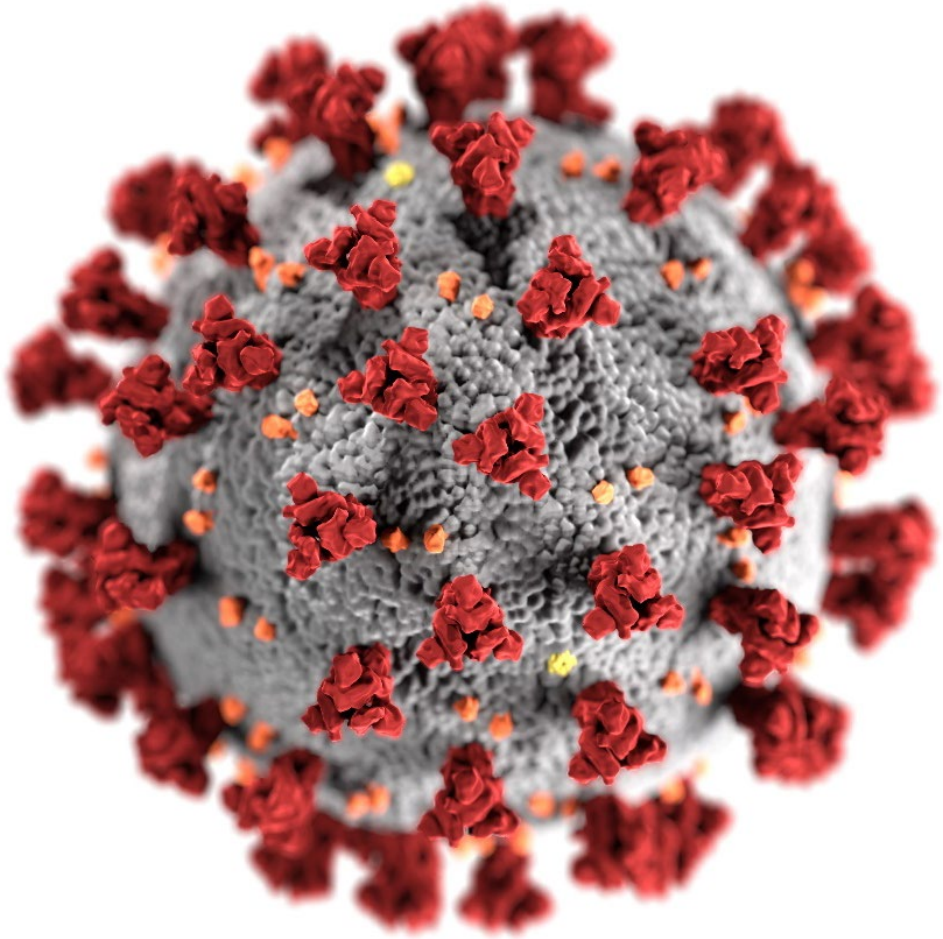
Update on myocarditis following mRNA COVID-19 vaccination

Advisory Committee on Immunization Practices (ACIP)

June 23, 2022



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Topics

- Background on classic myocarditis and myocarditis associated with mRNA COVID-19 vaccination
- Update on myocarditis following mRNA COVID-19 vaccination with a focus on children ages 5–17 years*
  - Findings from the Vaccine Adverse Event Reporting System (VAERS)
  - Findings from the Vaccine Safety Datalink (VSD)
- Comparative risk for myocarditis between the two mRNA COVID-19 vaccines, Moderna and Pfizer-BioNTech

* Analyses focus on children ages 5–11 years for the 2-dose (10 µg) primary series separated by at least 3 weeks, and children ages 12–17 years for the 2-dose (30 µg) primary series separated by at least 3 weeks followed by a booster dose at least 5 months after completion of the primary series; data outside of these authorizations and recommendations (e.g., off authorization use, vaccination errors, special population authorizations/recommendations) are not included in these analyses

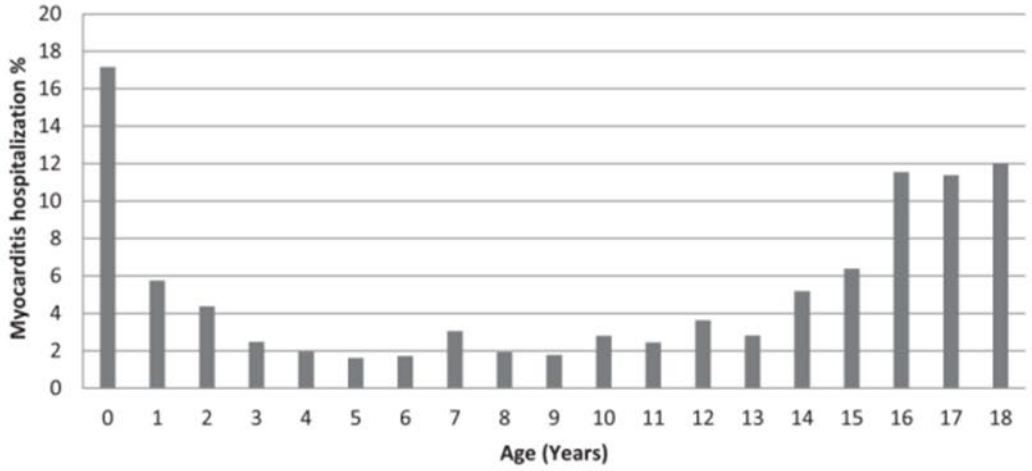
Epidemiology of classic myocarditis in children (excluding infants)

- Usually an infectious cause, typically viral or presumed to be viral, although infection with a pathogen is frequently not identified (only ~40% of time a pathogen is identified)[1,2,3]
- Can be due to direct microbial infection of myocardial cells and/or ongoing inflammatory response, with or without clearance of pathogen[4,5,6]
  - Can also be toxin-mediated or in setting of systemic infection or infection of non-cardiac tissue
- Rarer causes include autoimmune, hypersensitivity, and giant cell myocarditis
- Incidence in males > females starting after age 5 years[7]
- Previously unrecognized myocarditis was identified as cause of death in 8% of cases of sudden, unexplained death in 1–17- year-olds[8] and 9% of sudden death in athletes[9]
- It is common to not identify a pathogen or possible infectious etiology for myocarditis
  - Based on case series, where autopsy tissues were examined and tissue-based infectious disease testing was performed, a specific infectious cause was only identified in 13%–36% of cases across age groups[6,10,11]
  - For a case series where endomyocardial biopsy tissues were tested, viral nucleic acids were detected in heart tissues in ~38% (adults and children combined)[1]

[1]Bowles et al. J Am Coll Cardiol. 2003;42:466-72. [2]Simpson et al. J Am Coll Cardiol. 2013;61:(10_Supplement) E1264. [3]Park et al. J Korean Med Sci. 2021;36:e232. [4]Caforio et al. Eur Heart J. 2013;34:2636-48, 2648a-2648d. [5]Feldman et al. N Engl J Med. 2000;343:1388-98. [6]Guarner et al. Hum Pathol. 2007;38:1412-9. [7]Arola et al. J Am Heart Assoc. 2017;6:e005306. [8]Burns et al. J Pediatr X. 2020;2:100023. [9]Maron et al. Circulation. 2009;119:1085-92. [10]Weber et al. Arch Dis Child. 2008;93:594-8. [11]Ilina et al. Pediatrics. 2011;128:e513-20.

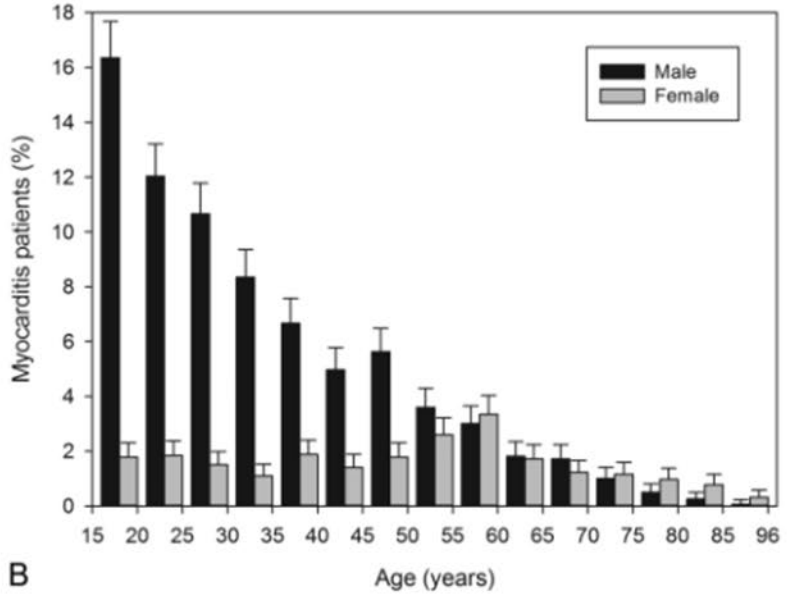
Epidemiology of myocarditis

- Children
  - Annual incidence 0.8 per 100,000
    - In 15-18yo, 1.8 per 100,000 in 2015-2016
  - 66% male
  - Median LOS 6.1 days



Vasudeva et al. *American J Cardiology.* 2021.

- Adults
  - Gradual decrease in incidence with age
  - 76% male



Kyto et al. *Heart*. 2013.

Previously presented at the June 23, 2021, ACIP meeting: https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-06/02-COVID-Oster-508.pdf

LOS = Length of hospital stay

Characteristic	Myocarditis associated with mRNA COVID-19 vaccination*,†	Viral myocarditis‡
Inciting exposure	mRNA COVID-19 vaccination • Dose 2 > Dose 1	Viral illness • 30–60% with asymptomatic viral course
Demographics	Most cases in adolescents and young adults, males > females	Males > females, male incidence peaks in adolescence and gradually declines
Symptom onset	A few days after vaccination, most within a week	1–4 weeks after viral illness
Fulminant course	Rare¶	23%
ICU level support	~2%	~50%
Mortality/transplant	Rare¶	11–22%
Cardiac dysfunction	12%	60%
Recovery of cardiac function	Nearly all	~75%
Time to recovery of cardiac function (ejection fraction on cardiac echo), if initially poor	Hours to days	Days to weeks to months

* https://www.cdc.gov/vaccines/acip/meetings/index.html, https://www.cdc.gov/vaccinesafety/research/publications/index.html

† Oster et al. JAMA. 2022;327:331-340.

‡ Law et al. Circulation. 2021;144:e123-e135. Ghelani et al. Circ Cardiovasc Qual Outcomes. 2012;5:622-7. Kim et al. Korean Circ J. 2020;50:1013-1022. Messroghli et al. Am Heart J. 2017;187:133-144. Patel et al. J Am Heart Assoc. 2022;11:e024393.

¶ There are rare reports in the literature, especially from other countries, but it is unclear to what extent such cases were investigated

VAERS is the nation's early warning system for vaccine safety

CDC + FDA

VAERS

Vaccine Adverse Event Reporting System

http://vaers.hhs.gov

VAERS

VAERS accepts reports from everyone (healthcare professionals, patients, parents, caregivers, manufacturers, etc.) regardless of the plausibility of the vaccine causing the event or the clinical seriousness of the event

Key strengths

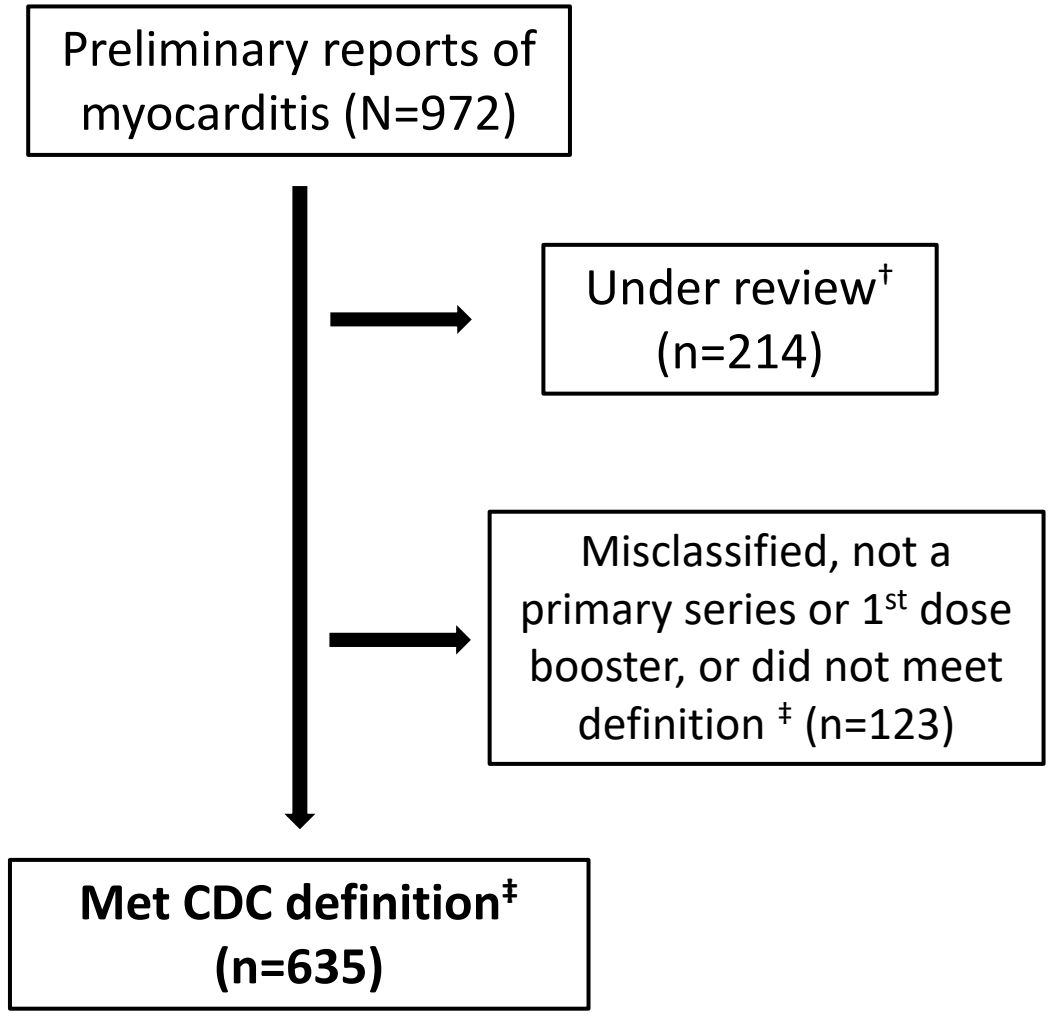
- Rapidly detects potential safety problems
- Can detect rare adverse events

Key limitations

- Passive surveillance system
- Inconsistent quality and completeness of information
- Reporting biases
- Generally, cannot determine cause and effect

Reports to VAERS of myocarditis after Pfizer-BioNTech vaccination among children ages 5–17 years (as of May 26, 2022)*

- 54.8 million total Pfizer-BioNTech doses administered to children ages 5–17 years in the Unites States
  - 27.7 million dose 1
  - 23.3 million dose 2
  - 3.8 million 1st booster dose (ages 12–17 years)



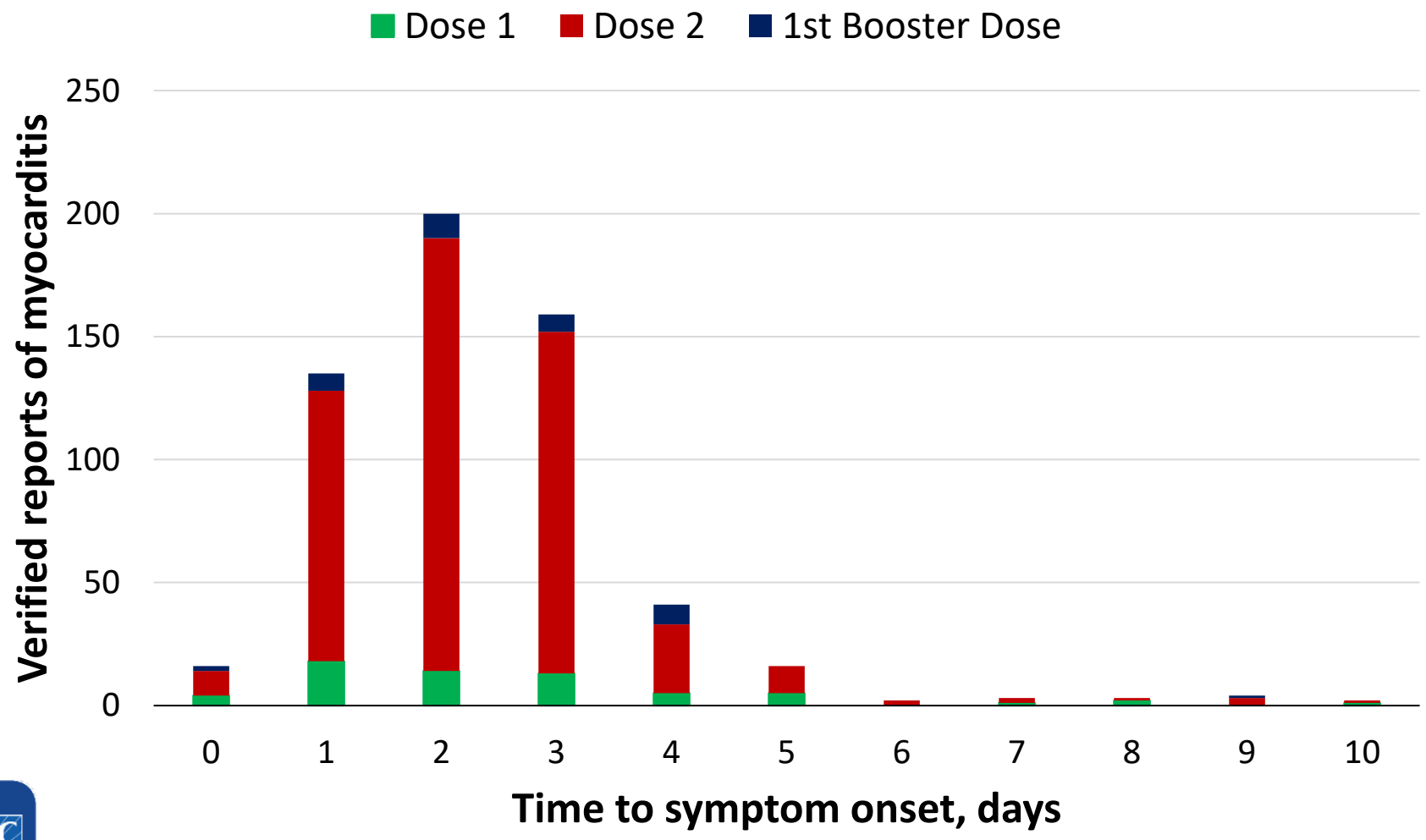
* As of May 26, 2022, primary series vaccination among children ages 16–17 years since Dec 14, 2020; children ages 12–15 years since May 10, 2021; children ages 5–11 years since Nov 3, 2021; 1st dose booster vaccination among children ages 16–17 years since Dec 9, 2021; children ages 12–15 years since Jan 5, 2022.

† Awaiting medical records and/or healthcare provider interview; some still processing

‡ Adjudicated after healthcare provider interview and/or medical record review; CDC myocarditis case definition available at: https://www.cdc.gov/mmwr/volumes/70/wr/mm7027e2.htm

Verified* U.S. reports to VAERS of myocarditis after Pfizer-BioNTech vaccination among children ages 5–17 years, by time to symptom onset† and dose number

(N=630, as of May 26, 2022)



† 630 of 635 (99%) with known time to symptom onset; 49 (8%) reports with time to symptom onset >10 days

*Verified according to CDC myocarditis case definition available at: https://www.cdc.gov/mmwr/volumes/70/wr/mm7027e2.htm

VAERS reporting rates of myocarditis (per 1 million doses administered) after mRNA COVID-19 vaccination, days 0–7 and 8–21 post-vaccination*,†

		0–7 days			8–21 days			0–7 days			8–21 days		
		Males			Males			Females			Females		
	Age (yrs)	Dose 1	Dose 2	Booster	Dose 1	Dose 2	Booster	Dose 1	Dose 2	Booster	Dose 1	Dose 2	Booster
Pfizer-BioNTech	5–11	0.2	2.6	0.0	0.6	0.0	0.0	0.2	0.7	0.0	0.2	0.0	0.0
	12–15	5.3	46.4	15.3	1.2	1.2	0.9	0.7	4.1	0.0	0.4	0.2	0.9
	16–17	7.2	75.9	24.1	1.7	3.2	1.3	0.0	7.5	0.0	0.7	0.4	0.0
Pfizer-BioNTech and Moderna	18–24	4.2	38.9	9.9	1.1	2.2	0.4	0.6	4.0	0.6	0.2	0.7	0.0
	25–29	1.8	15.2	4.8	0.4	1.1	0.5	0.4	3.5	2.0	0.2	0.0	0.8
	30–39	1.9	7.5	1.8	0.4	0.8	0.2	0.6	0.9	0.6	0.3	0.2	0.0
	40–49	0.5	3.3	0.4	0.2	0.5	0.0	0.4	1.6	0.6	0.2	0.2	0.0
	50–64	0.5	0.7	0.4	0.2	0.3	0.1	0.6	0.5	0.1	0.2	0.5	0.1
	65+	0.2	0.3	0.6	0.3	0.2	0.1	0.1	0.5	0.1	0.1	0.2	0.1

* As of May 26, 2022; reports verified to meet case definition by provider interview or medical record review; primary series and 1st booster doses only

† An estimated 1–10 cases of myocarditis per 100,000 person years occurs among people in the United States, regardless of vaccination status; adjusted for days 0–7 and 8–21 risk intervals, this estimated background is **0.2 to 2.2 per 1 million person-day 0–7 risk interval and 0.4 to 3.8 per 1 million person-day 8–21 risk interval** (peach shaded cells indicate that reporting rate exceeded estimated background incidence for the period)

CDC enhanced surveillance for myocarditis outcomes following mRNA COVID-19 vaccination in VAERS case reports among children ages 5–17 years*

- **Purpose**: Assess functional status and clinical outcomes among individuals reported to have developed myocarditis after COVID-19 mRNA vaccination
- **Methods**: A two-component survey conducted at least 90 days after the onset of myocarditis symptoms
  - **Patient or parent survey**: Focused on ascertaining functional status, clinical symptoms, quality of life, and need for medication or other medical treatment
  - **Healthcare provider (e.g., cardiologist) survey**: Gather data on cardiac health and functional status

* https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/myo-outcomes.html; surveillance project includes two separate cohorts, children ages 5–11 years and people ages 12–29 years

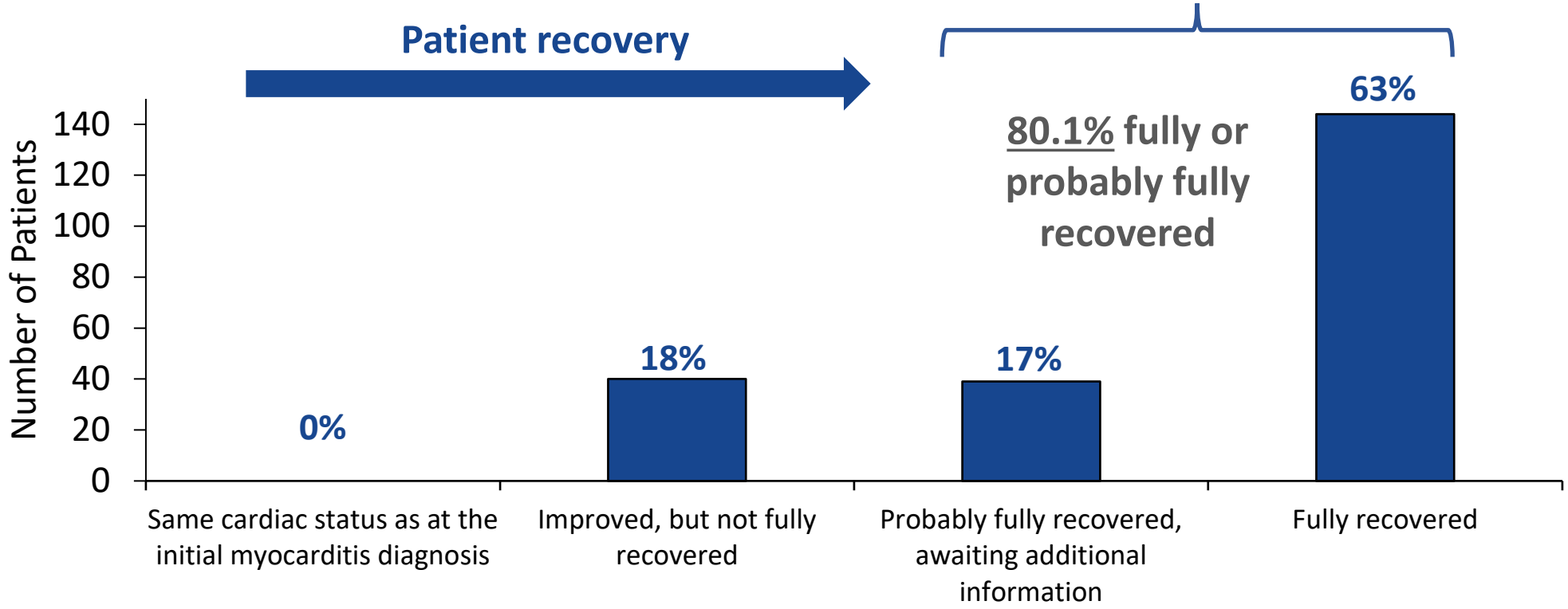
CDC enhanced surveillance for myocarditis outcomes following mRNA COVID-19 vaccination in VAERS case reports among children ages 5–17 years

- During the surveillance periods (through November 2021 for 12–17 years and April 2022 for 5–11 years), VAERS received **430 reports** of myocarditis or myopericarditis after mRNA COVID-19 vaccination in children ages 5–17 years that met CDC case definition* and were at least 90 days post-myocarditis diagnosis
  - **190 completed the patient or parent survey**, 128 were unreachable on multiple attempts, 98 had no telephone contact information in the report, and 7 declined to participate
  - **226 cardiologists or other healthcare providers (HCP) completed a survey**, 120 were unreachable on multiple attempts, and 65 had no telephone contact information in the report

* https://www.cdc.gov/mmwr/volumes/70/wr/mm7027e2.htm

CDC enhanced surveillance for myocarditis outcomes following mRNA COVID-19 vaccination in VAERS case reports among children ages 5–17 years

- Based on the cardiologists or healthcare provider assessment, most patients appear to have fully or probably fully recovered from their myocarditis
  - 226 patients received a follow-up assessment by a cardiologist or other healthcare provider regarding their myocarditis recovery



Children ages 5–17 years

Note: 5 (2%) providers were unsure

CDC enhanced surveillance for myocarditis outcomes following mRNA COVID-19 vaccination in VAERS case reports among children ages 5–17 years

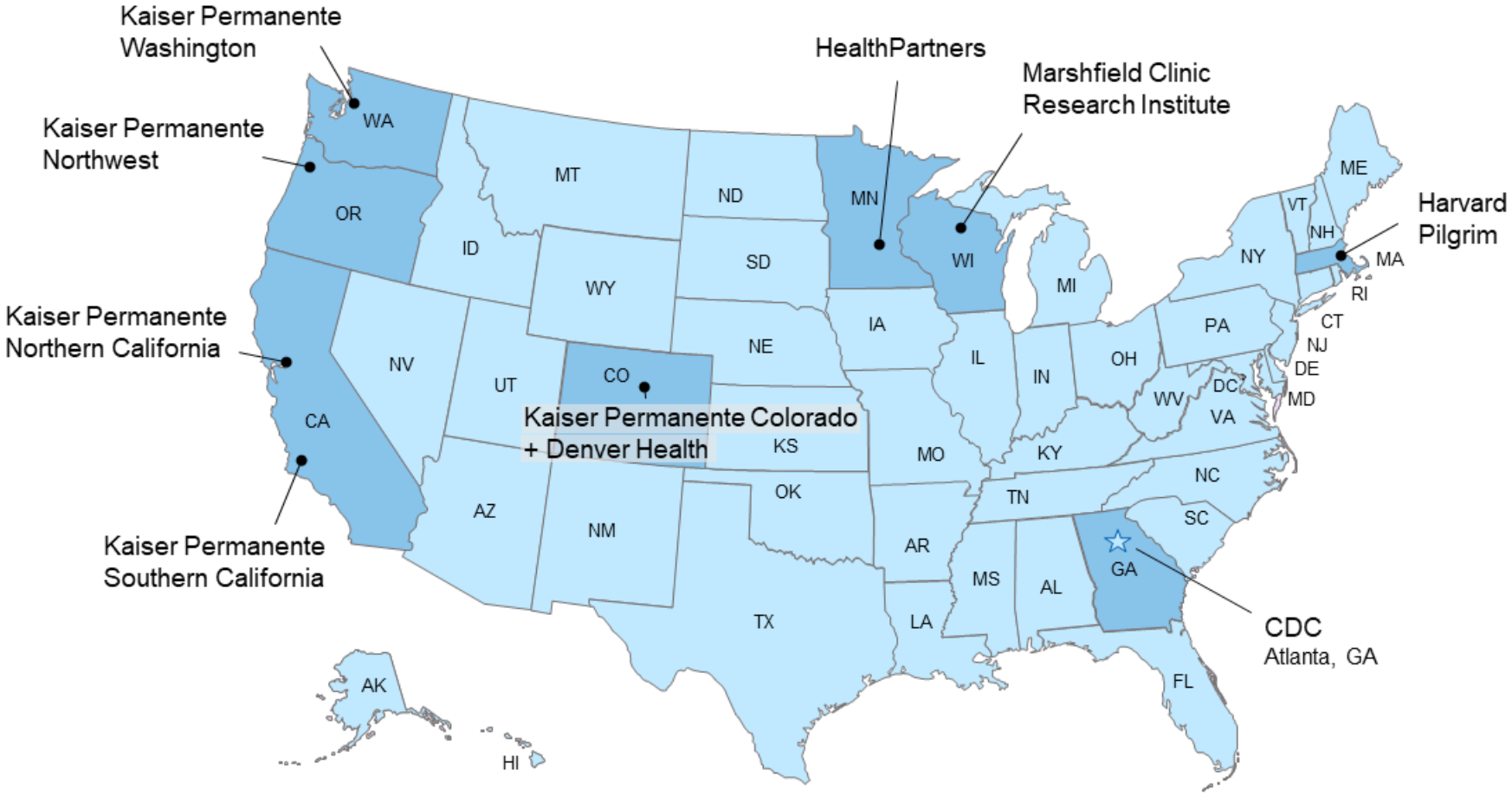
Key findings

- At least 90 days after myocarditis diagnosis, most patients who were reached reported no impact on their quality of life, and most did not report missing school or work
- Most (80.1%) healthcare providers who completed surveys indicated the patient was fully recovered or probably fully recovered
  - There was substantial heterogeneity in initial and follow-up treatment and testing
  - There did not appear to be a single test that was indicative of recovery

Next steps

- Additional follow-up with patients who were not yet recovered at time of the 90+ day survey (and their healthcare providers) to further assess recovery status at 12+ months

Vaccine Safety Datalink (VSD)



- Established in 1990
- Collaborative project between CDC and 9 integrated healthcare organizations

VSD Rapid Cycle Analysis (RCA)

Aims:

- To monitor the safety of COVID-19 vaccines weekly using prespecified outcomes of interest among VSD members
- To describe the uptake of COVID-19 vaccines over time among eligible VSD members overall and in strata by age, site, and race/ethnicity

VSD COVID-19 vaccine RCA prespecified surveillance outcomes

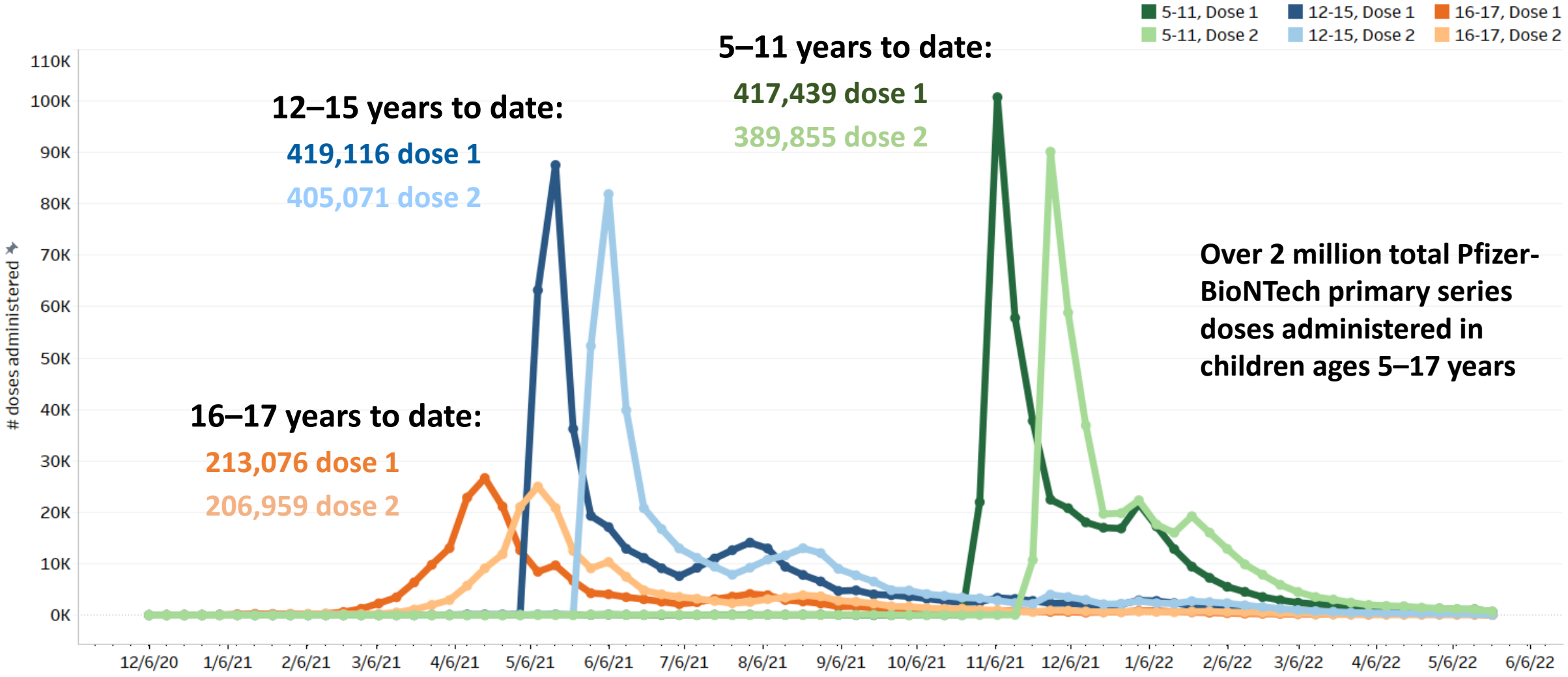
Prespecified outcomes	Settings
Acute disseminated encephalomyelitis	Emergency dept, Inpatient
Acute myocardial infarction – **First ever in EHR in ICD-10 era**	Emergency dept, Inpatient
Acute respiratory distress syndrome (descriptive monitoring only)	Emergency dept, Inpatient
Anaphylaxis – **First in 7 days in EHR in ICD-10 era** (descriptive monitoring only)	Emergency dept, Inpatient
Appendicitis	Emergency dept, Inpatient
Bell's palsy – **First ever in EHR in ICD-10 era**	Emergency dept, Inpatient, Outpatient
Cerebral venous sinus thrombosis	Emergency dept, Inpatient
Disseminated intravascular coagulation	Emergency dept, Inpatient
Encephalitis / myelitis / encephalomyelitis	Emergency dept, Inpatient
Guillain-Barré syndrome	Emergency dept, Inpatient
Immune thrombocytopenia	Emergency dept, Inpatient, Outpatient
Kawasaki disease (descriptive monitoring only)	Emergency dept, Inpatient
Multisystem inflammatory syndrome in children/adults (MIS-C/MIS-A) (descriptive monitoring only)	Emergency dept, Inpatient
Myocarditis / pericarditis – **First in 60 days in EHR in ICD-10 era**	Emergency dept, Inpatient
Narcolepsy / cataplexy (descriptive monitoring only)	Emergency dept, Inpatient, Outpatient
Pulmonary embolism – **First ever in EHR in ICD-10 era**	Emergency dept, Inpatient
Seizures	Emergency dept, Inpatient
Stroke, hemorrhagic	Emergency dept, Inpatient
Stroke, ischemic	Emergency dept, Inpatient
Thrombosis with thrombocytopenia syndrome – **First ever in EHR in ICD-10 era**	Emergency dept, Inpatient
Thrombotic thrombocytopenic purpura	Emergency dept, Inpatient
Transverse myelitis	Emergency dept, Inpatient
Venous thromboembolism – **First ever in EHR in ICD-10 era**	Emergency dept, Inpatient, Outpatient

EHR = Electronic health record

VSD Rapid Cycle Analysis (RCA) analytic strategy

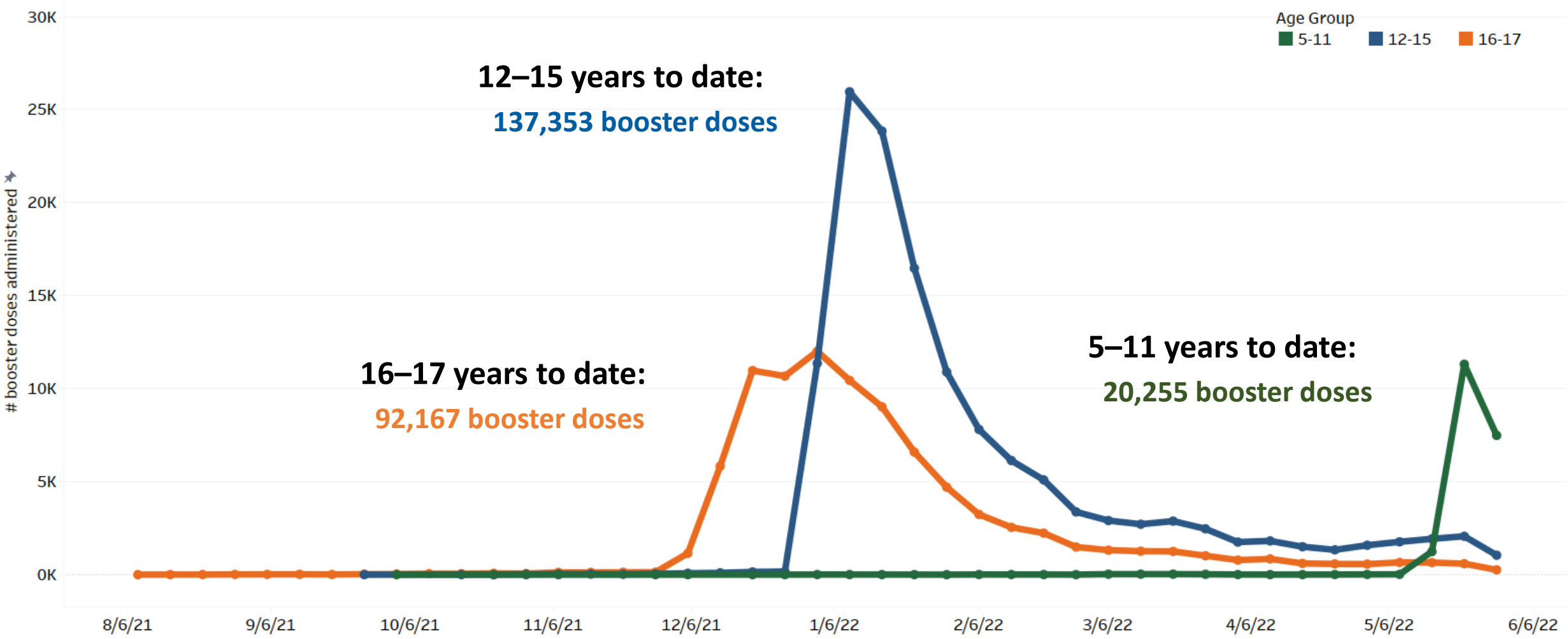
- For the primary analysis, the number of outcomes observed in the risk interval after COVID-19 vaccination were compared to the number expected
- The expected was derived from “vaccinated concurrent comparators” who were in a comparison interval after COVID-19 vaccination
- On each day that an outcome occurred, vaccinees who were in their risk interval were compared with similar vaccinees who were concurrently in their comparison interval
  - Comparisons were adjusted for age group, sex, race/ethnicity, VSD site, as well as calendar date
- For the prespecified outcome myocarditis/pericarditis, cases were verified using the CDC case definition (https://www.cdc.gov/mmwr/volumes/70/wr/mm7027e2.htm)

Pfizer-BioNTech vaccine doses administered* in VSD in pediatric age groups



* Pfizer-BioNTech was the only authorized vaccine in these ages during the surveillance period

Pfizer-BioNTech vaccine booster doses administered* in VSD in pediatric age groups



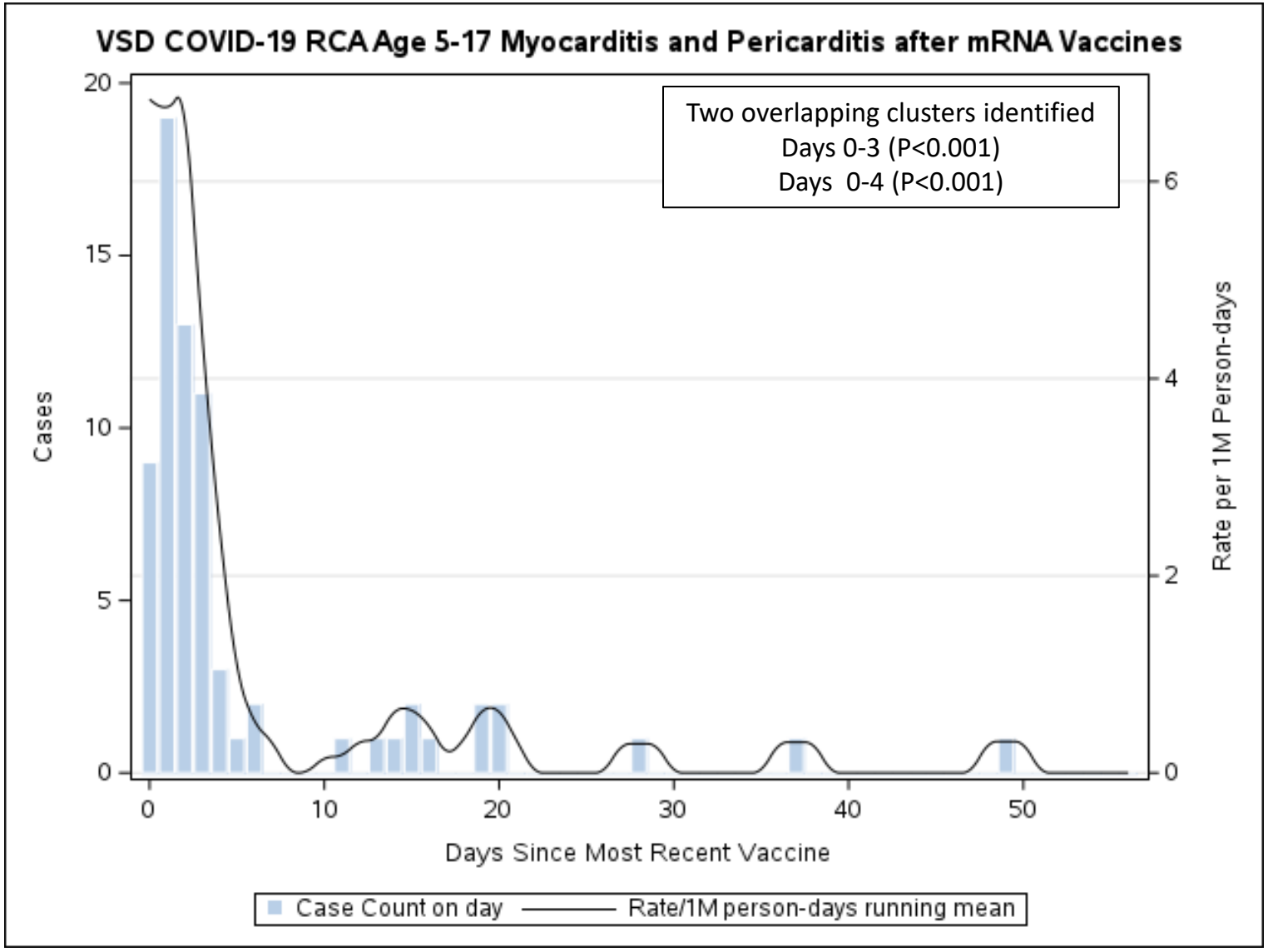
* Pfizer-BioNTech was the only authorized vaccine in these ages during the surveillance period

VSD RCA findings for myocarditis and pericarditis following mRNA COVID-19 vaccines

- Children ages 5–11 years (primary series only)
  - No statistical signals to date for myocarditis/pericarditis

- People ages ≥12 years, including adults
  - Statistical signals detected for myocarditis/pericarditis for Pfizer-BioNTech and for both mRNA COVID-19 vaccines combined for primary series vaccination
  - Statistical signals detected for myocarditis/pericarditis for both mRNA COVID-19 vaccines combined for 1st booster dose

Day of symptom onset of verified myocarditis/pericarditis among children ages 5–17 years after either primary series dose of an mRNA COVID-19 vaccine



Based on data through May 28, 2022

Verified myocarditis and pericarditis in the 0–7-day risk interval among MALE children ages 5-17 years by age group and dose (compared with outcome events in vaccinated comparators on the same calendar days, based on data through May 28, 2022)

Age Group	Pfizer-BioNTech dose	Events in Risk Interval	Events in Comparison Interval*	Adjusted Rate Ratio†	95% Conf Interval	2-sided P-value	Excess cases in Risk Period per million doses
5–11 Years	Dose 1	0	0	NE	NE	NE	NE
	Dose 2‡	2	0	NE	0.87 – ∞	0.061	15.2
	1st Booster	0	0	NE	NE	NE	NE
12–17 Years¶	Dose 1	3	1	**14.00**	**1.20 – 421.96**	**0.035**	**8.9**
	Dose 2	44	1	**160.52**	**30.19 – 3343.73**	**<0.001**	**147.0**
	1st Booster	9	1	**14.98**	**1.39 – 484.33**	**0.023**	**85.1**
12–15 Years subgroup	Dose 1	2	1	**13.63**	**0.94 – 433.36**	**0.056**	**8.8**
	Dose 2	28	1	**104.88**	**18.45 – 2267.59**	**<0.001**	**151.0**
	1st Booster	1	1	3.97	0.05 – 320.79	0.560	12.7
16–17 Years subgroup	Dose 1	1	0	NE	0.13 – ∞	0.285	9.6
	Dose 2	14	0	**NE**	**10.20 – ∞**	**<0.001**	**138.7**
	1st Booster	7	0	**NE**	**1.16 – ∞**	**0.038**	**200.3**

NE=not estimable

* Comparison interval is 22–42 days after either dose.

† Adjusted for VSD site, 5-year age group, sex, race/ethnicity, and calendar date. 1st booster analyses are also adjusted for time since primary series.

‡ One case was non-informative for the risk interval analyses but was included in the excess risk calculation estimates.

¶ Subgroup events may not sum to "12–17" total due to non-informative events.

Verified myocarditis and pericarditis in the 0–7-day risk interval among FEMALE children ages 5-17 years by age group and dose (compared with outcome events in vaccinated comparators on the same calendar days, based on data through May 28, 2022)

Age Group	Pfizer-BioNTech dose	Events in Risk Interval	Events in Comparison Interval*	Adjusted Rate Ratio†	95% Conf Interval	2-sided P-value	Excess cases in Risk Period per million doses
5-11 Years	Dose 1	0	0	NE	NE	NE	NE
	Dose 2	0	0	NE	NE	NE	NE
	1st Booster	0	0	NE	NE	NE	NE
12 – 17 Years‡	Dose 1	1	1	9.16	0.23 – 364.80	0.200	2.8
	Dose 2	**5**	**1**	**18.15**	**1.62 – 558.73**	**0.018**	**18.4**
	1st Booster	2	3	0.79	0.07 – 7.49	0.835	- 5.0
12 – 15 Years subgroup	Dose 1	0	0	NE	NE	NE	0.0
	Dose 2	**4**	**0**	**NE**	**1.01 – ∞**	**0.049**	**24.8**
	1st Booster	0	0	NE	NE	NE	0.0
16 – 17 Years subgroup	Dose 1	1	1	12.11	0.31 – 477.83	0.154	8.4
	Dose 2	1	1	6.10	0.16 – 239.90	0.283	7.9
	1st Booster	2	3	1.10	0.11 – 9.58	0.924	4.0

NE=not estimable

* Comparison interval is 22–42 days after either dose.

† Adjusted for VSD site, 5-year age group, sex, race/ethnicity, and calendar date. 1st booster analyses are also adjusted for time since primary series.

‡ Subgroup events may not sum to "12–17" total due to non-informative events.

VSD incidence rates of verified myocarditis/pericarditis in the 0–7 days following Pfizer-BioNTech vaccination, December 14, 2020–May 28, 2022

Children ages 5-17 years	Cases	Doses	Incidence rate per million doses admin.	95% Confidence Intervals
5–11 years				
Males – Dose 1	0	211,644	0.0	0.0 – 14.2
Males – Dose 2	**3**	**197,465**	**15.2**	**3.1 – 44.5**
Females – Dose 1	0	205,795	0.0	0.0 – 14.6
Females – Dose 2	0	192,380	0.0	0.0 – 15.6
12–15 years				
Males – Dose 1	2	210,622	9.5	1.2 – 34.3
Males – Dose 2	31	203,420	**152.5**	**103.6 – 216.4**
Males – 1st Booster	1	59,483	17.0	0.4 – 94.9
Females – Dose 1	0	208,494	0.0	0.0 – 14.4
Females – Dose 2	5	201,638	**24.8**	**8.1 – 57.9**
Females - 1st Booster	0	61,876	0.0	0.0 – 48.4
16–17 years				
Males – Dose 1	1	104,142	9.6	0.2 – 53.5
Males – Dose 2	14	100,980	**138.7**	**75.8 – 232.8**
Males – 1st Booster	8	40,177	**200.3**	**86.5 – 394.7**
Females – Dose 1	1	108,934	9.2	0.2 – 51.2
Females – Dose 2	1	105,929	9.4	0.2 – 52.6
Females - 1st Booster	2	45,794	**44.0**	**5.3 – 159.0**

Level of care and status of verified myocarditis and pericarditis case ages 5–17 years in the 0-7 days after primary series and 1st booster dose of mRNA COVID-19 vaccine, VSD

Level of care and status	Pfizer-BioNTech primary series (n=58)	Pfizer-BioNTech 1st booster (n=12)
Highest level of care		
Emergency department	4 (7%)	0 (0%)
Admitted to hospital	34 (59%)	6 (50%)
Admitted to ICU	20 (34%)	6 (50%)
Length of hospital stay, median (range)	2 days (0–7 days)	1 day (1–4 days)
0 – 1 days	20 (34%)	8 (67%)
2 – 3 days	28 (48%)	3 (25%)
4+ days	10 (17%)	1 (8%)
Discharged to home	58 (100%)	12 (100%)

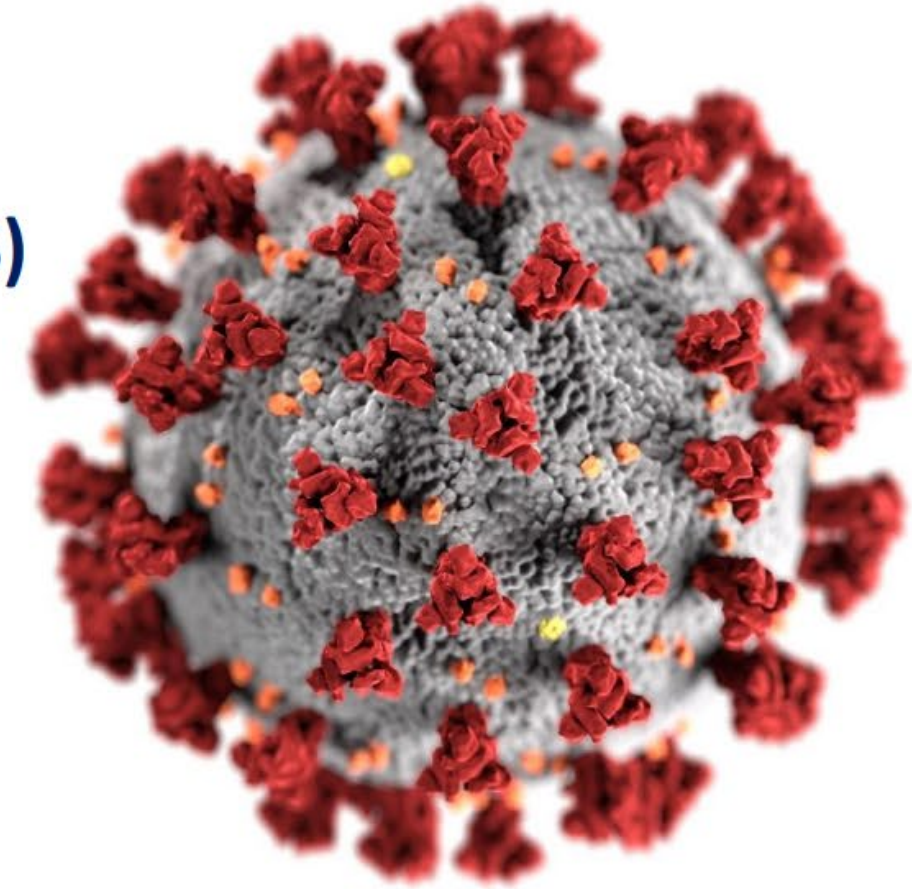
Based on data through June 4, 2022

Comparative risk for myocarditis between the two available mRNA COVID-19 vaccines, Moderna and Pfizer-BioNTech

Myopericarditis following COVID-19 vaccination: Updates from the Vaccine Adverse Event Reporting System (VAERS)

Oct 21, 2021

John R. Su, MD, PhD, MPH
Vaccine Safety Team
CDC COVID-19 Vaccine Task Force



cdc.gov/coronavirus

Reporting rates (per 1 million doses administered) of myocarditis among males after mRNA COVID-19 vaccines, 7-day risk period (N=797)*

- **169,740,953** doses of mRNA vaccine administered to males (dose 1 and dose 2)
- Reporting rates exceed background incidence
  - After dose 1 of Pfizer (12–24 years) and Moderna (18–39 years)
  - After dose 2 of Pfizer (12–39 years) and Moderna (18–49 years)

	Pfizer (Males)		Moderna (Males)	
Ages	**Dose 1**	**Dose 2**	**Dose 1**	**Dose 2**
12-15	**4.2**	**39.9**	0.0	not calculated
16-17	**5.7**	**69.1**	0.0	not calculated
18-24	**2.3**	**36.8**	**6.1**	**38.5**
25-29	1.3	**10.8**	**3.4**	**17.2**
30-39	0.5	**5.2**	**2.3**	**6.7**
40-49	0.3	2.0	0.2	**2.9**
50-64	0.2	0.3	0.5	0.6
65+	0.2	0.1	0.1	0.3

Reporting rates (per 1 million doses administered) of myocarditis among females after mRNA COVID-19 vaccines, 7-day risk period (N=138)*

- **193,215,313** doses of mRNA vaccine administered to females (dose 1 and dose 2)
- Reporting rates exceed background incidence
  - After dose 2 of Pfizer (12–24 years) and dose 2 Moderna (18–29 years)

	Pfizer (Females)		Moderna (Females)	
Ages	**Dose 1**	**Dose 2**	**Dose 1**	**Dose 2**
12-15	0.4	**3.9**	0.0	0.0
16-17	0.0	**7.9**	0.0	0.0
18-24	0.2	**2.5**	0.6	**5.3**
25-29	0.2	1.2	0.4	**5.7**
30-39	0.6	0.7	0.5	0.4
40-49	0.1	1.1	0.2	1.4
50-64	0.3	0.5	0.5	0.4
65+	0.1	0.3	0.0	0.3

Myocarditis Analyses in the Vaccine Safety Datalink: Rapid Cycle Analyses and "Head-to-Head" Product Comparisons

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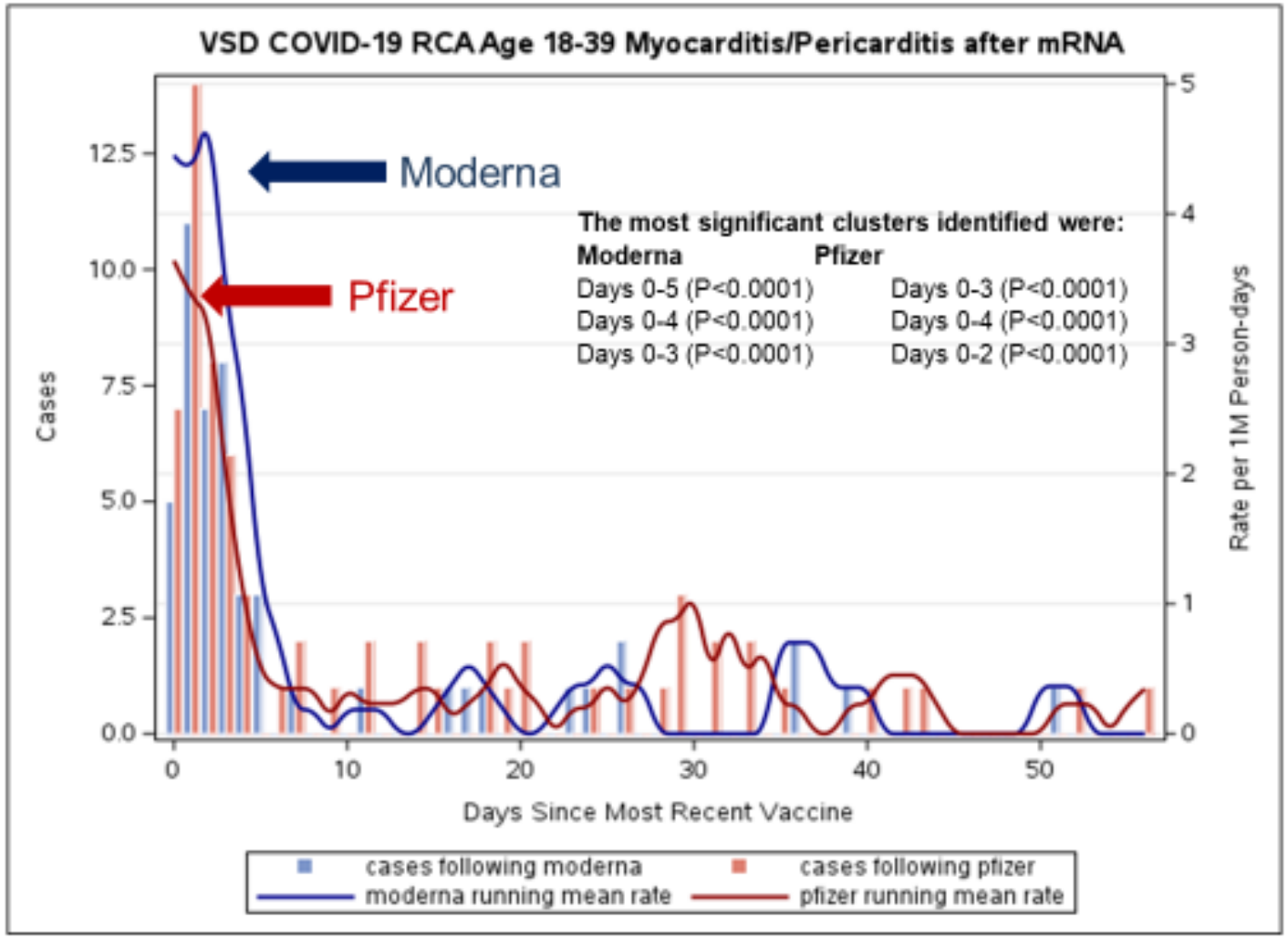
KAISER PERMANENTE
VACCINE STUDY CENTER

CDC

Marshfield Clinic
Research Institute

Symptom Onset of Verified Myocarditis and Pericarditis among 18–39-Year-Olds by Vaccine Product



Presented at the February 4, 2021, ACIP meeting: https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2022-02-04/10-COVID-Klein-508.pdf

Myocarditis and Pericarditis in 18–39-Year-Olds in the 0-7 Day Risk Interval: Moderna vs Pfizer

	Sex	Moderna (N)	Pfizer (N)	Adjusted Rate Ratio[1]	95% Confidence Interval	2-Sided P-value	Excess Cases in Risk Period per 1M Doses of Moderna vs Pfizer[2]
Either Dose	All	38	41	**1.61**	**1.02 – 2.54**	**0.041**	**8.0**
	Male	32	36	1.52	0.93 – 2.48	0.097	13.4
	Female	6	5	2.34	0.65 – 8.71	0.188	3.5
Dose 1	All	9	7	2.27	0.80 – 6.65	0.122	5.5
	Male	6	6	1.65	0.49 – 5.57	0.414	5.6
	Female	3	1	6.79	0.65 – 197.90	0.116	5.1
Dose 2	All	29	34	1.48	0.88 – 2.50	0.141	10.7
	Male	26	30	1.50	0.86 – 2.61	0.152	21.9
	Female	3	4	1.35	0.23 – 7.15	0.714	1.6

[1]Adjusted for VSD site, age, sex, race/ethnicity, and calendar date. Adjusted rate ratio is an estimate of the Moderna rate divided by Pfizer rate.

[2]Excess cases is an estimate of the Moderna rate minus the Pfizer rate. Excess cases per million doses were estimated by dividing the Moderna incidence rate by the rate ratio estimate and subtracting the result from the Moderna rate.

VSD incidence rates of verified myocarditis/pericarditis 0–7 days following COVID-19 mRNA vaccination – December 14, 2020–March 31, 2022

(Adults ages 18-39 years)	Pfizer-BioNTech*	Moderna†
	Incidence rate per million doses admin	Incidence rate per million doses admin
18–29 years		
Males – Dose 1	11.5	24.1
Males – Dose 2	81.7	97.3
Males – 1st Booster	47.6	70.3
Females – Dose 1	2.4	3.9
Females – Dose 2	5.0	0.0
Females - 1st Booster	4.7	13.9
30–39 years		
Males – Dose 1	2.8	4.5
Males – Dose 2	14.7	37.0
Males – 1st Booster	16.5	7.1
Females – Dose 1	0.0	3.8
Females – Dose 2	7.3	3.9
Females - 1st Booster	4.0	11.1

* Pfizer dose totals, all ages/sexes: dose 1: 2,583,600, dose 2: 2,464,035, 1st booster: 997,217;
† Moderna dose totals, all ages/sexes: dose 1: 950,608, dose 2: 914,745, 1st booster: 563,824

Summary: Myocarditis and pericarditis following mRNA COVID-19 vaccination

- Current evidence supports a causal association between mRNA COVID-19 vaccines and myocarditis and pericarditis with cases clustering within the first week of vaccination
- Myocarditis is a rare event following mRNA COVID-19 vaccination
  - CDC has verified 635 myocarditis case reports in children ages 5–17 years after 54.8 million Pfizer-BioNTech doses administered in this age group in the United States
- Risk appears greatest in adolescents in the age groups 16–17 and 12–15 years and is generally higher after dose 2 compared to dose 1 of the primary series and in males compared to females
  - In VSD analysis, in a minority of age and sex strata, incidence is highest following booster dose
- The reporting rate in VAERS of myocarditis following Pfizer-BioNTech in male children ages 5–11 years after dose 2 of the primary series is slightly elevated when compared to background incidence; otherwise, reporting rates are within background incidence
- To date, myocarditis and pericarditis has not statistically signaled in VSD RCA surveillance in children ages 5–11 years

Summary: Myocarditis and pericarditis following mRNA COVID-19 vaccination (cont.)

- Available information suggests that most persons with myocarditis after mRNA COVID-19 vaccination recover from their myocarditis by 90+ days after diagnosis
- In age groups where product comparisons can be made (e.g., 18–39 years), some evidence suggests that myocarditis and pericarditis risk may be higher after Moderna than after Pfizer-BioNTech; however, findings are not consistent in all U.S. monitoring systems

Acknowledgments

- VAERS Team
- V-safe Team
- Clinical Immunization Safety Assessment (CISA) Project
- Vaccine Safety Datalink (VSD) Team
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- CDC Infectious Diseases Pathology Branch
- COVID-19 Vaccine Task Force Data Monitoring and Reporting Group
- FDA/Center for Biologics Evaluation and Research
- Kaiser Permanente Northern California (VSD)
- Marshfield Clinic Research Institute (VSD)
- VSD sites
  - HealthPartners Institute, Minneapolis, MN
  - Kaiser Permanente Colorado, Denver, CO
  - Kaiser Permanente Northwest, Portland, OR
  - Kaiser Permanente Southern California, Los Angeles, CA
  - Kaiser Permanente Washington, Seattle, WA
  - Denver Health, Denver, CO

Promoting v-safe in practice– we need help!

How:

- Direct patients to https://vsafe.cdc.gov/en/
  - Ideally this should occur before vaccination
- Provide **v-safe** information sheet to patients
- Display posters about **v-safe**

https://www.cdc.gov/coronavirus/2019ncov/vaccines/safety/vsafe/printresources.html

Get vaccinated.
Get your smartphone.
Get started with v-safe.

What is v-safe?

V-safe provides personalized and confidential health check-ins via text messages and web surveys so you can quickly and easily share with CDC how you or your dependent feel after getting a COVID-19 vaccine. It takes just a few minutes to enroll and your participation in **v-safe** helps us monitor the safety of COVID-19 vaccines for everyone.

V-safe features:

- **Enroll your dependents** and complete check-ins on their behalf
- **Enter** and report how you feel after **first, second, additional, and booster doses**

How can I enroll and how does it work?

You can enroll in **v-safe** after any dose of COVID-19 vaccine by using your smartphone and going to vsafe.cdc.gov.

During the first week after each vaccination, **v-safe** will send you a text message each day to ask how you are feeling. After that, you will receive occasional check-ins, which you can opt out of at any time. Depending on your answers, someone from CDC may call to get more information. Your personal information in **v-safe** is protected so it's safe and private*.

How can I enroll my child or dependent?

You can enroll any family member (or friend) who is eligible to be vaccinated in **v-safe.** Children under 16 years old must be enrolled using a parent or guardian's **v-safe** account. You can add a dependent to your existing account or create a new account if you don't have one yet. Creating an account to enroll a dependent does not require that you enter your own vaccination information or complete health check-ins for yourself.

Need step-by-step instructions? Go to: www.cdc.gov/vsafe

*v-safe uses existing information systems managed by CDC, FDA, and other federal agencies. These systems use strict security measures to keep information confidential. These measures comply, where applicable, with the following federal laws, including the Privacy Act of 1974; standards enacted that are consistent with the Health Insurance Portability and Accountability Act of 1996 (HIPAA); the Federal Information Security Management Act, and the Freedom of Information Act.

v-safe℠
after vaccination health checker

Sign up with your smartphone's browser at vsafe.cdc.gov

OR

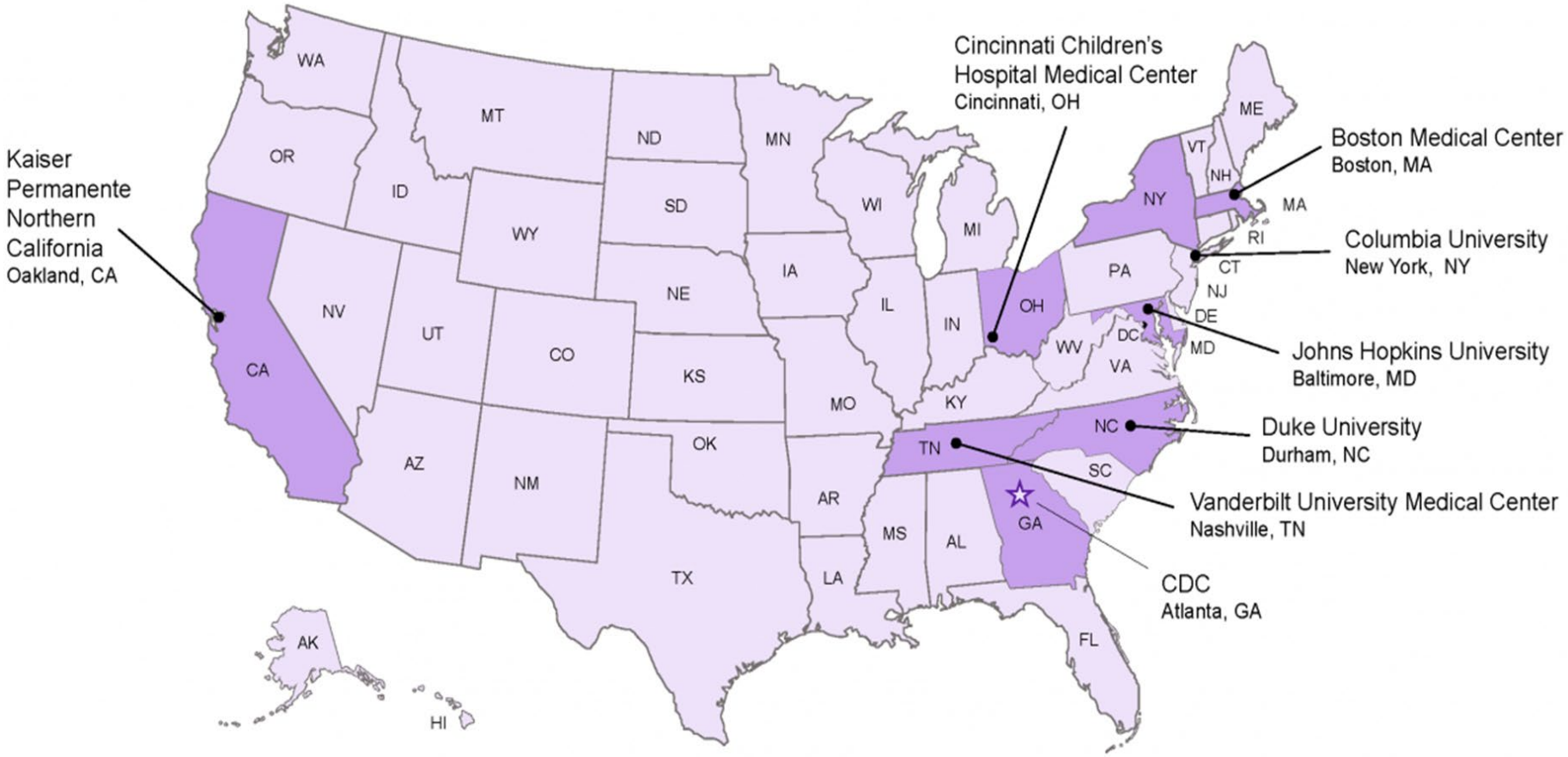
Aim your smartphone's camera at this code

Need help with *v-safe*?
Call 800-CDC-INFO (800-232-4636)
TTY 888-232-6348
Open 24 hours, 7 days a week
Visit www.cdc.gov/vsafe

CS324195-L 06/10/2022

CISA

Clinical Immunization Safety Assessment (CISA) Project



7 participating medical research centers with vaccine safety experts

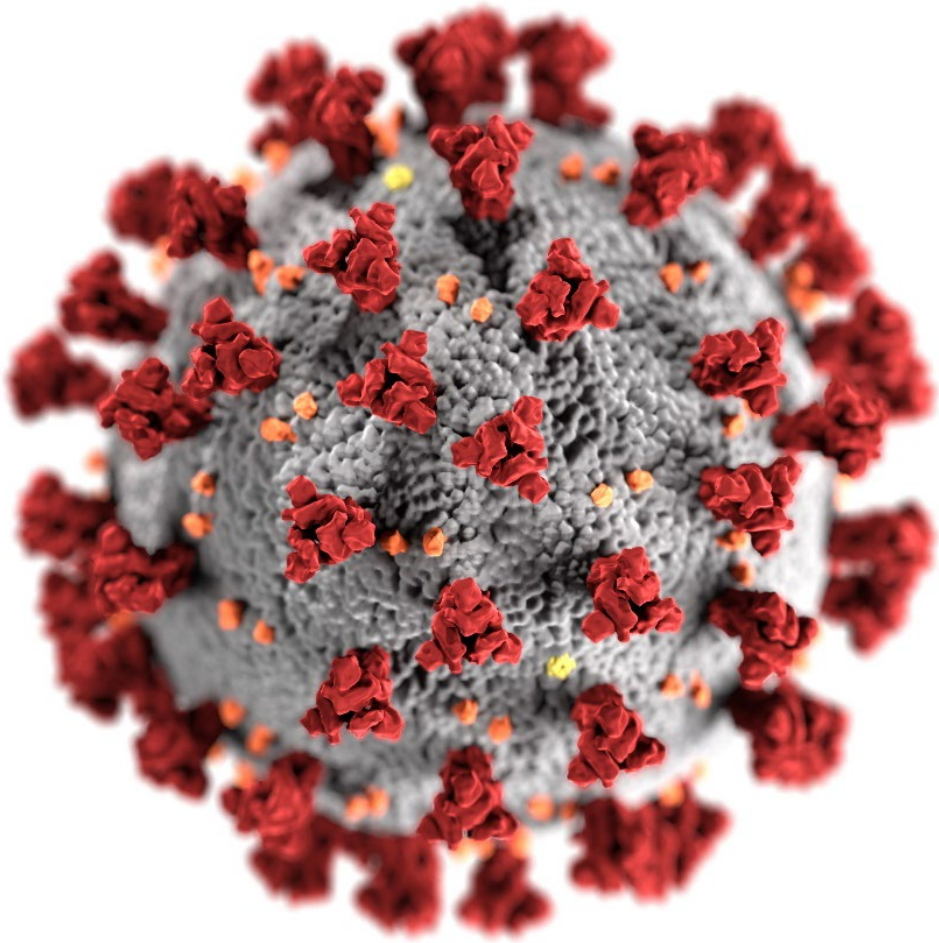
- clinical consult services†
- clinical research

†More information about clinical consults available at http://www.cdc.gov/vaccinesafety/Activities/CISA.html

Disclaimer

- The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC) or the U.S. Food and Drug Administration (FDA)
- Mention of a product or company name is for identification purposes only and does not constitute endorsement by CDC or FDA

Thank you!



For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

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