

A photograph of the Vanderbilt University Medical Center building at dusk. The building is a large, multi-story structure made of red brick with white stone accents. It features a prominent central tower with a Gothic-style spire that is illuminated from within, casting a warm glow. The sky is a pale, clear blue. In the foreground, there are several large, leafy trees and a dark metal fence. The overall scene is peaceful and well-lit.

Pediatric COVID Vaccines

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Disclosures

- Consultant
 - Pfizer, Moderna, Janssen, GSK, Cowen Investments, Vir
- Royalties
 - UpToDate
- Grant Funding
 - NIH Vaccine and Treatment Evaluation Unit (PI)
 - Lead PI for Moderna KidCOVE study and site PI for multiple COVID related trials of mRNA-1273 and Ad26.CoV2.S vaccines
 - CDC Clinical Immunization Safety Assessment Network (PI)

Clinical Infectious Diseases

VIEWPOINTS



Warp Speed for Coronavirus Disease 2019 (COVID-19) Vaccines: Why Are Children Stuck in Neutral?

Evan J. Anderson,^{1,2,3, } James D. Campbell,⁴ C. Buddy Creech,⁵ Robert Frenck,⁶ Satoshi Kamidani,^{1,3} Flor M. Munoz,^{7,8} Sharon Nachman,⁹ and Paul Spearman^{6, }

Share of reported coronavirus infections in the US that led to deaths, by age

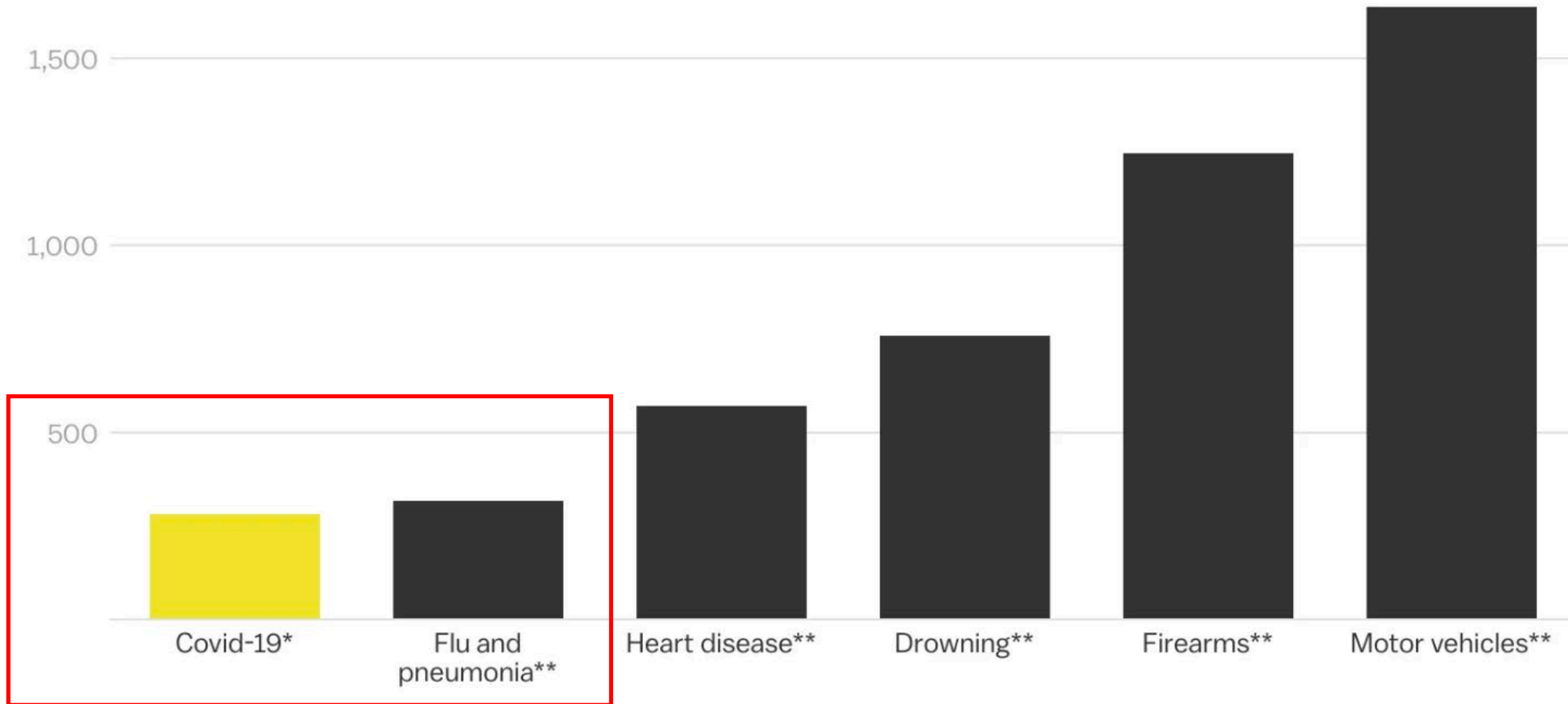


*Data includes all Covid-19 cases and deaths in the US from January 2020 to September 2021.

Source: Centers for Disease Control and Prevention

Childhood deaths in the US from Covid-19 and other causes

Average annual deaths of children under 18 in recent years, from January through September



*Covid-19 deaths: January through September 2021

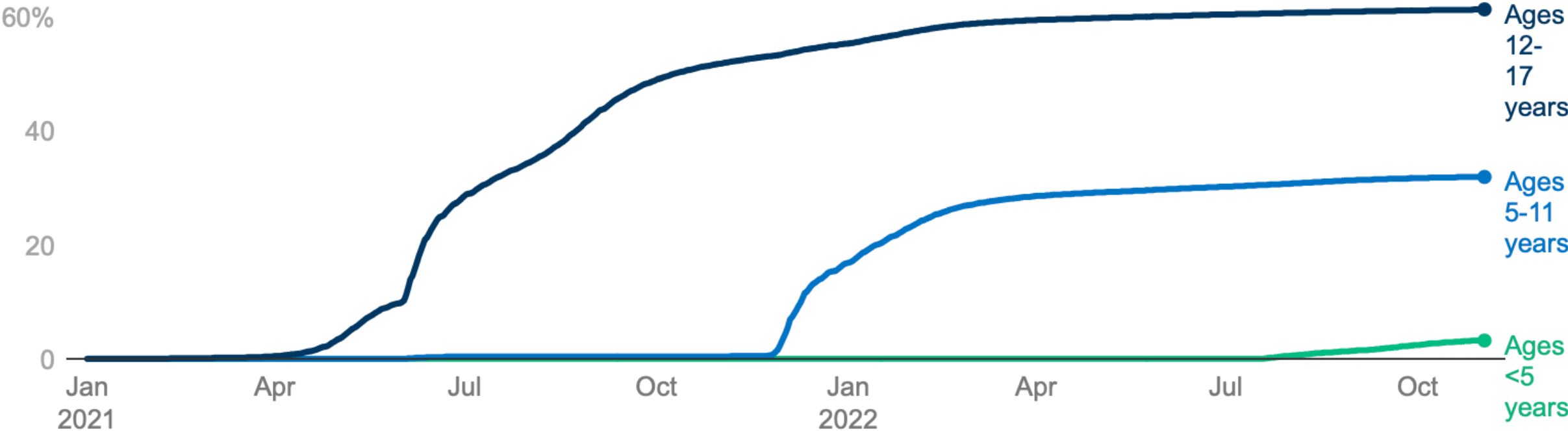
**Other deaths: Annual average from January through September across 2015 to 2019 (latest available data)

Source: Centers for Disease Control and Prevention

Vaccine	0 month	1 month	2 month	3 month	4 month	5 month	6 month
Pfizer-BioNTech (ages 6 months – 4 years)	1st Dose	2nd Dose¹ (3–8 weeks after 1 st dose)		3rd Dose (At least 8 weeks after 2 nd dose)			
Moderna (ages 6 months –5 years)	1st Dose	2nd Dose¹ (4–8 weeks after 1 st dose)					
Pfizer-BioNTech (ages 5 years and older)	1st Dose	2nd Dose¹ (3–8 weeks after 1 st dose)		Bivalent Booster Dose^{2 3 5} (At least 2 months after last dose)			
Moderna (ages 6 years and older)	1st Dose	2nd Dose¹ (4–8 weeks after 1 st dose)		Bivalent Booster Dose^{2 3 5} (At least 2 months after last dose)			
Novavax (ages 12 years and older)	1st Dose	2nd Dose¹ (3–8 weeks after 1 st dose)		Bivalent Booster Dose^{2 3 5} (At least 2 months after last dose)			
Janssen⁴ (ages 18 years and older)	1st Dose		Bivalent Booster Dose^{2 3 5} (At least 2 months after 1 st dose)				

Figure 1

Percent of Children With Completed COVID-19 Primary Series, by Age Group



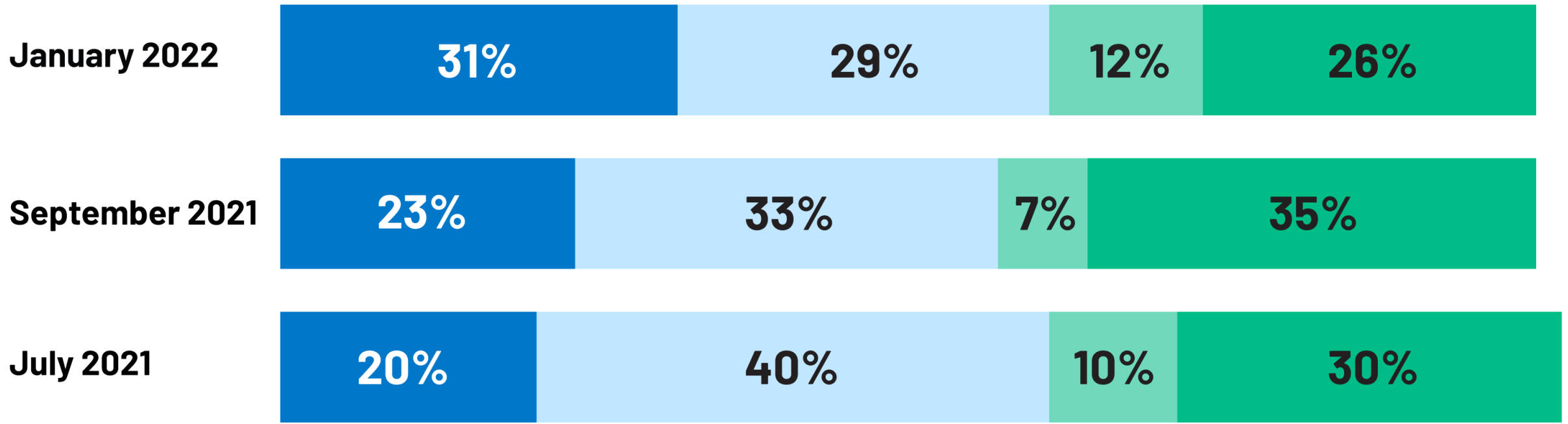
NOTE: Data as of November 2, 2022. Children between the ages of 16-17 became eligible on December 11, 2020. Children between the ages of 12-15 became eligible on May 10, 2021. Children between the ages of 5-11 became eligible on November 2, 2021. Children under 5 became eligible for COVID-19 vaccination on June 18, 2022.

SOURCE: KFF analysis of data from the [CDC COVID Data Tracker](#). • PNG



3 in 10 Parents of Children Under 5 Say They'll Get Them a COVID-19 Vaccine ASAP Once Authorized for Their Age Group

● Get them vaccinated right away ● Wait and see ● Only if required ● Definitely not



Are vaccines (in general) important?

Respondents who strongly agree (%)

0-29.9 30-39.9 40-49.9 50-59.9 60-69.9 70-79.9 80-89.9 90-99.9

November, 2015

November, 2018

C Vaccines are important

D Vaccines are important

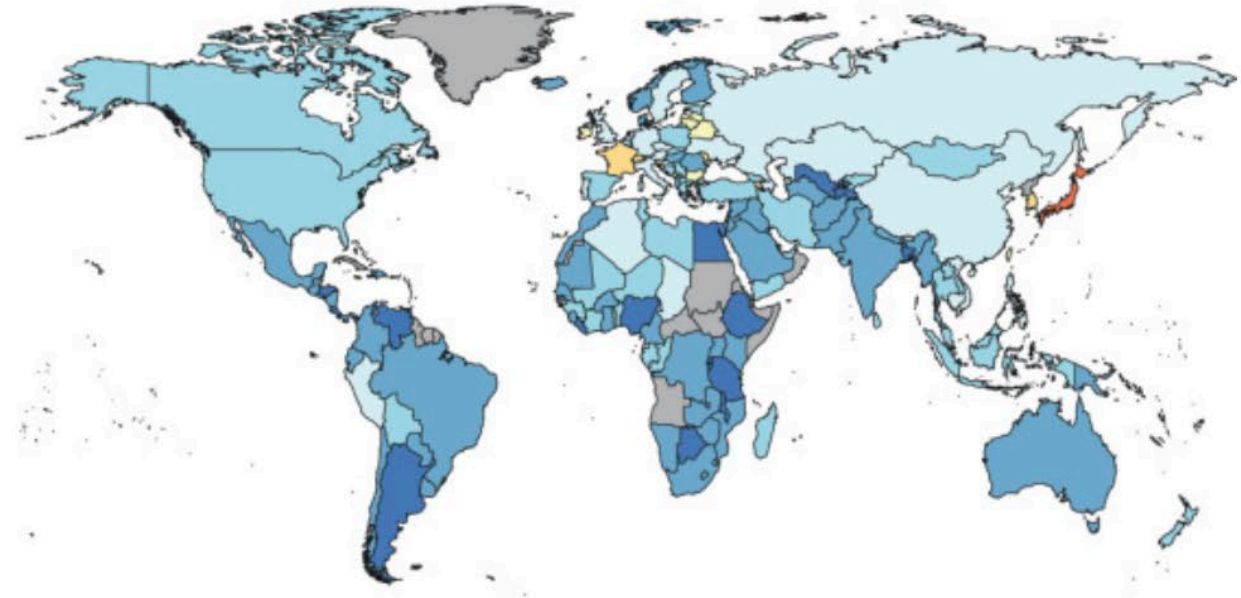
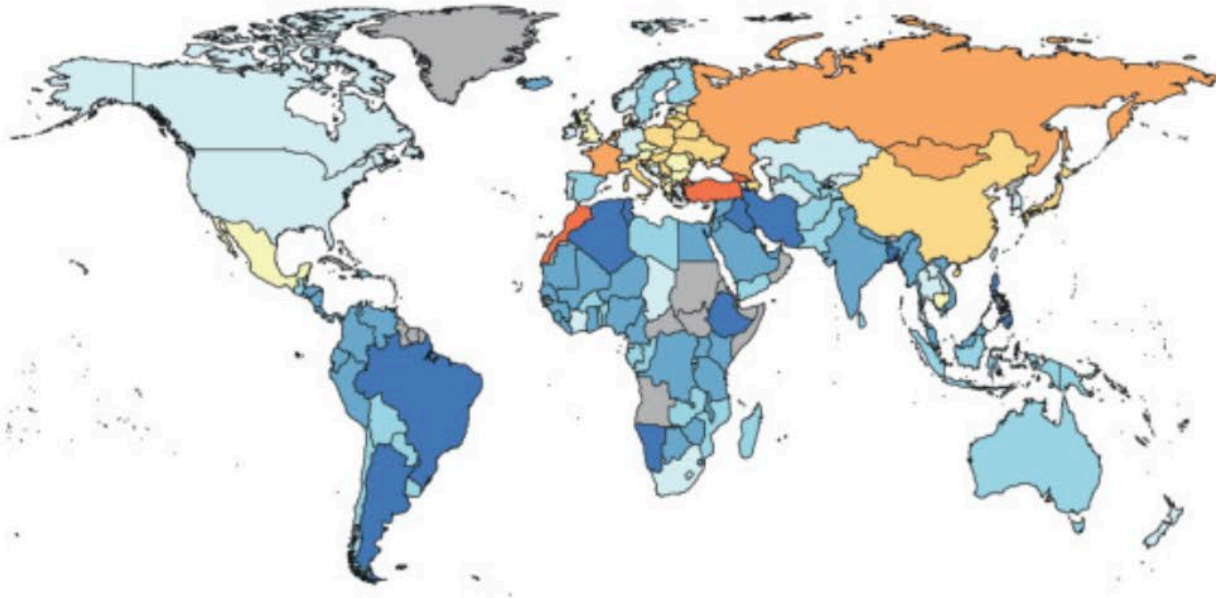


Figure 1 Global trends in perceptions towards the safety of vaccines in November, 2015, and November, 2018

Are vaccines (in general) effective?

Respondents who strongly agree (%)

0-29.9 30-39.9 40-49.9 50-59.9 60-69.9 70-79.9 80-89.9 90-99.9

November, 2015

November, 2018

E Vaccines are effective

F Vaccines are effective

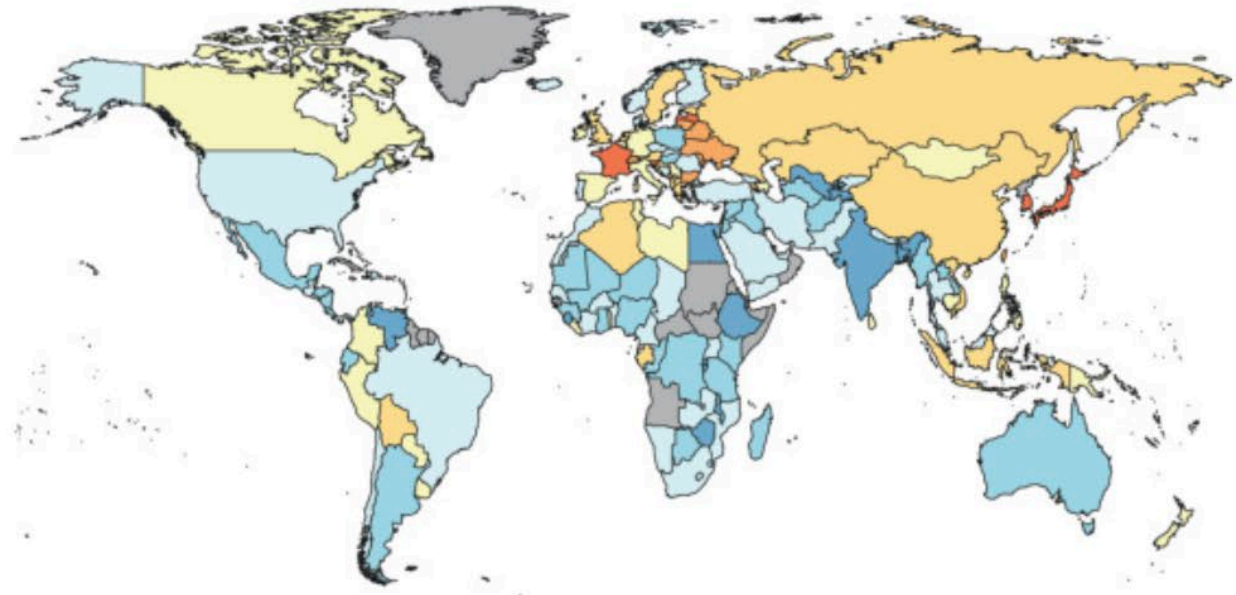
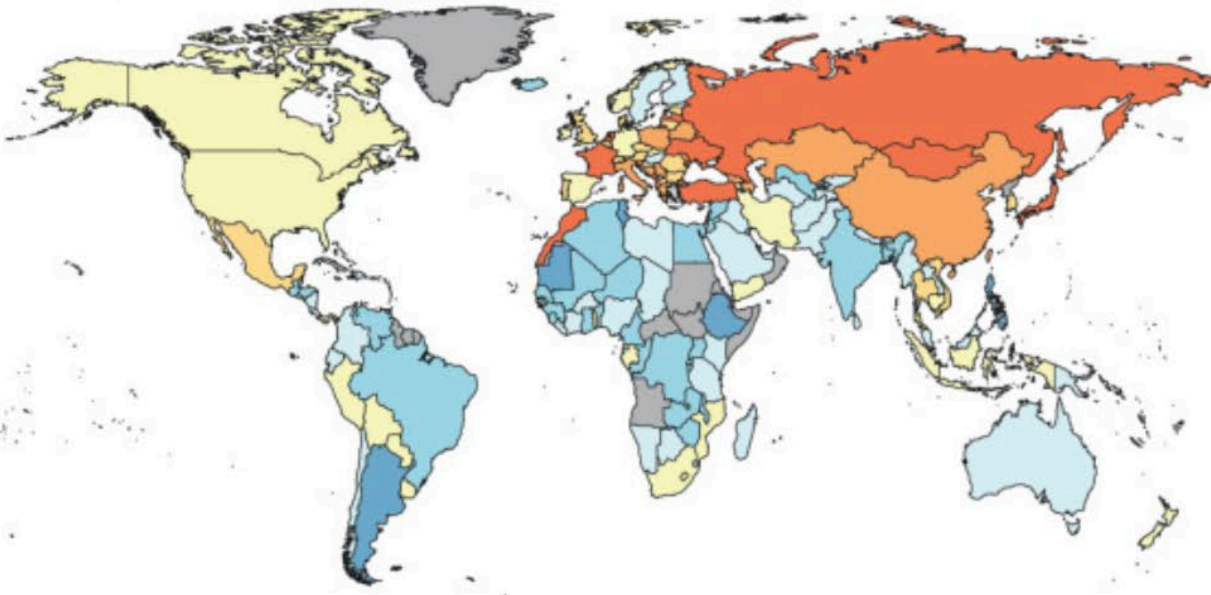


Figure 1 Global trends in perceptions towards the safety of vaccines in November, 2015, and November, 2018

Are vaccines (in general) safe?

Respondents who strongly agree (%)

0-29.9 30-39.9 40-49.9 50-59.9 60-69.9 70-79.9 80-89.9 90-99.9

November, 2015

November, 2018

A Vaccines are safe

B Vaccines are safe

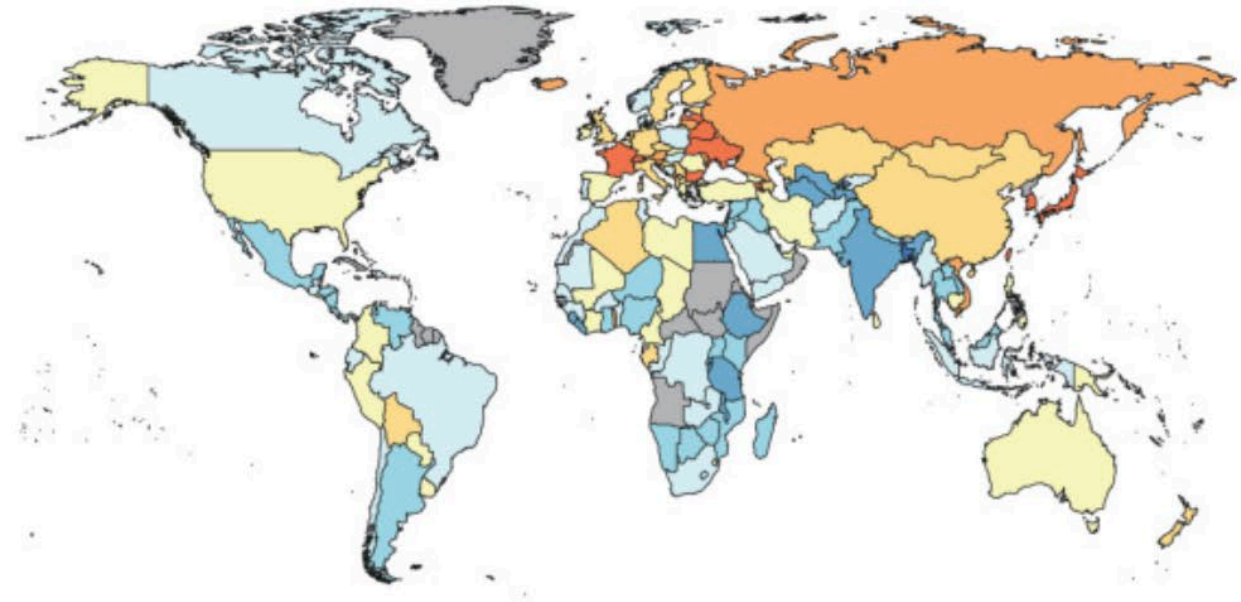
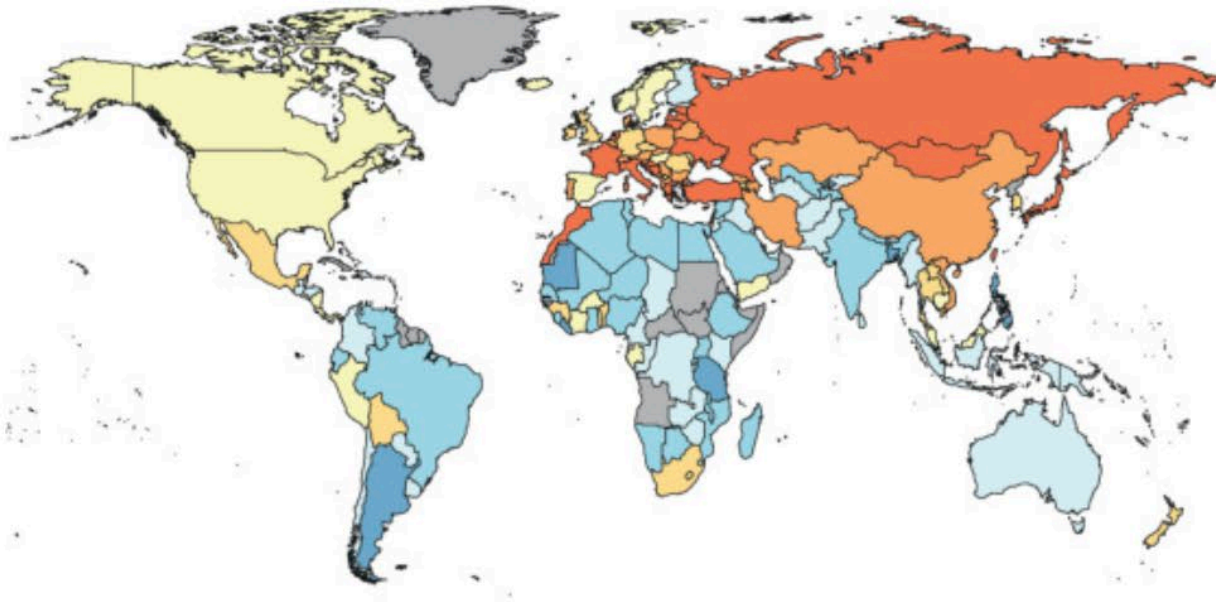
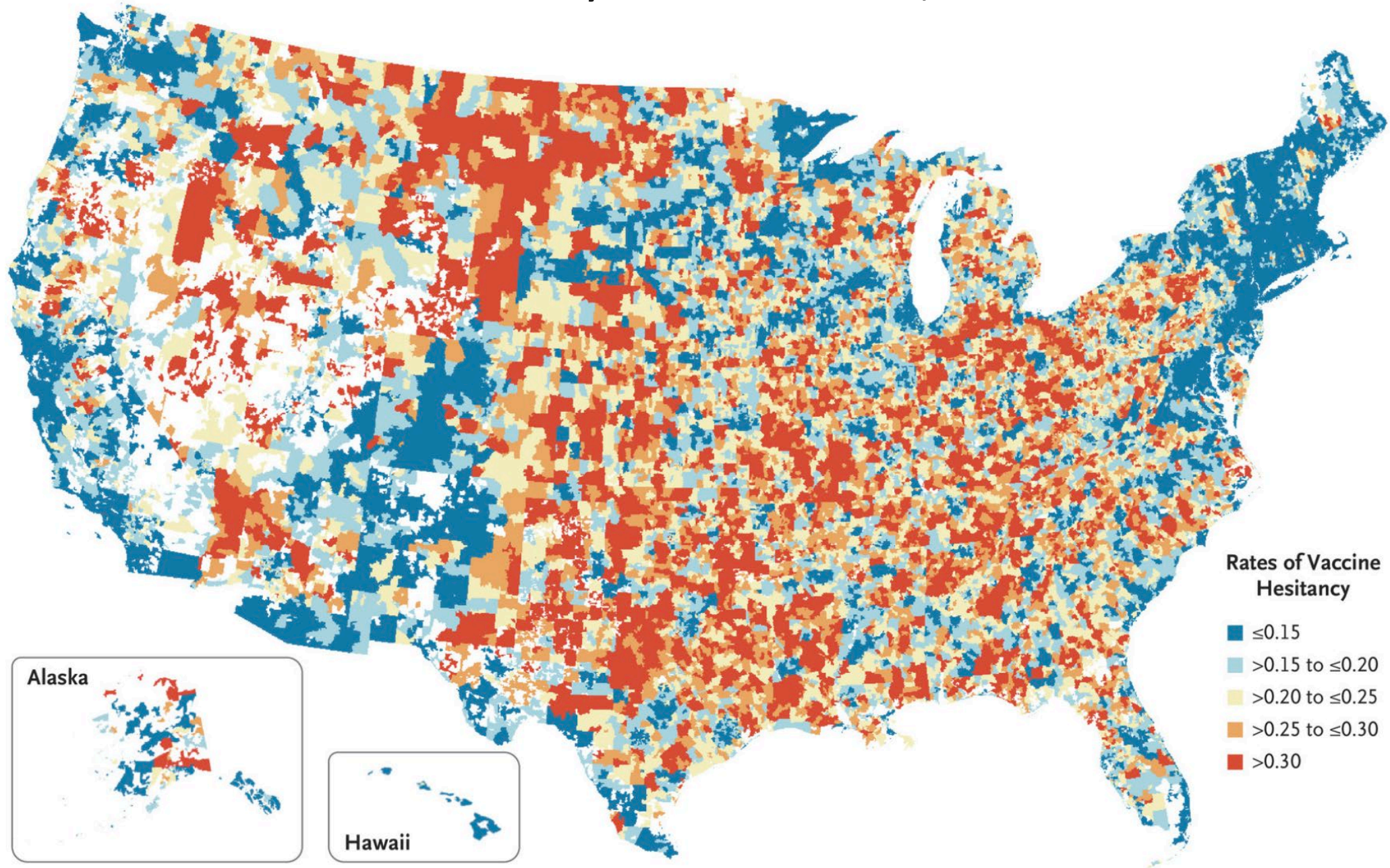


Figure 1 Global trends in perceptions towards the safety of vaccines in November, 2015, and November, 2018

Rates of Vaccine Hesitancy across U.S. ZIP Codes, December 2021





Why should we vaccinate children against COVID-19?



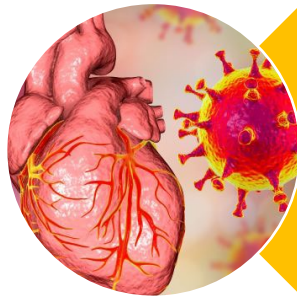
Children benefit from vaccination



Fewer missed days of school



Fewer infections and deaths



Fewer complications of infection
(Long-COVID, myocarditis, MIS-C)



Reduced likelihood of spreading
COVID to family members and
others

KidCOVE

Operational Characteristics



6-11 years



2-5 years



>6 months

Part 1: Open label, dose escalation (25, 50, 100 mcg), age de-escalation (n=1200)

Part 2: Randomized 3:1 to receive vaccine or placebo (n=4000 per age group)

Evaluation of mRNA-1273 Covid-19 Vaccine in Children 6 to 11 Years of Age

Creech CB et al. DOI: 10.1056/NEJMoa2203315

CLINICAL PROBLEM

Vaccination of children against Covid-19 is an important step toward protecting them from Covid-19 and controlling the pandemic, but just one vaccine (BNT162b2; Pfizer–BioNTech) is currently authorized in the United States for children 6–11 years of age.

CLINICAL TRIAL

Design: An ongoing phase 2–3 trial, consisting of two parts — open label for dose selection (part 1) and observer-blinded, randomized, placebo-controlled expansion (part 2) — examined the safety and immunogenicity of the mRNA-1273 Covid-19 vaccine (Moderna) in U.S. and Canadian children 6–11 years of age.

Intervention: In part 1, a total of 751 children received 50- μ g or 100- μ g injections of the mRNA-1273 vaccine; on the basis of safety and immunogenicity results, the 50- μ g dose level was selected for part 2 of the trial. In part 2, a total of 4016 children were randomly assigned (3:1) to receive two injections (28 days apart) of vaccine or placebo. Primary objectives, assessed in the randomized cohort, were evaluations of safety and of noninferiority of immune responses in the children relative to a comparison cohort of young adults 18–25 years of age.

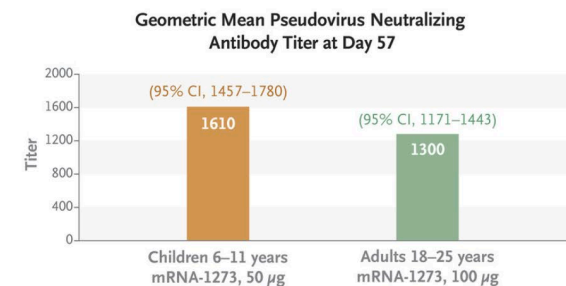
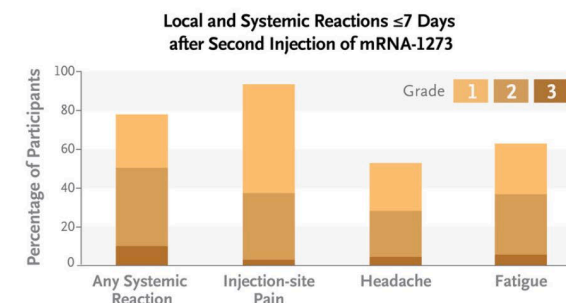
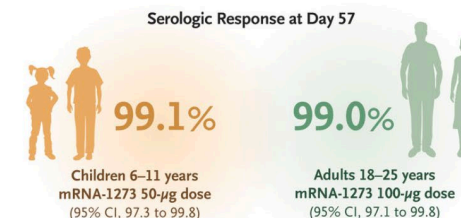
RESULTS

Safety: Adverse events within 7 days after injection were usually grade 1 or 2; injection-site pain, headache, and fatigue were most common. Through a median of 51 days after the second dose, there were no reports of death or vaccine-related serious adverse events.

Immunogenicity: The geometric mean neutralizing antibody titers and the serologic responses in children were noninferior to those in young adults.

LIMITATIONS AND REMAINING QUESTIONS

- Longer-term follow-up for both safety and efficacy is needed.
- Analysis of vaccine efficacy after two doses of vaccine was limited by a small number of incident Covid-19 cases.

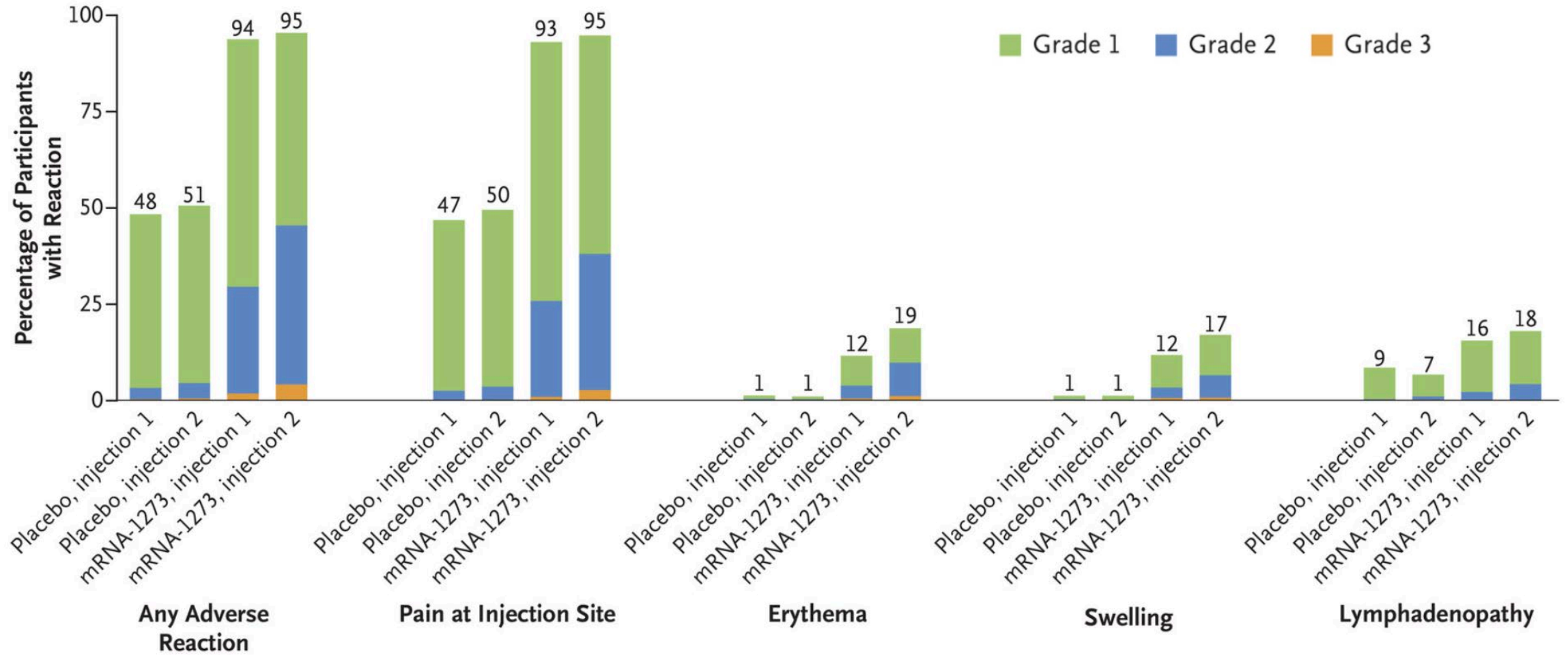


CONCLUSIONS

Two 50- μ g doses of the mRNA-1273 Covid-19 vaccine were safe and immunogenic in children 6–11 years of age.

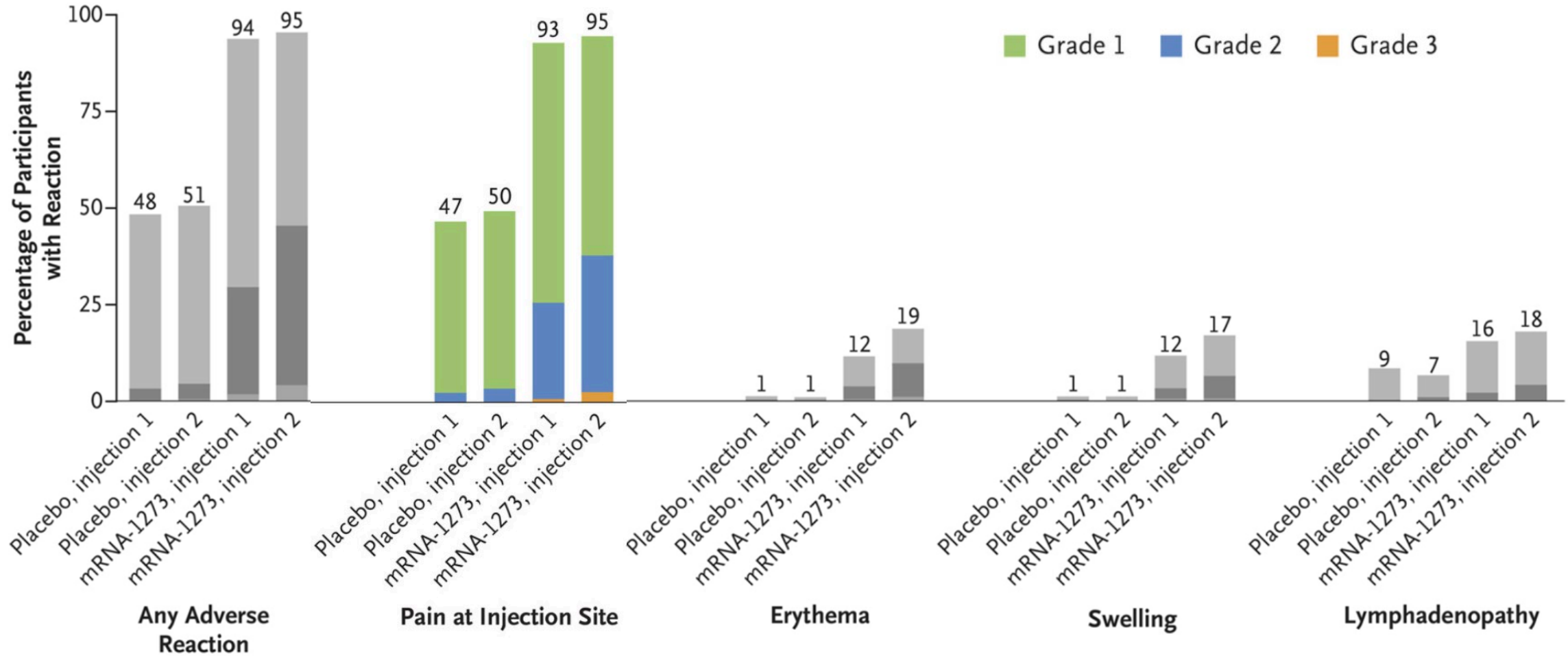
Pain at the injection site was common

A Local Reactions



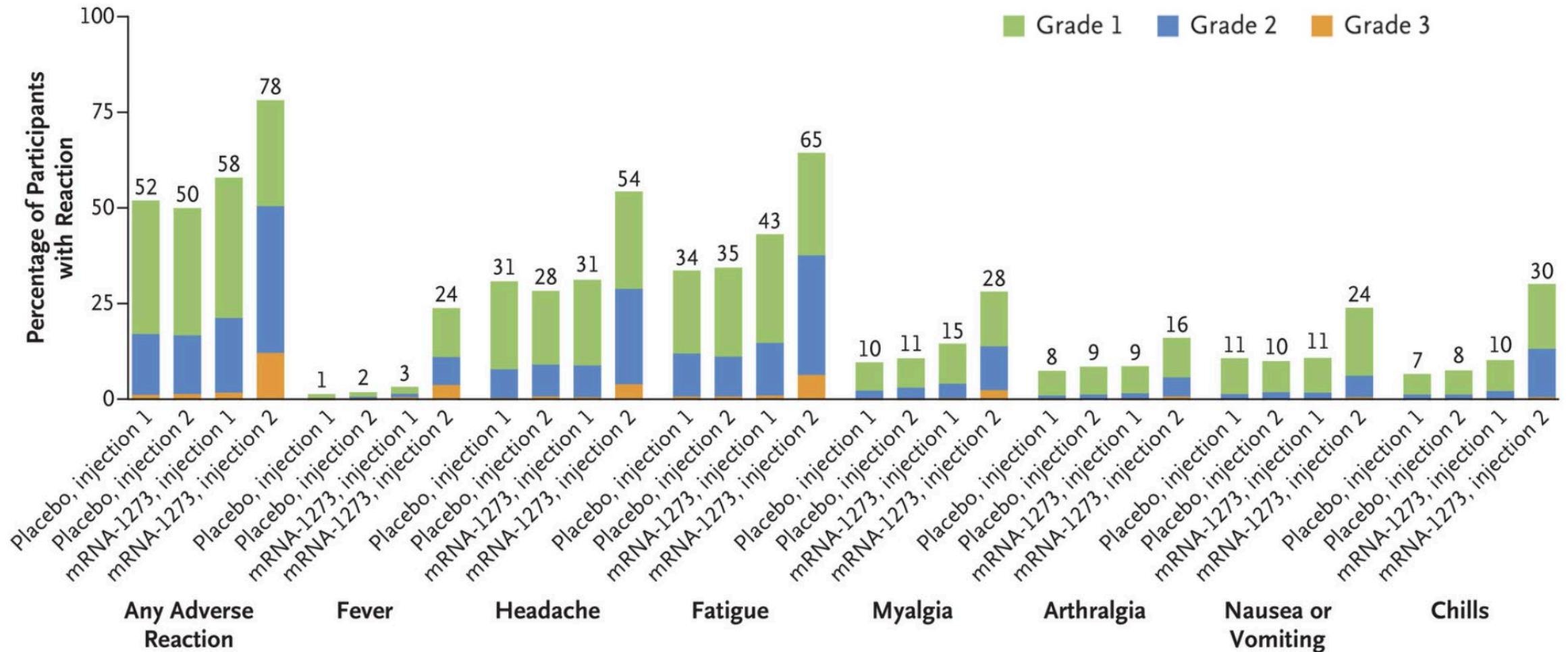
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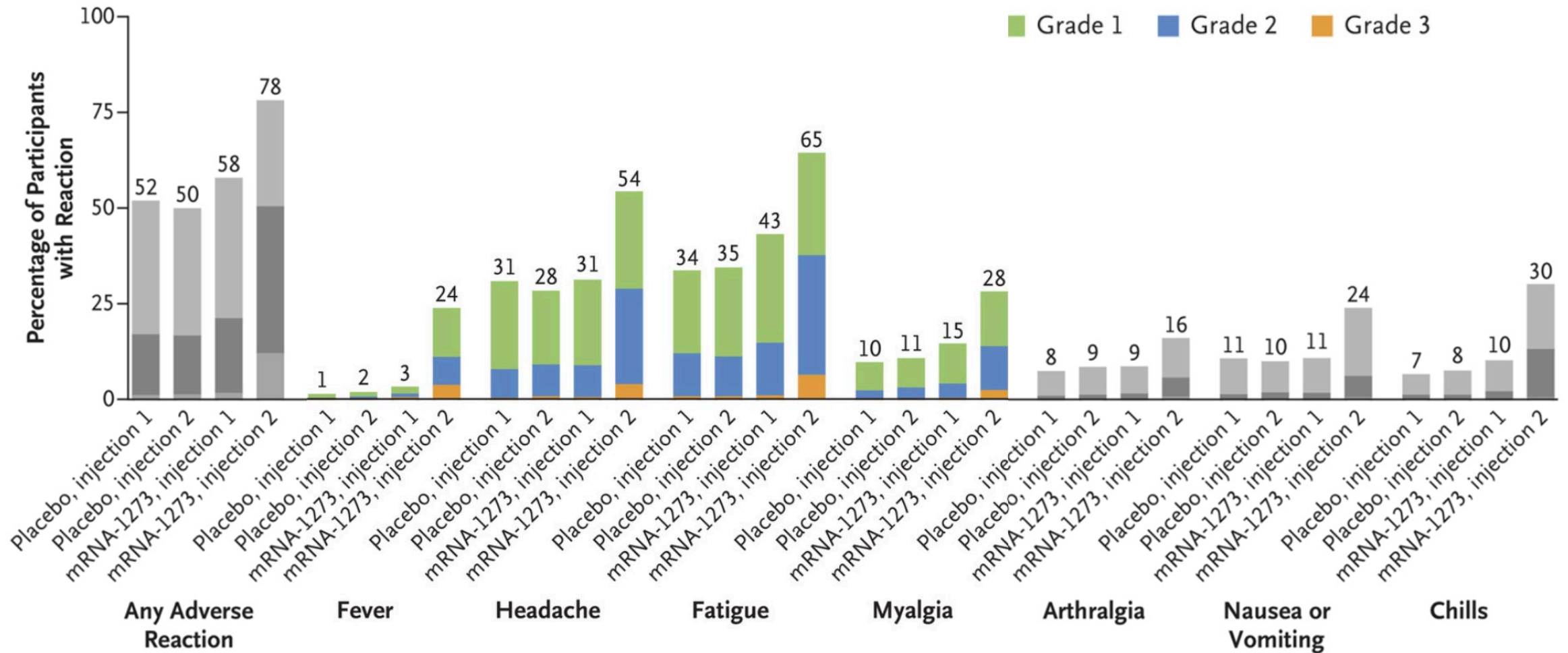
Fatigue and headache were common after the 2nd dose

B Systemic Reactions



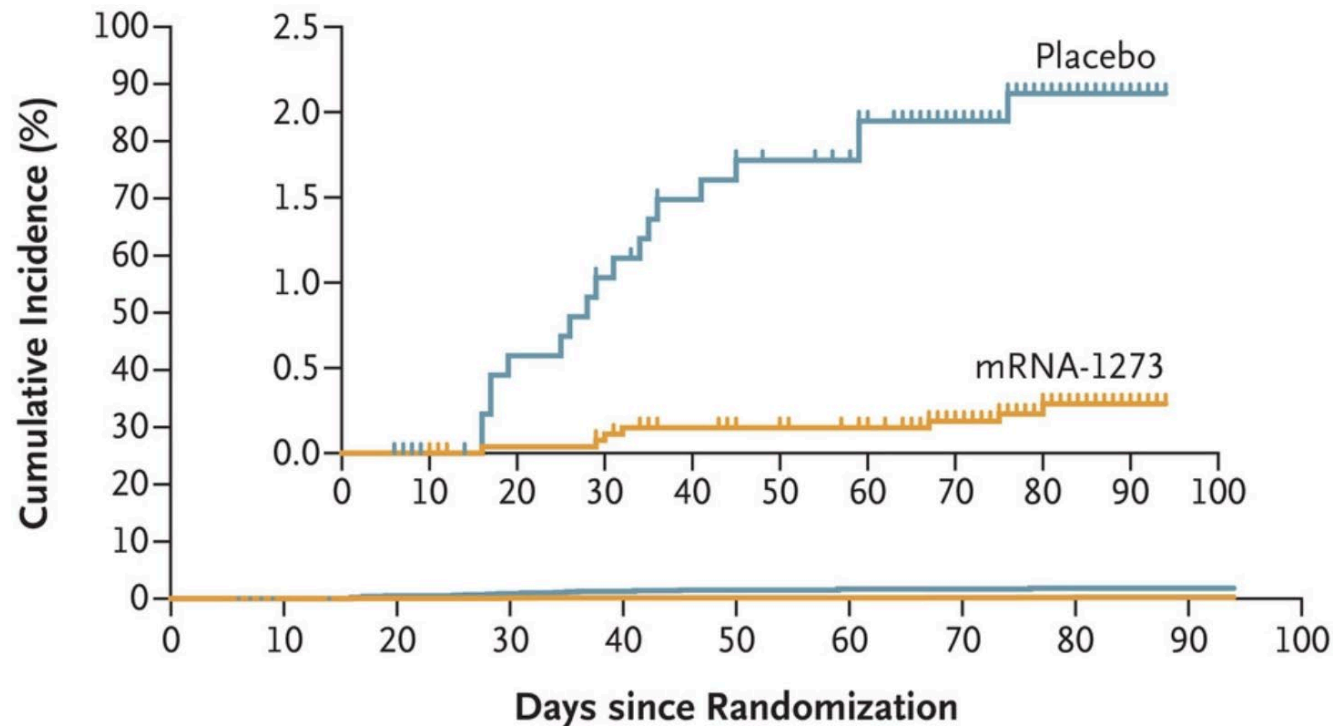
Fatigue and headache were common after the 2nd dose

B Systemic Reactions



Vaccine efficacy over the first 100 days is similar to VE seen in adults.

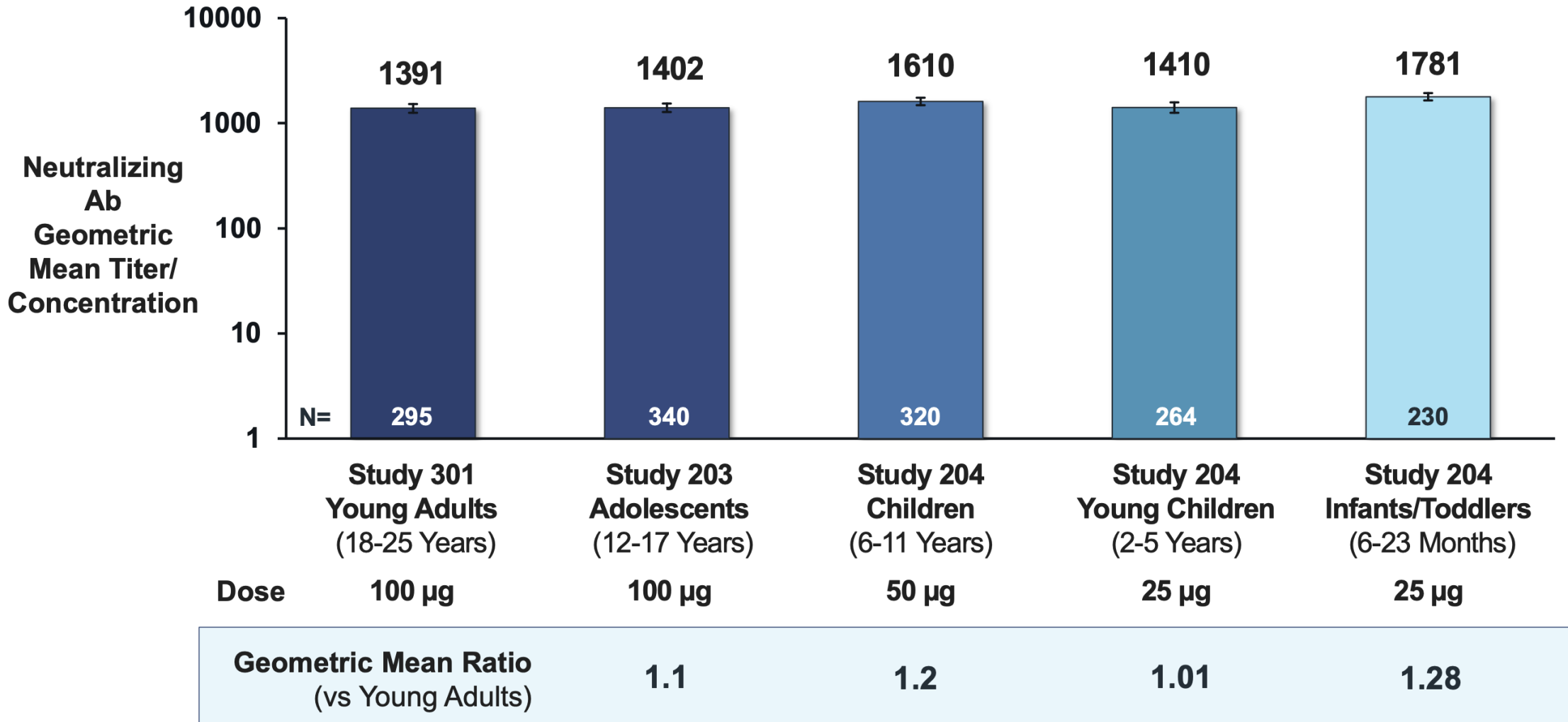
A Covid-19, CDC Definition



CDC Definition: 1 systemic symptom or 1 respiratory symptom PLUS positive PCR

	Vaccine Efficacy (95% CI) %	Incidence Rate (95% CI) per 1000 person-yr
Placebo		117.1 (69.4–185.1)
mRNA-1273	88.0 (70.0–95.8)	14.0 (5.6–28.9)

Similar immunogenicity of mRNA-1273 one month after a 2-dose primary series in all age groups





Where are we
going?

Unresolved Issues for Pediatrics

Dosing

Do we have the right, 'Goldilocks' dose for pediatrics? Should we consider extending the primary series to >8 weeks?

Boosters

What frequency of boosters will be required to prevent hospitalization, severe disease, and long COVID?

Safety

Myocarditis remains the most important AEFI; the exact pathogenesis is still elusive.

Coadministration

Coadministration is allowed, but systematic data are only now coming in. Increased reactogenicity with some vaccines may be observed.



Vanderbilt Vaccine Research Program

Shanda Phillips	Catherine Jones	Roberta Winfrey (retired)
Deborah Myers	Katherine Wright	Stephanie Rolsma
Shelly McGehee	Cindy Trimmer	Shannon Walker
Natalia Jimenez	Fiona Oaks	Emma Alexander
Naomi Kown	Paula Campbell	Gabby Ess
Kate Sokolow	Robert Adkisson	Faith Glover
Susan Johnson	Amy Riddle	Robert Samuels
Wendy Winn	Emily Mitchell	Foday Moravia

Leigh Howard
 Matt Donio
 April Hanlatxamphou
 Anna Gallion
 Braxton Hern
 Kathy Edwards
 Jon Soslow
 Jeff Dendy

VVRP Laboratory

Isaac Thomsen
 Sandy Yoder
 Eric Brady
 Monique Bennett
 Nicki Soper

CRC Nurses (Howard)
IDS (Oleis, Torr)



NIAID



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