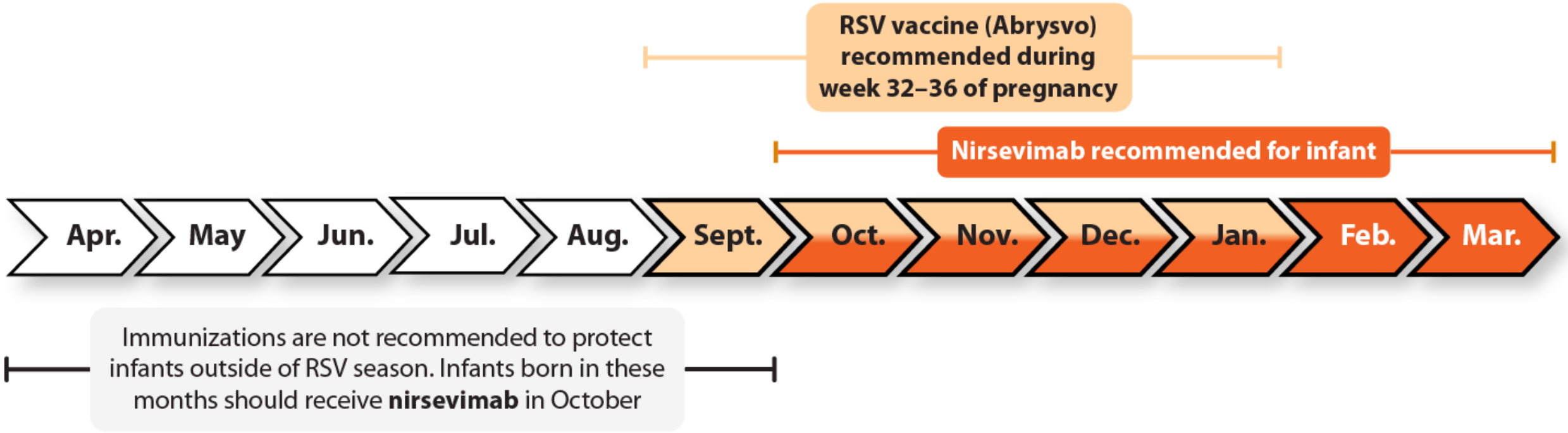
Among those who preferred nirsevimab for their infant, 43.6% believed that it would be more effective, and 32.4% believed that it would be safer.



Razzaghi et al, MMWR, 2024

	Advantages	Disadvantages
Maternal RSV Vaccine 	• Immediate protection for baby after birth • Reduces number of vaccines for infant at birth	• Potentially reduced protection in some situations (e.g., pregnant person is immunocompromised or infant born soon after vaccination) • Potential risk for preterm birth and hypertensive disorders of pregnancy (recent data are reassuring)
Nirsevimab 	• Protection may wane more slowly than from maternal RSV vaccine • Direct receipt of antibodies rather than relying on transplacental transfer • No risk for adverse pregnancy outcomes	• Requires infant injection • Delay in administration could leave the infant unprotected

Seasonal Recommendations



RSV typically peaks between December and February. It is important that babies have protection before RSV season peaks.

CDC, 2024

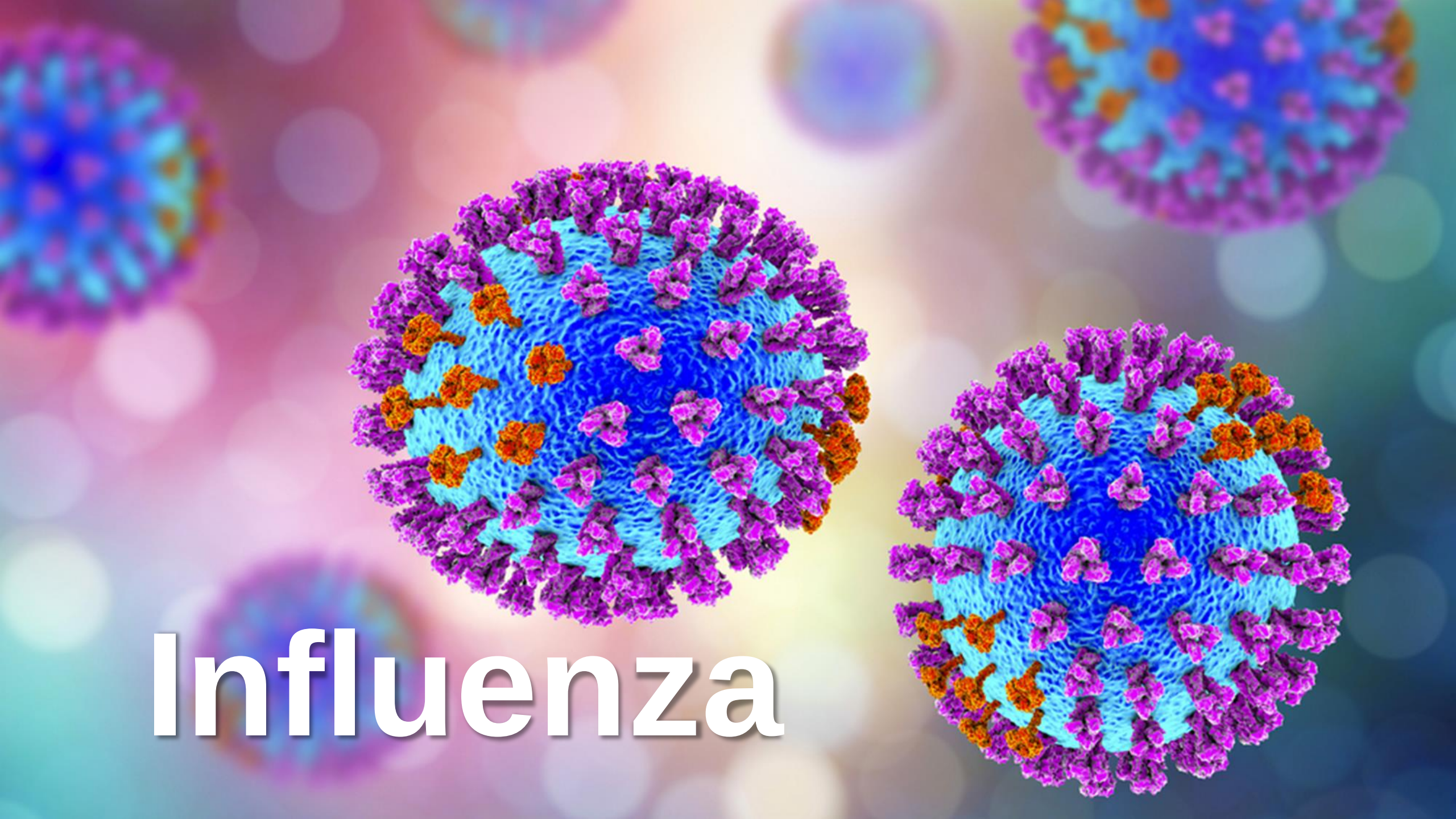
CDC 2024; Long, 2024 – Presented at ACIP on 6/28/2024

Should a pregnant person receive maternal RSV vaccine during pregnancy this season if they received maternal RSV vaccine during pregnancy in a previous season?

No.

Rather, that infant should receive nirsevimab.

ACOG 2024 – Nirsevimab Frequently Asked Questions, Updated 9/13/2024

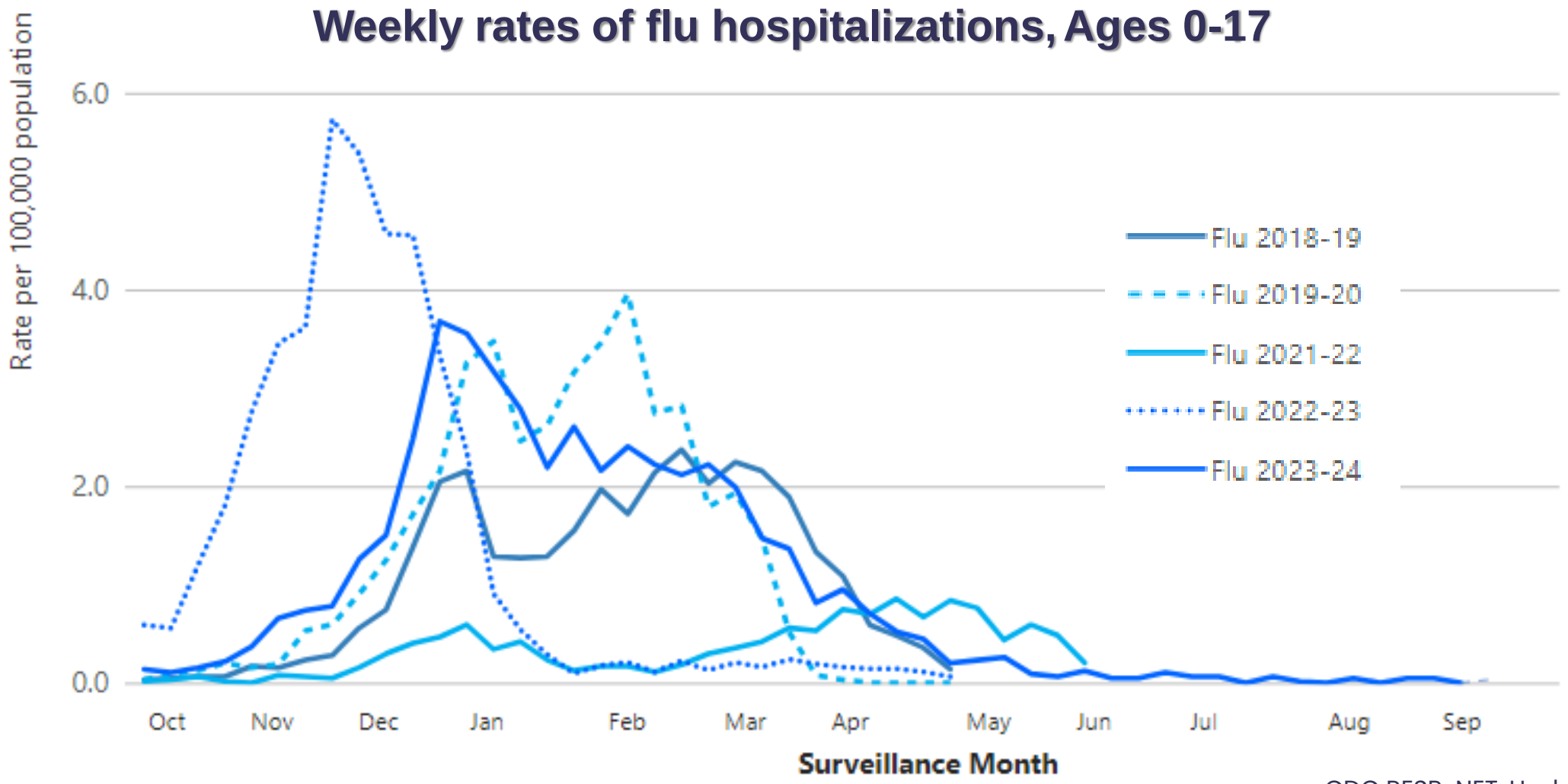

Influenza

Influenza in Children

- Every year, 8-10% of U.S. children develop symptomatic influenza
- Hospitalization rates are highest in kids under 5 years of age
- Viral infections have been known to lead to invasive bacterial infections in kids
- 8-11% of hospitalized children experience neurologic complications (e.g., seizures, encephalopathy)

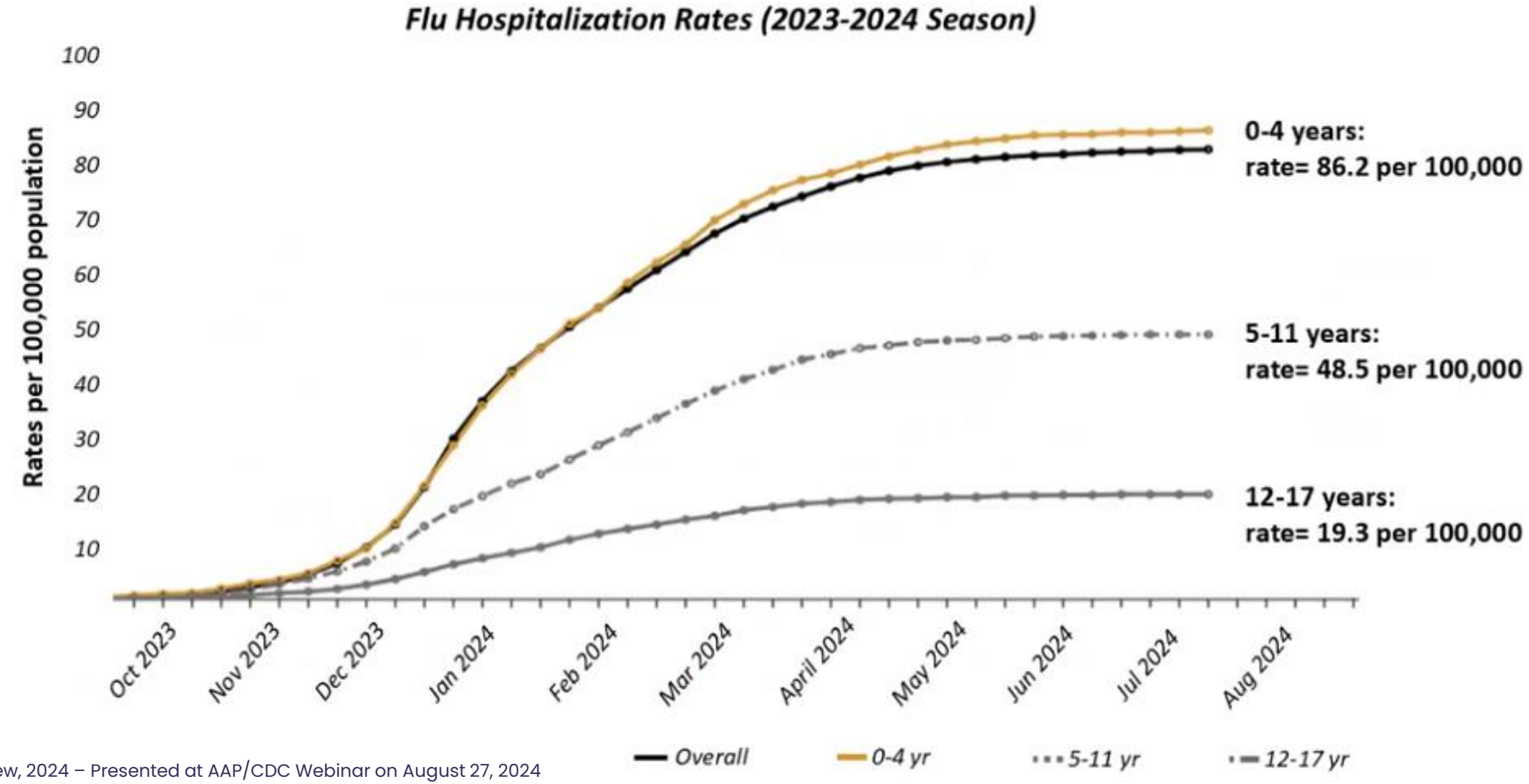
AAP Committee on Infectious Diseases, *Pediatrics*, 2024.

Influenza seasonality is shifting back to pre-pandemic period, peaking around mid-January



CDC RESP-NET, Updated 10/4/2024.

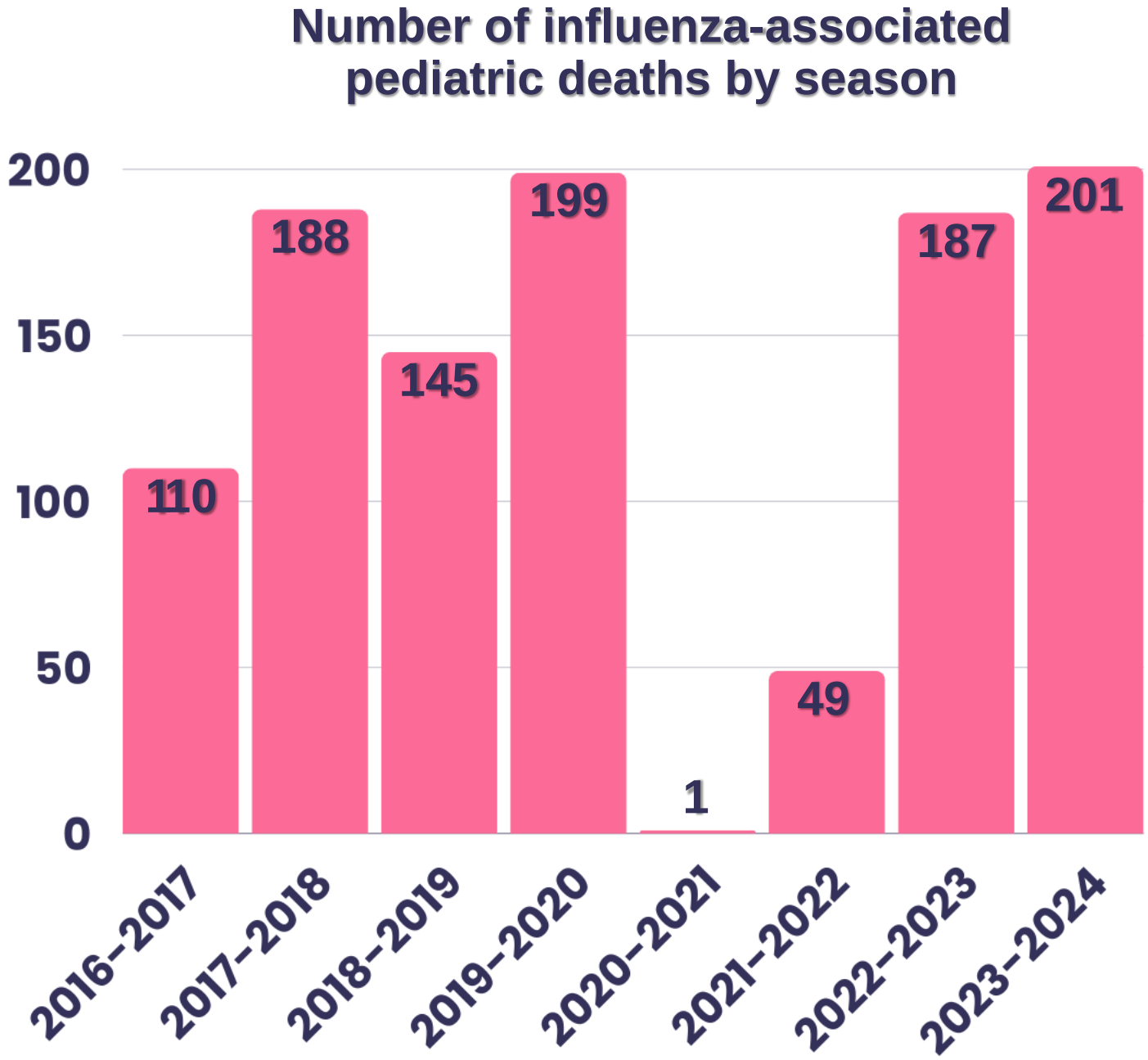
In the 2023-2024 flu season, pediatric hospitalizations were highest among the 0-4 year age group



CDC FluView, 2024 – Presented at AAP/CDC Webinar on August 27, 2024

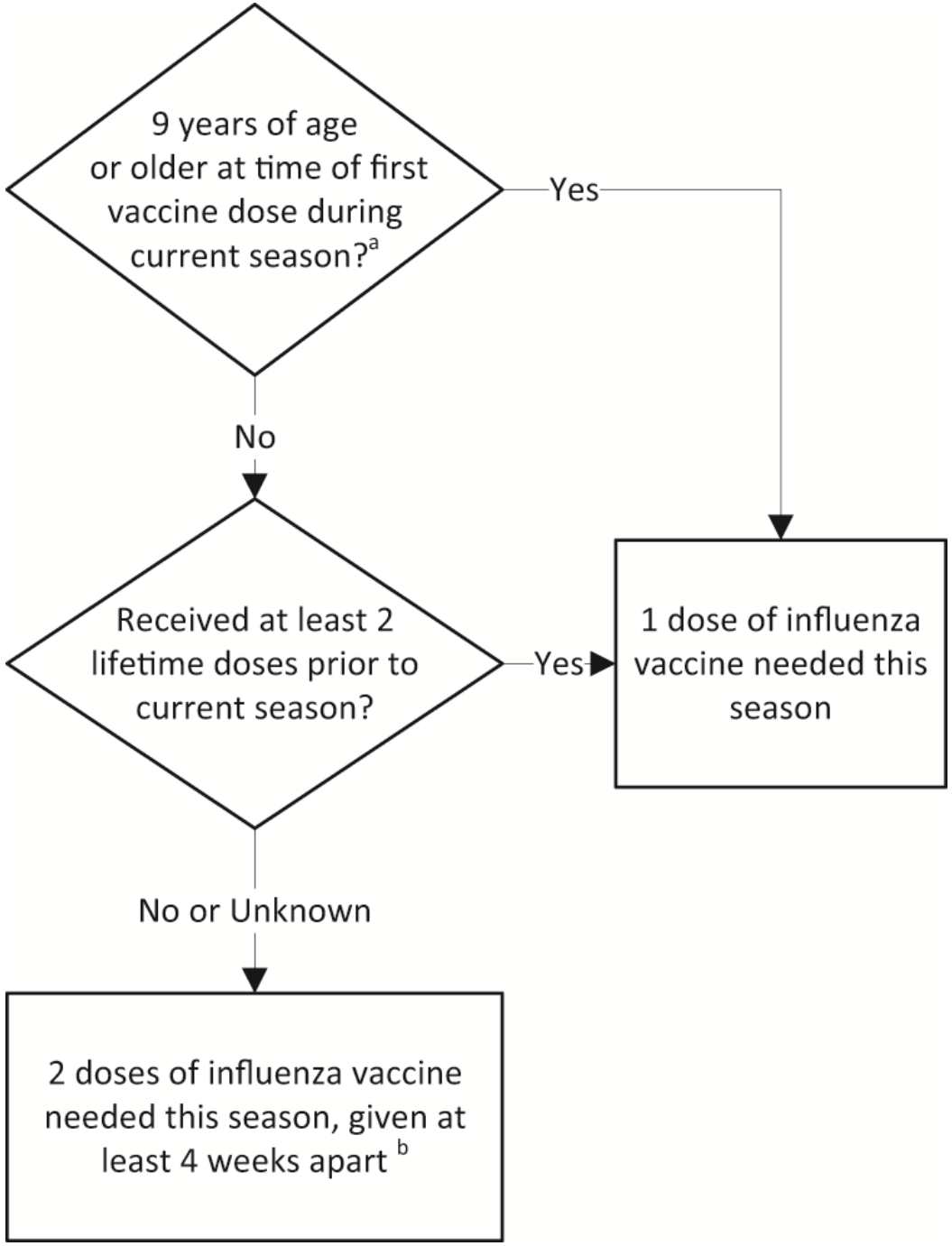
Flu Severity in Kids

- 2023-24 pediatric flu deaths exceed the previous high reported for a non-pandemic flu season at **201 total deaths**
- **80%** of flu-associated pediatric deaths occur in unvaccinated children



CDC 2024 - Influenza-Associated Pediatric Mortality Surveillance System, accessed 10/9/2024.

INFLUENZA VACCINES FOR KIDS



Influenza Vaccine

- Annual flu vaccine is recommended for **everyone 6 months and older**
- All 2024-25 influenza vaccines will be trivalent, targeting an influenza A(H1N1) virus, an A(H3N2) virus, and a B/Victoria virus

Because influenza B/Yamagata viruses, which are included in current four-component (quadrivalent) flu vaccines, are no longer actively circulating, their inclusion in flu vaccines is no longer warranted.

- Recommended dose(s) ideally received by the end of October
- Pregnant/postpartum individuals should receive the flu vaccine
- Can be coadministered with other vaccines

AAP Committee on Infectious Diseases, *Pediatrics*, 2024; CDC, 2024.

Children who got the 2023-2024 flu vaccine were:

59% - 67%

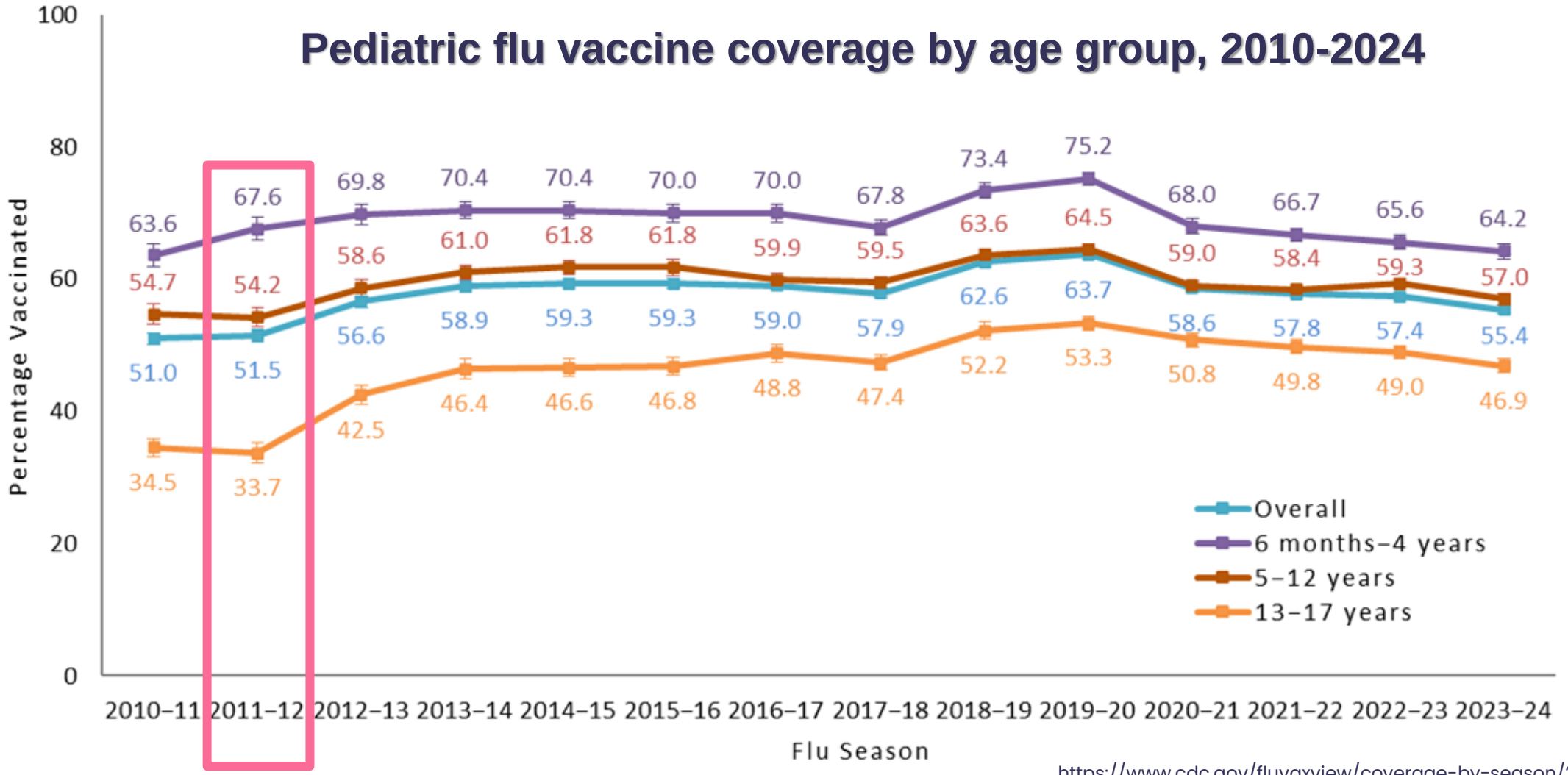
less likely to visit a health care provider because of flu.

52% - 61%

less likely to be hospitalized with flu.

CDC 2024 – This Season's Flu Vaccines Reduced Flu Medical Visits and Hospitalizations Across All Ages, Updated 2/29/2024.

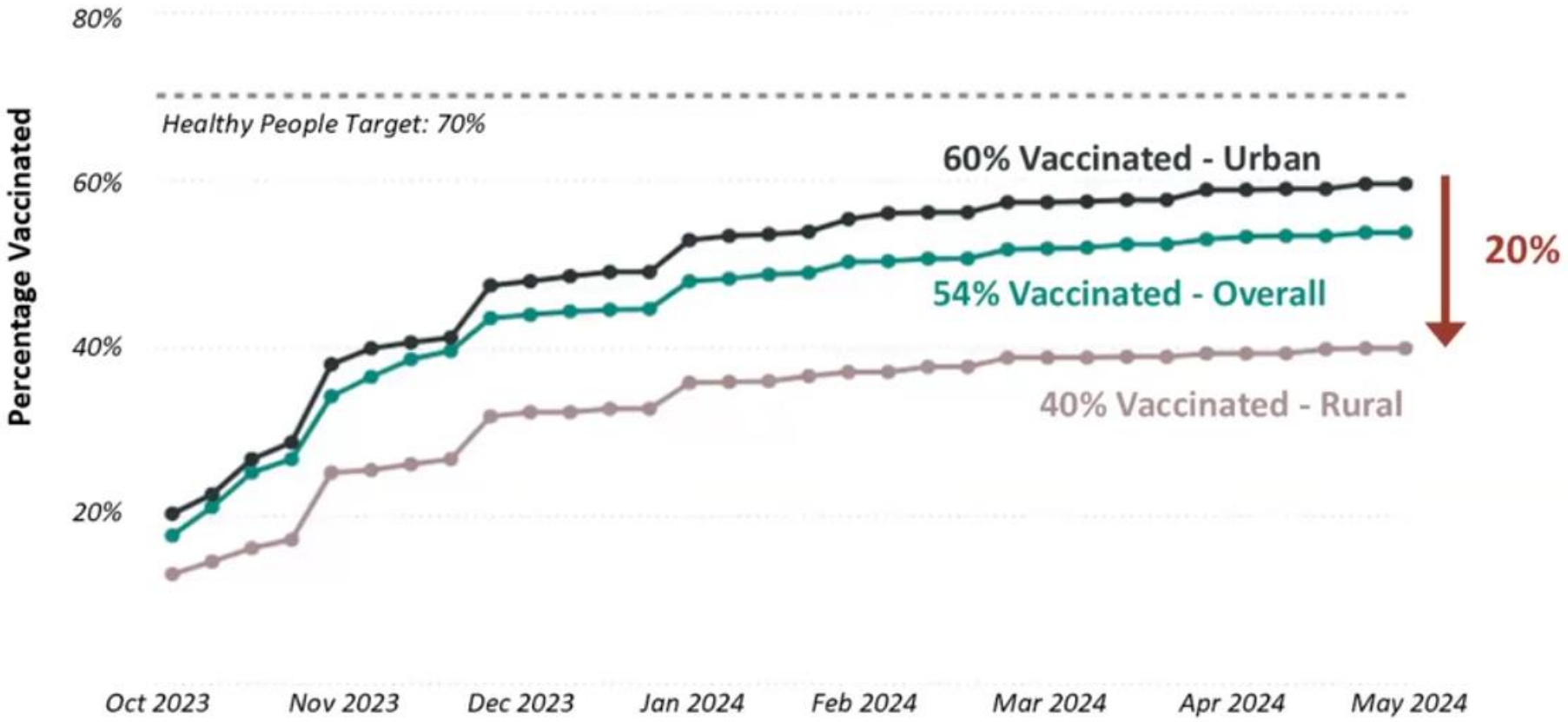
2023-24 flu vaccine coverage in children 6 months - 17 years was the lowest it has been in 12 seasons



https://www.cdc.gov/fluvaxview/coverage-by-season/2023-2024.html.

Children living in rural areas have lower vaccine coverage rates than children living in urban areas

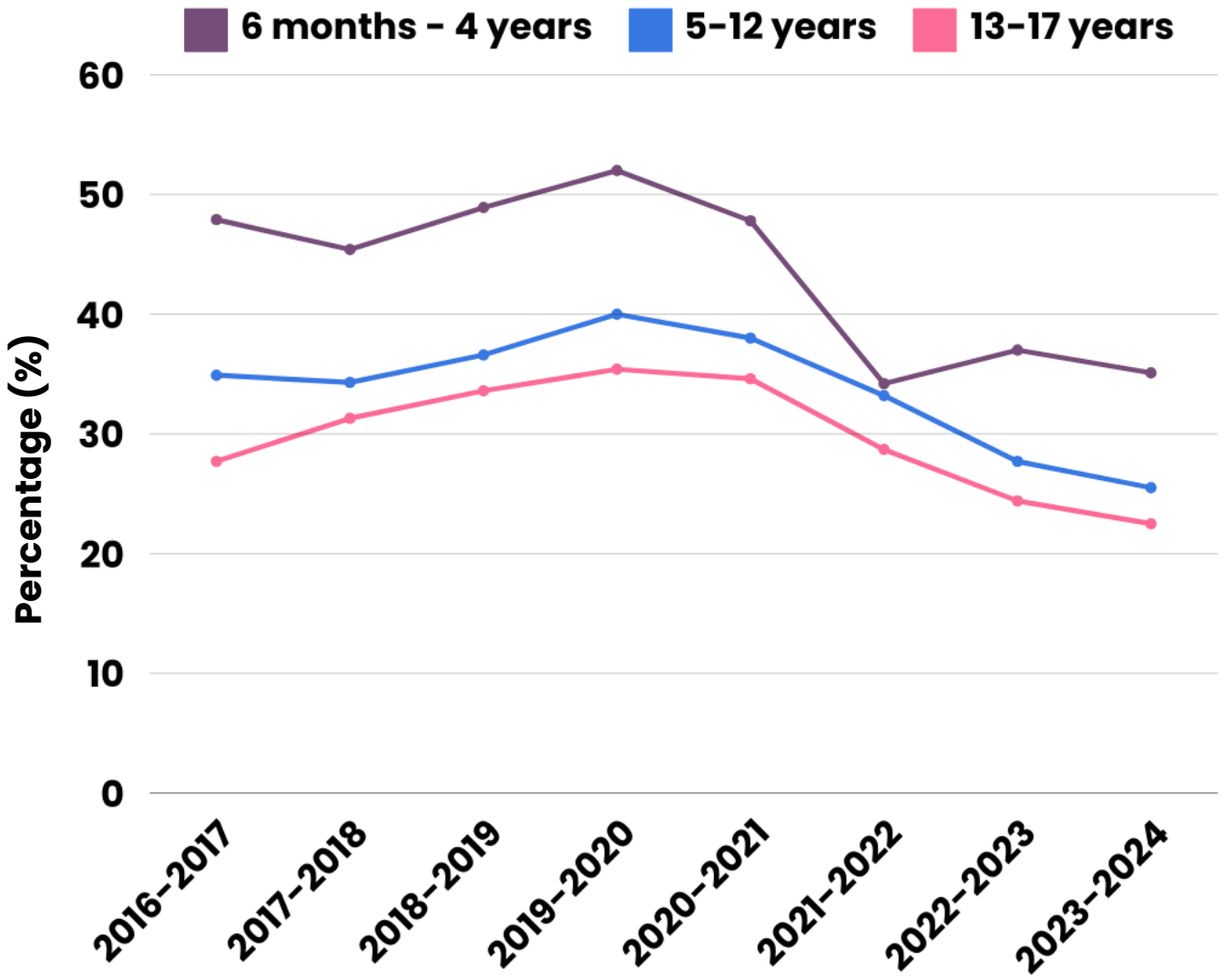
Flu vaccination among children 6 mos-17 years in urban and rural communities (2023-2024 season)



Children in rural areas have 20% lower flu vaccine coverage than children in urban areas.

https://www.aap.org/en/patient-care/immunizations/preparing-for-respiratory-virus-season/

Pediatric flu vaccine coverage by age group, North Dakota, 2016-2024



NDHHS Flu Vaccine Dashboard, Oct 7, 2024; CDC NIS-Flu, 2024.

North Dakota 2023-2024 Pediatric Flu Vaccine Coverage

6 months - 4 years	35.1%
5-12 years	25.5%
13-17 years	22.5%

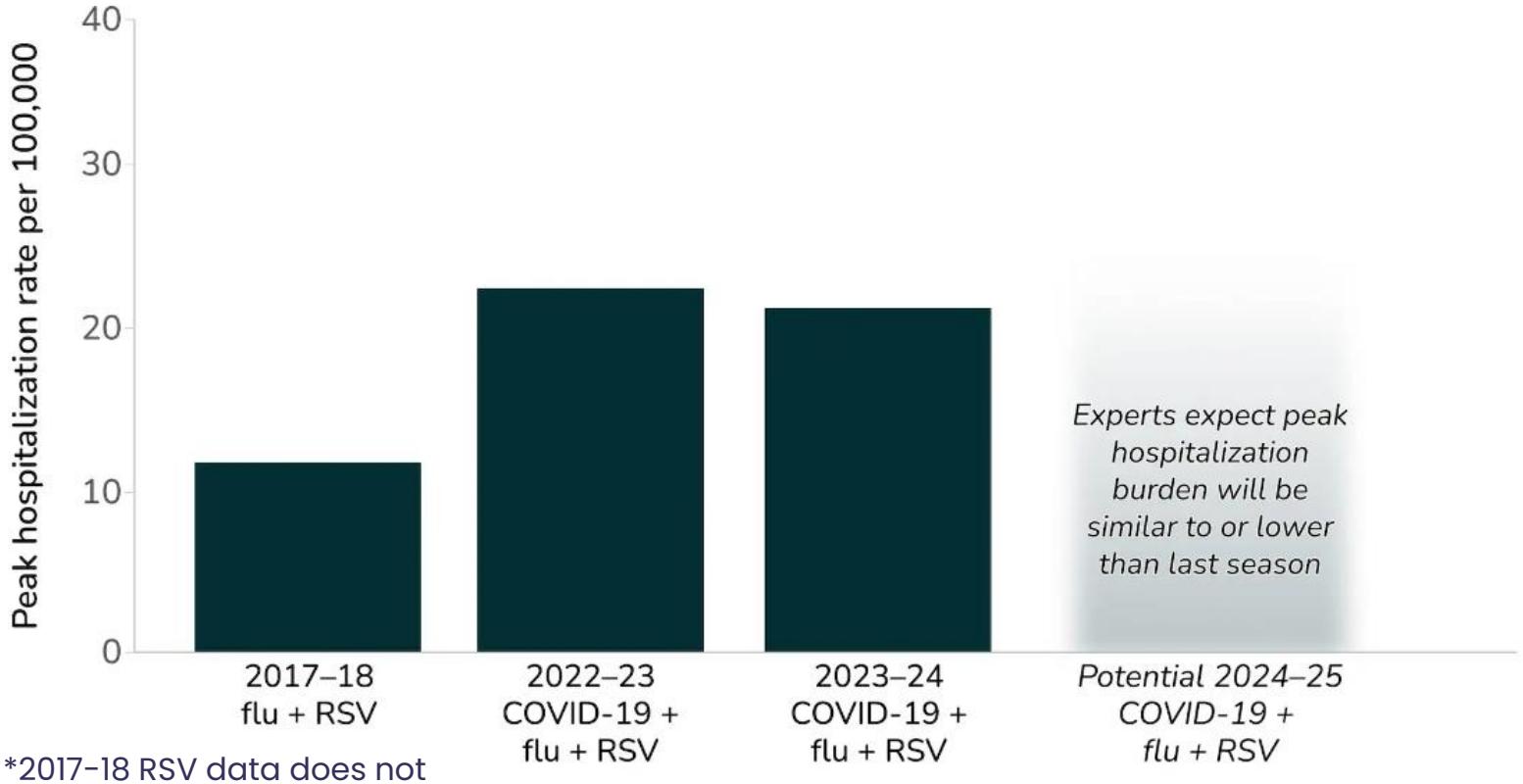
#36

ND ranked 36/50 in pediatric flu vaccine coverage

2024-2025 Respiratory Season Outlook

Upcoming 2024–25 respiratory season peak hospitalization burden likely similar to or lower than last year

Combined peak hospitalization burden of COVID-19, influenza, and RSV

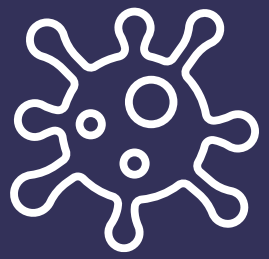


*2017-18 RSV data does not include pediatric hospitalizations.

- Estimated 80% chance that the hospitalization burden (for all ages) for COVID-19, flu, and RSV combined at their peak during the 2024-2025 season will be **similar to or lower than last season**
- Since the COVID-19 summer wave peaked early, expecting second, smaller wave during respiratory season
- Flu vaccine effectiveness against hospitalization anticipated to be between 42% (low uptake) and 55% (high uptake) in adults 18+
- Compared to no uptake of infant RSV prevention, between 76% (high uptake) and 43% (low uptake) of hospitalizations in infants <1 would be prevented

CDC, 2024 - 2024-2025 Respiratory Disease Season Outlook, Updated 8/29/2024

Pediatric Respiratory Virus Summary

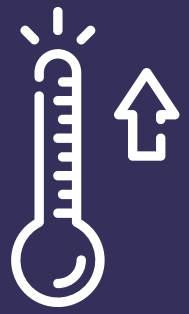


COVID

- Rates of COVID-associated hospitalization highest among those <4 years
  - Infants <6 months are most vulnerable
- Over half of children hospitalized for COVID in 23-24 season had no underlying medical conditions
- Everyone 6 months and older should stay up to date on COVID vaccine
- Pediatric COVID vaccines reduce the risk of hospitalization, MIS-C, long COVID, and death from the virus
- Vaccine coverage and intent is low

RSV

- RSV is the most common cause of hospitalization among infants
- Two options for prevention: nirsevimab (mAB) or maternal RSV vaccine
  - Both options are safe and effective; preference may vary based on patient situation
  - Nirsevimab should ideally be administered at birth or within 1 week of birth
  - Maternal RSV vaccine should be administered during 32-36 weeks of pregnancy



FLU

- The 2023-2024 flu season was particularly severe among our pediatric patients
  - Pediatric deaths have reached a new high at 201 total deaths
- Everyone 6 months and older should get an annual flu vaccine
- The 2023-2024 flu vaccine reduced the risk of healthcare visits and hospitalization substantially
- Flu vaccine coverage has decreased markedly over time, with 2023-2024 rates reaching the lowest they've been since 2011-2012

Remember, YOU are your patients' most trusted source of information!

Fall and Winter Immunization Guide

COVID-19 and Flu Updated 2024-25 Vaccines

Everyone 6 months and older

RSV Immunization to Protect Babies

Vaccine

Pregnant women during weeks 32-36 of pregnancy during RSV season

OR

Monoclonal Antibodies

Babies entering or born during the RSV season

CDC.gov

Questions?