Updates from the 2022–2023 U.S. Mpox Outbreak: Epidemiology, Vaccine Safety, and Vaccine Effectiveness

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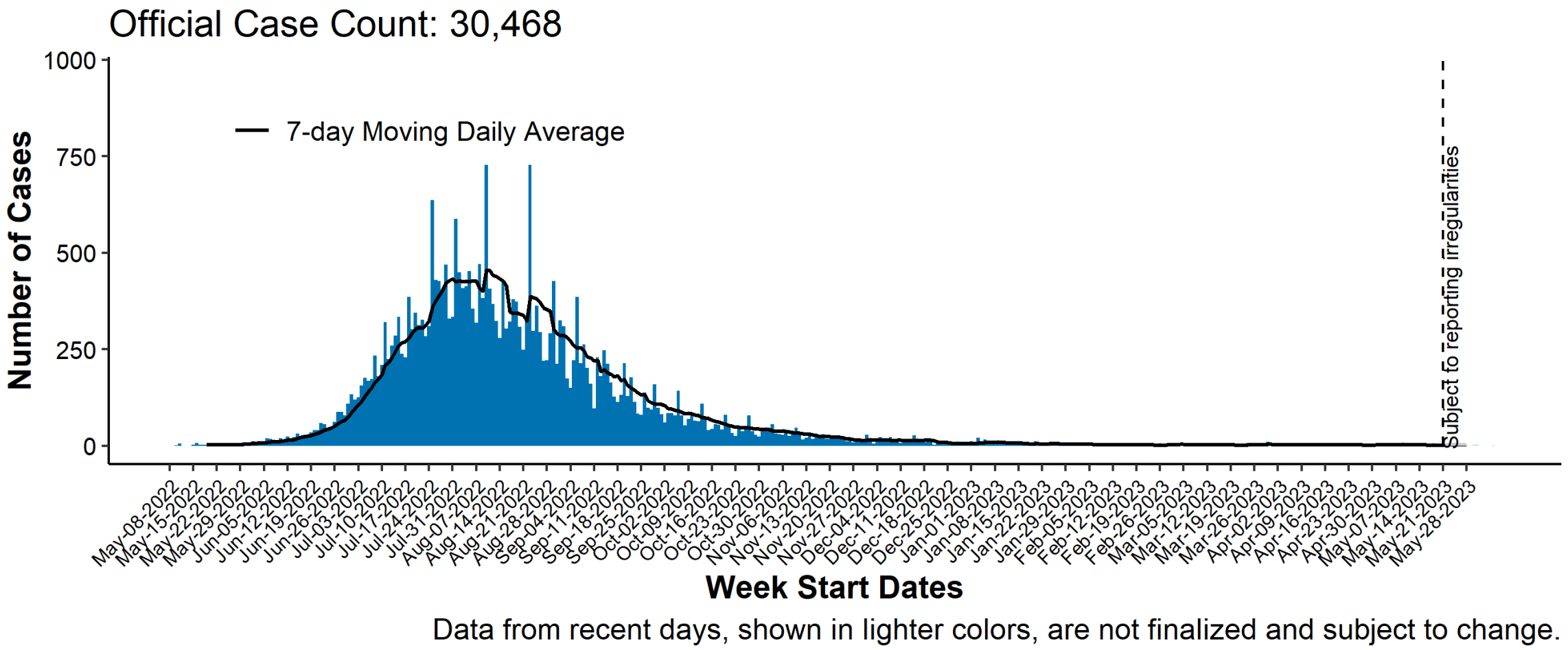
ACIP Meeting

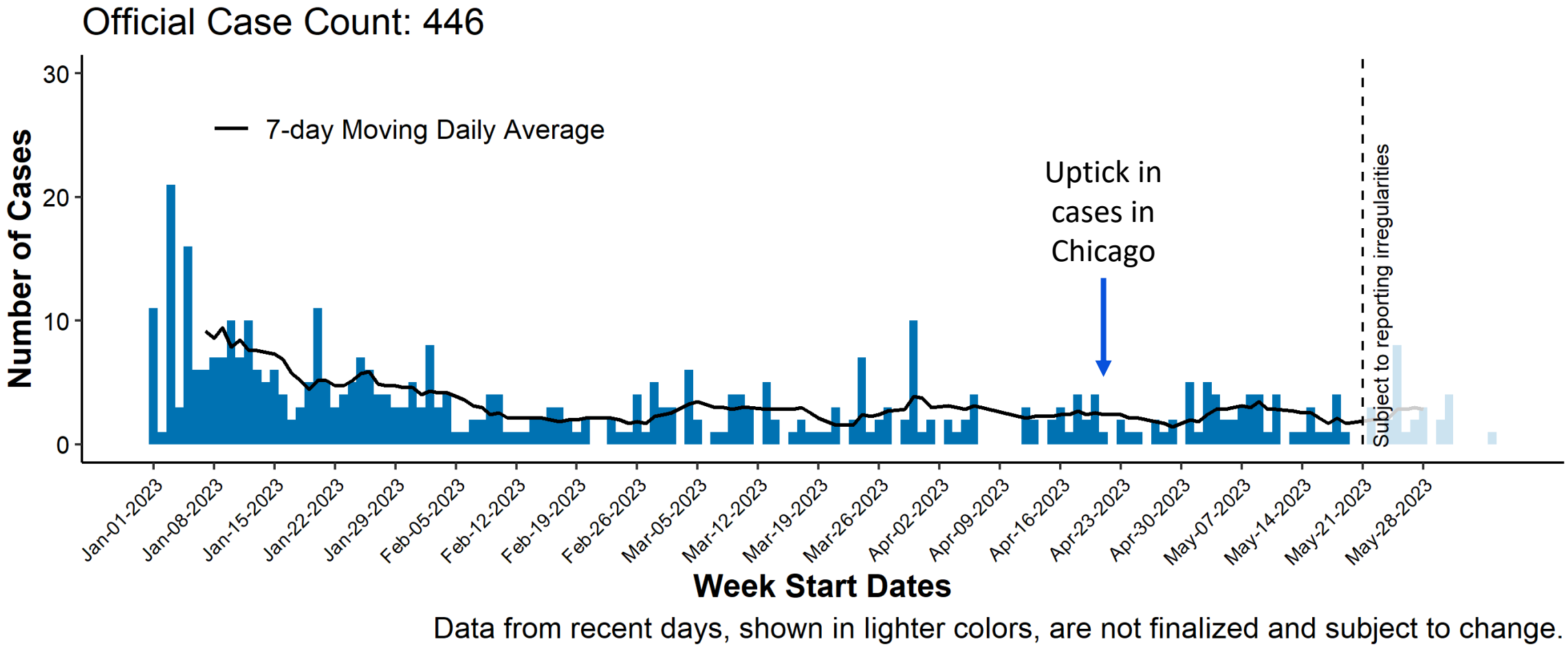
June 23, 2023

United States Mpox Case Counts April 2022–June 2023



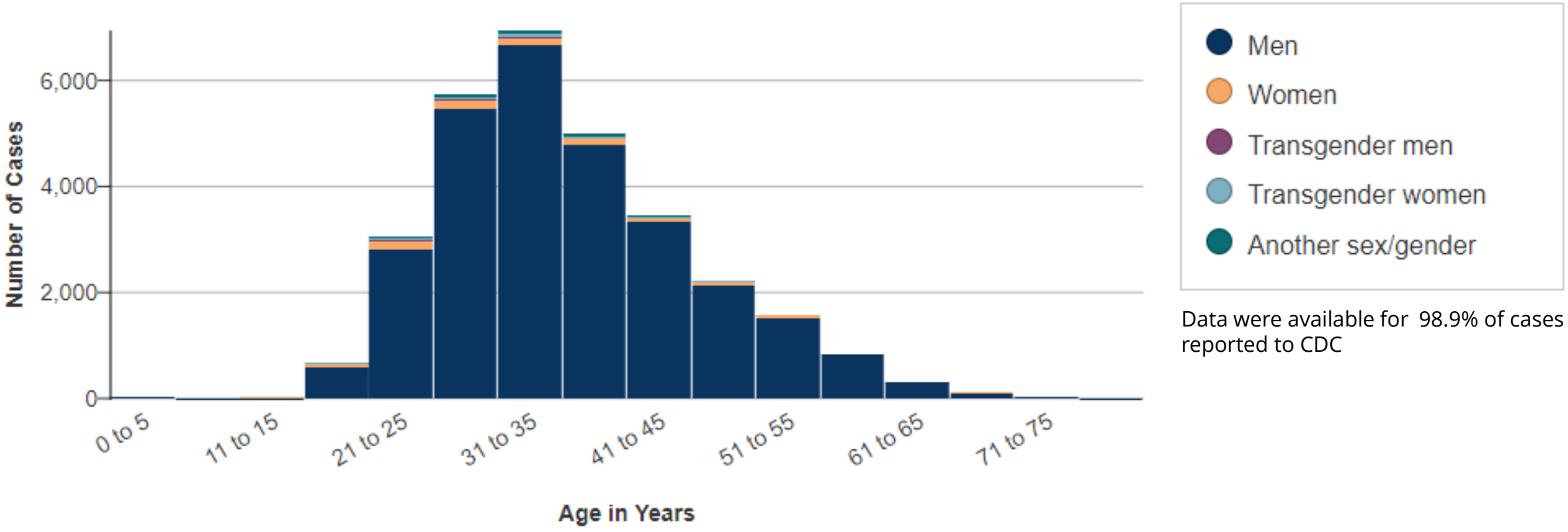
https://www.cdc.gov/poxvirus/mpox/response/2022/mpx-trends.html

United States Mpox Case Counts January 1–June 6, 2023



https://www.cdc.gov/poxvirus/mpox/response/2022/mpx-trends.html

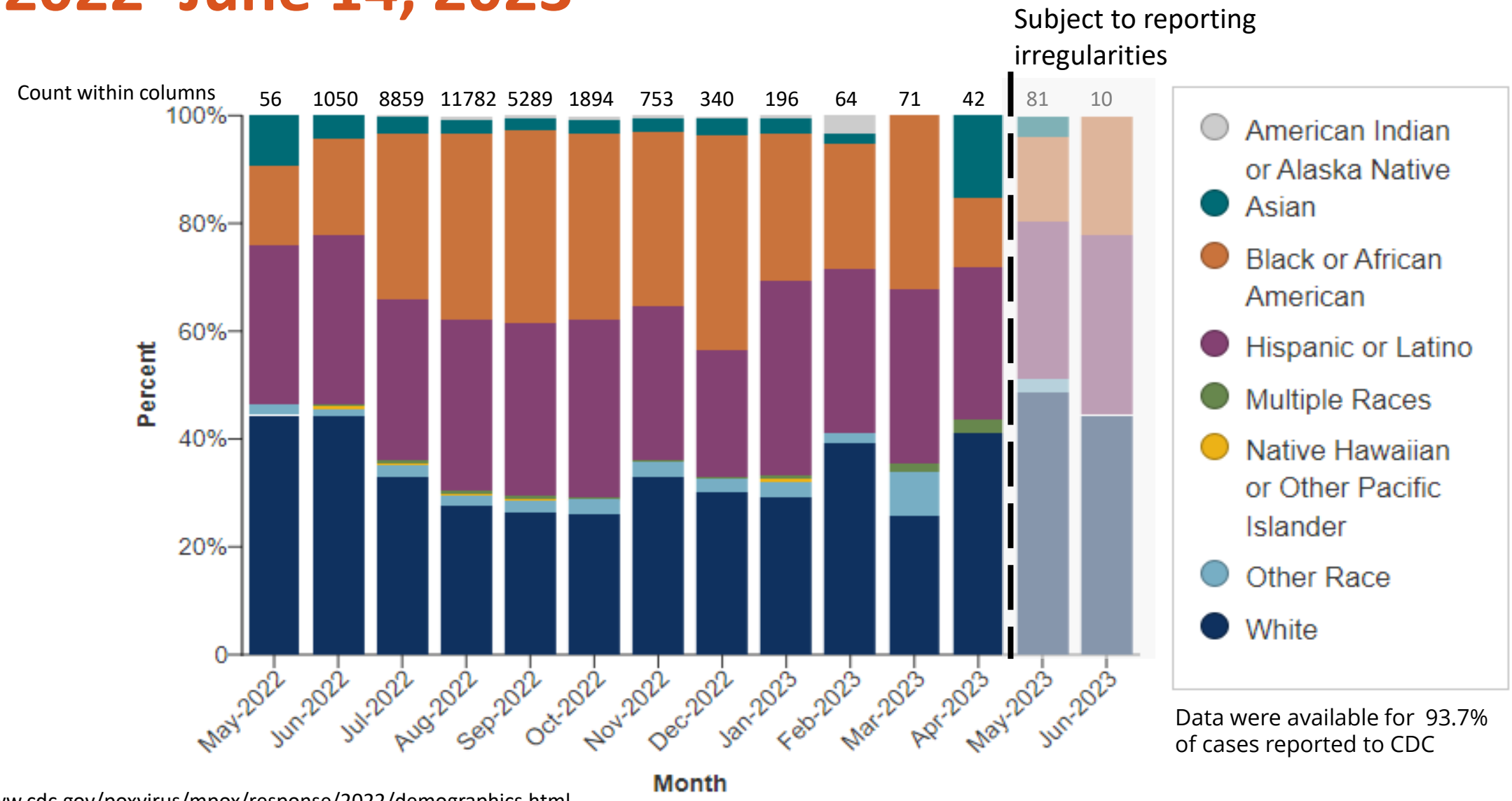
Mpox cases reported to CDC by age and gender May 2022–June 14, 2023



Data were available for 98.9% of cases reported to CDC

https://www.cdc.gov/poxvirus/mpox/response/2022/demographics.html

Mpox cases reported to CDC by race and ethnicity May 2022–June 14, 2023



Data were available for 93.7% of cases reported to CDC

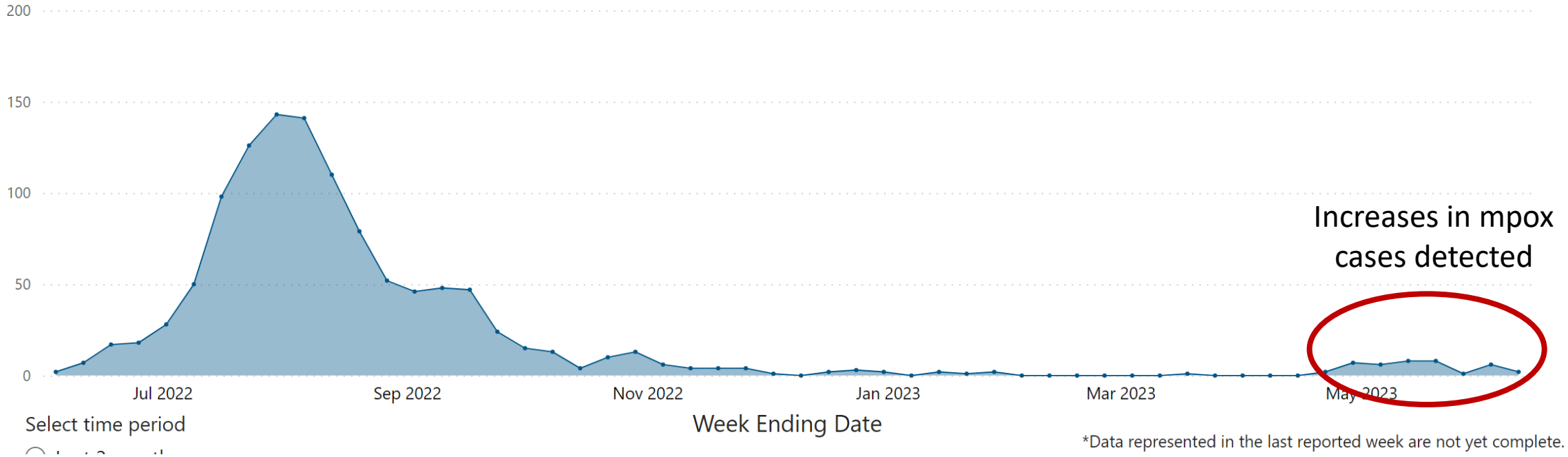
https://www.cdc.gov/poxvirus/mpox/response/2022/demographics.html

Chicago Mpox Cases

Cases of Mpox Diagnosed in Chicagoans Between 6/4/2022 - 6/10/2023

2 cases were diagnosed last week. This is 66.7% lower than the number of cases diagnosed during the prior week.

Cases	Hospitalizations	Deaths
1,163	64	3



https://www.chicago.gov/city/en/sites/monkeypox/home/data.html

Cluster of cases in Chicago

- From March 18–June 12, Chicago identified 40 laboratory confirmed mpox cases
  - All males with a median age of 36 years (IQR 23–49)
  - 22 (55%) were vaccinated with 2 doses of JYNNEOS or 1-dose of ACAM2000
  - 5 (13%) were partially vaccinated (i.e., 1 dose JYNNEOS)
  - 13 (33%) were unvaccinated

- 11 were living with HIV
  - 10 were vaccinated with 2 doses of JYNNEOS or 1 dose of ACAM2000 had well controlled HIV
- Median time from 2nd dose of JYNNEOS to mpox diagnosis was 8.4 months (IQR 7.9–8.8 months)

https://www.cdc.gov/mmwr/volumes/72/wr/mm7225a6.htm

Cluster of cases in Chicago

- Individuals with 2 doses of JYNNEOS or 1 dose of ACAM2000 had self-limiting illness
  - Lower prevalence of mucosal lesions
  - None were hospitalized
- Individuals with 2 doses of JYNNEOS or 1 dose of ACAM2000 had a higher number of sexual partners 3 weeks before symptom onset compared to partially or unvaccinated
- Preliminary sequencing indicates the virus is the same B.1 variant of Clade IIB which is the predominant variant of the 2022–2023 outbreak
  - There were no mutations that would confer increased pathogenicity

- This investigation is ongoing, however no similar clusters are being seen elsewhere in the U.S.

https://www.cdc.gov/mmwr/volumes/72/wr/mm7225a6.htm

Epidemiology of Mpox in Less Affected Populations

Mpox in Pregnant People in the U.S.

- From May 11, 2022–May 31, 2023, 27 cases of mpox reported to CDC occurred in pregnant people
- All exposure were through close contact with a person with confirmed infection (including sexual or household contact)
- Infections occurred in all trimesters of pregnancy
- 11 (40.7%) received tecovirimat without adverse events reported
- Outcomes
  - 3 (11.1%) pregnancy losses at <20 weeks
  - 6 (22.2%) live births
  - 18 (66.7%) pregnancies ongoing

Neonatal Transmission and Breastfeeding Considerations

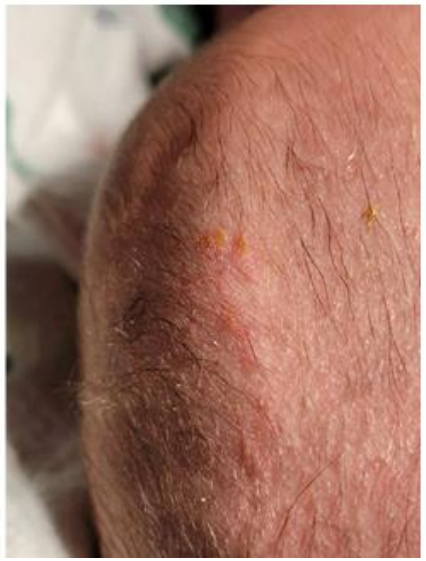
- Of 6 live births, two neonates developed lesions within one week after their mothers became symptomatic.
  - Both neonates received oral tecovirimat; one received VIGIV.
  - Both neonates responded to treatment and were discharged home.
  - One breastfeeding neonate developed face and chest lesions 6 days after the mother developed breast lesions.

- One woman with isolated ocular lesions continued to breastfeed her 2-year-old infant without transmission
  - Breastmilk tested on two separate occasions was MPXV PCR negative

VIGIV: vaccinia immune globulin intravenous

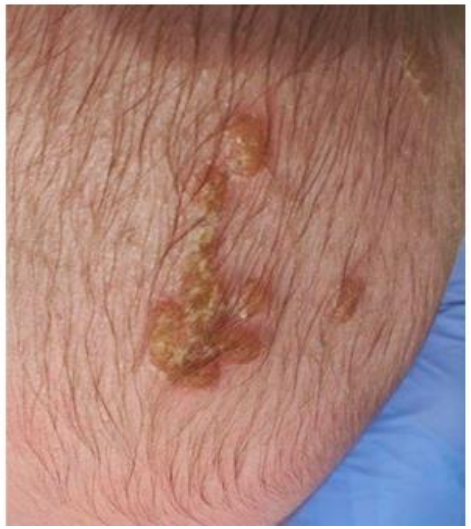
Mpox in a U.S. Neonate

- 12 hours after vaginal delivery, it was learned that dad had active mpox and had contact with mom prior to delivery
- Mom developed lesions 1 day after delivery on the abdomen and tested positive for mpox
- Baby was given VIGIV as post-exposure prophylaxis
- At 4 days old, baby developed scalp lesions and tested negative for HSV, positive for mpox
- Baby was given tecovirimat and discharged at 17 days old
- Full resolution 4 weeks after discharge



Scalp lesion, 4 days old

Scalp lesion, 13 days old



Nowalk A, Dunmore E (unpublished)

VIGIV: vaccinia immune globulin intravenous

Mpox in a neonate in the United Kingdom

- Nine days before birth, dad developed a febrile illness, followed by a rash that resolved prior to the baby's birth
- Four days after birth, a similar rash appeared on mom
- Nine days after birth, the infant also developed a similar rash and diagnosed with both mpox and adenovirus
- Treated with 14 days of enteral tecovirimat and intravenous cidofovir
- Critically ill, requiring 4 weeks in ICU and 14 days on mechanical ventilation before discharged home

Ramnarayan P, Mitting R, *N Engl J Med*. 2022 Oct 27;387(17):1618-1620.

Epidemiologic Characteristics of Pediatric Cases in the U.S., May 17–September 24, 2022

Characteristic	% by age group, yrs		
	0–4 (n = 16)	5–12 (n = 12)	13–17 (n = 55)
Sex			
Male	75%	50%	89%
Female	25%	50%	11%
Race or ethnicity			
Black, non-Hispanic	44%	42%	49%
Hispanic or Latino	31%	42%	34%
White, non-Hispanic	19%	17%	9%
Asian, non-Hispanic	—	—	4%
American Indian or Alaska Native, non-Hispanic	—	—	2%
Native Hawaiian or other Pacific Islander, non-Hispanic	6%	—	—
Other, non-Hispanic	—	—	2%
Exposure setting and route			
Sexual contact	—	—	97%
Household contact	93%	100%	—
Other	7%	—	3%

- **<1% of U.S. cases among persons <18 years of age**
- **Among adolescents, cases predominantly after male-to-male sexual contact**
- **Among younger children, predominantly household contact**

Hennessee I. *MMWR Morb Mortal Wkly Rep* 2022;71:1407–1411.

MPXV Infections Among Children Aged ≤12 Years — U.S., September 25–December 31, 2022

- Mpox cases in children ≤12 years are rare
- Transmission to children is primarily from mpox positive caregiver interactions

Characteristic	Age group, yrs, no./No. (%)		
	All ≤12 (N = 14)	0–4* (n = 10)	5–12 (n = 4)
Race and ethnicity†			
Black or African American, non-Hispanic	**9/14 (64)**	7/10 (70)	2/4 (50)
White, Hispanic	**2/14 (14)**	1/10 (10)	1/4 (25)
White, non-Hispanic	**3/14 (21)**	2/10 (20)	1/4 (25)
Exposure source§			
Caregiver or household contact¶	**8/14 (57)**	6/10 (60)	2/4 (50)
Nonhousehold contact**	**1/14 (7)**	1/10 (10)	0/4 (—)
Unknown contact	**5/14 (36)**	3/10 (30)	2/4 (50)
Types of contact with known exposure source††			
Blood or other body fluid	**0/4 (—)**	0/3 (—)	0/1 (—)
Diaper change or toilet use	**1/5 (20)**	1/3 (33)	0/2 (—)
Face-to-face	**6/7 (86)**	4/5 (80)	2/2 (100)
Feeding	**1/5 (20)**	1/3 (33)	0/2 (—)
Holding or cuddling	**3/4 (75)**	2/3 (67)	1/1 (100)
Medical care	**0/5 (—)**	0/3 (—)	0/2 (—)
Pet	**0/6 (—)**	0/4 (—)	0/2 (—)
Shared clothes, towels, bedding, or bed linens	**1/4 (25)**	1/3 (33)	0/1 (—)
Shared food or dishes	**3/4 (75)**	1/2 (50)	2/2 (100)
Shared living space	**3/6 (50)**	2/4 (50)	1/2 (50)
Shared toiletries	**1/3 (33)**	1/2 (50)	0/1 (—)
Shared toys	**0/4 (—)**	0/3 (—)	0/1 (—)
Skin-to-skin	**5/6 (83)**	4/5 (80)	1/1 (100)

Nemechek K, MMWR Morb Mortal Wkly Rep 2023;72:633–635.

Healthcare Personnel (HCP) Infections Reported to CDC

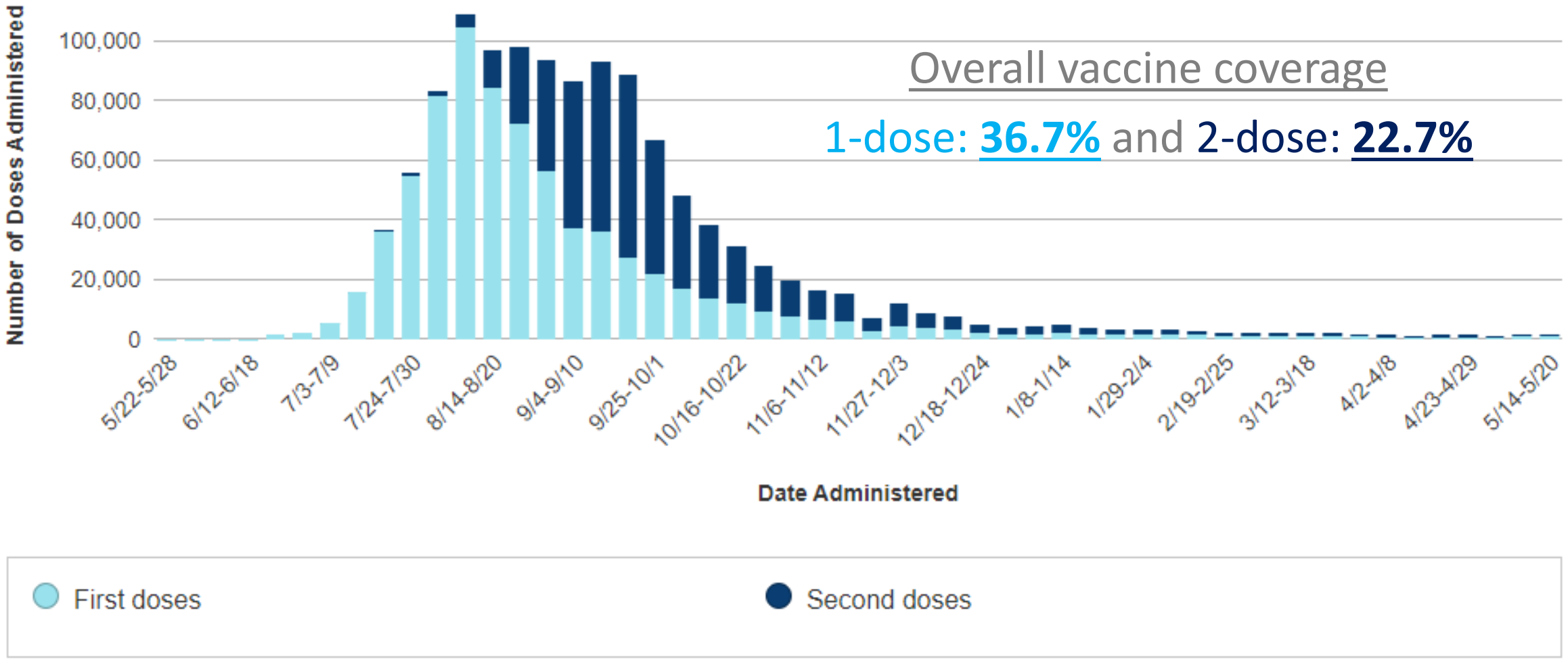
- During investigation of cases where HCP was noted within a case report form, the exposure was often outside the workplace
- After excluding all other more likely exposures, only 23 (0.08%) cases potentially involved HCP exposed at work
- HCP infections are very rare

Healthcare Personnel Cases That Consulted CDC (n=6)

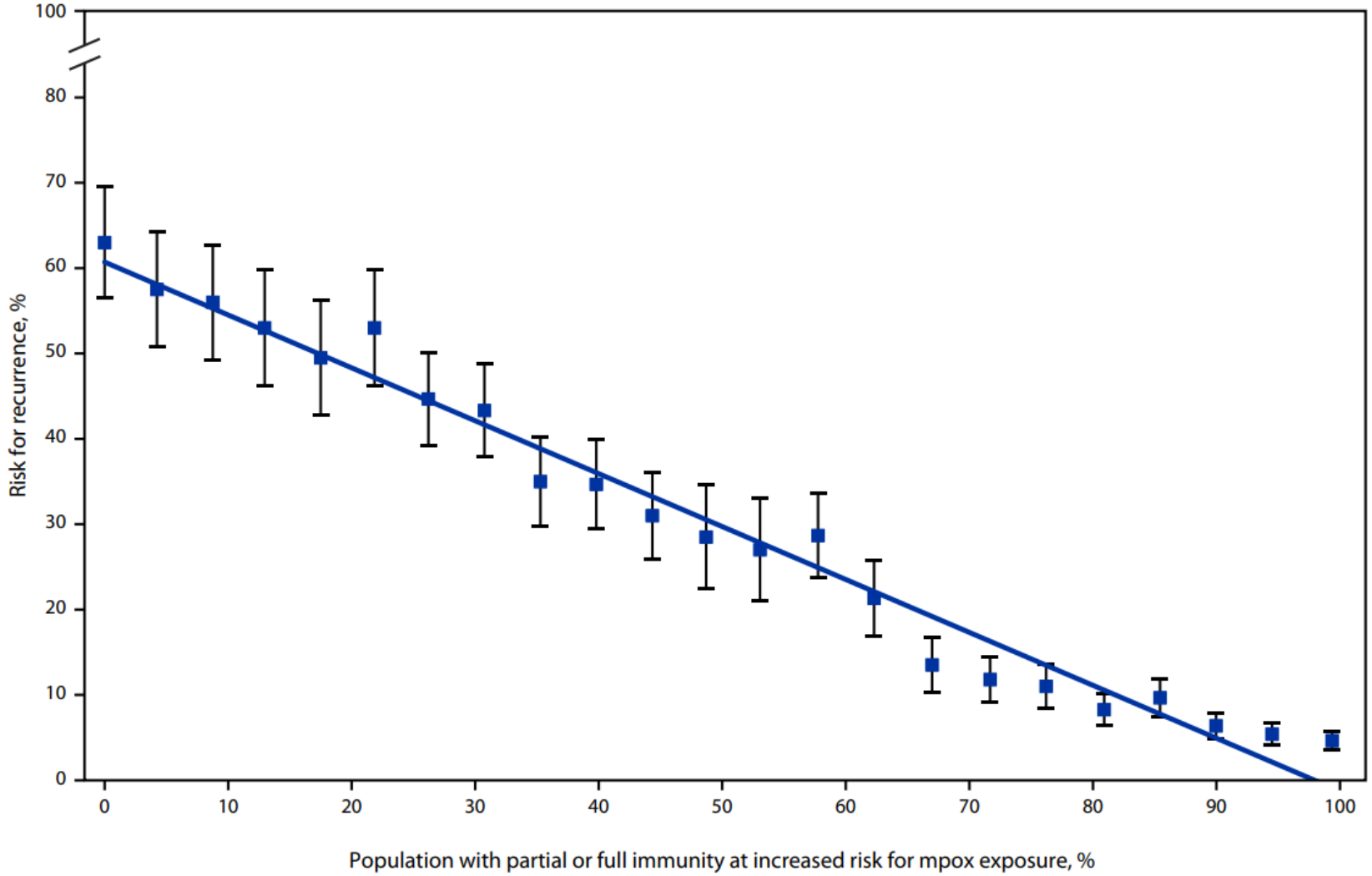
- Three were sharps injuries while trying to aspirate/unroof lesions
  - CDC has since revised its recommendations to discourage unroofing lesions
  - Globally, this constitutes the majority of HCP infections
- Two cases among HCP where improper personal protective equipment was worn
- One case where the exposure route was unclear

Vaccine: Coverage, Safety and Effectiveness

First and Second Doses of JYNNEOS Vaccine Administrations–United States, May, 2022 to May 2023

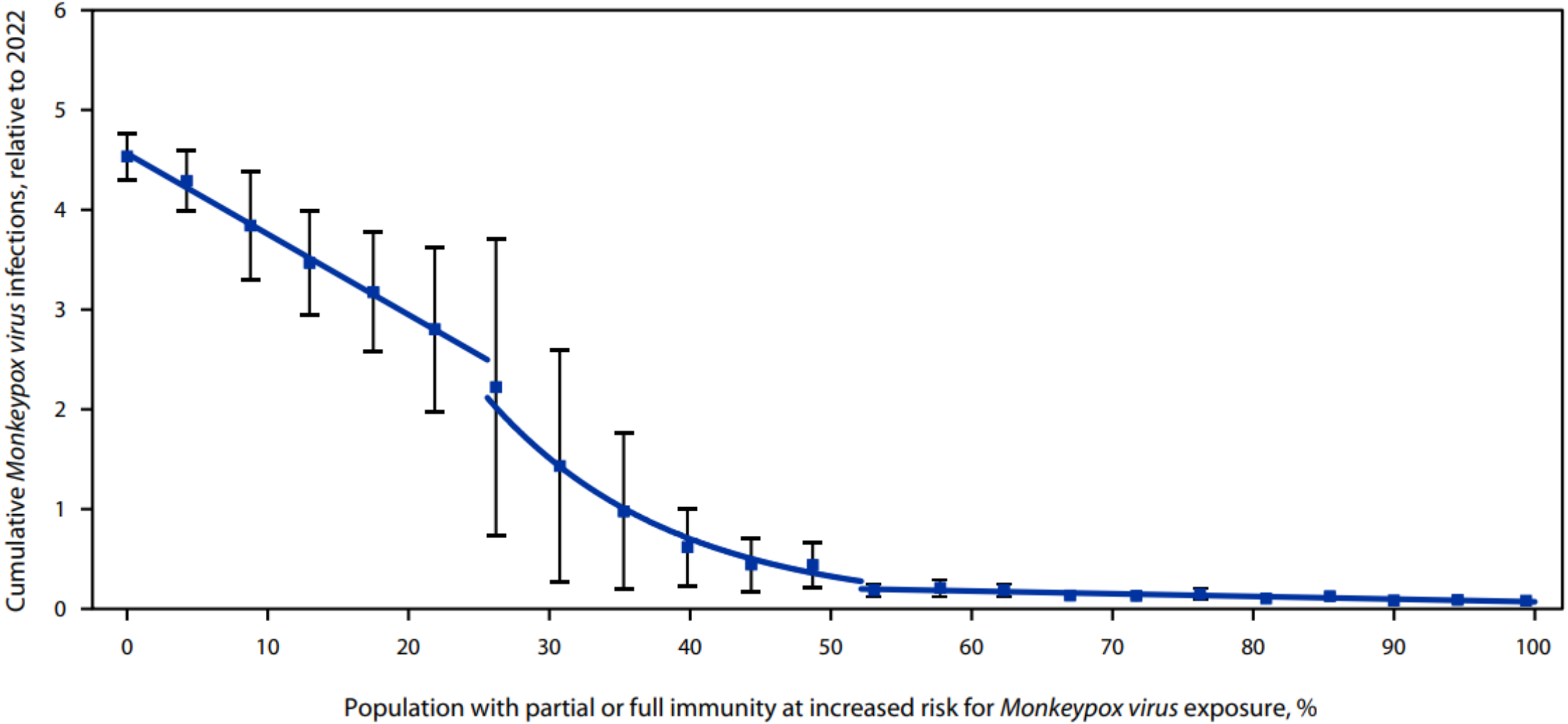


Risk for recurrent mpox outbreak lasting >3 months, by immunity level — United States, 2023



Pollock ED. MMWR Morb Mortal Wkly Rep 2023;72:568–573.

Cumulative *Monkeypox virus* infections relative to 2022, by immunity level — United States, 2023



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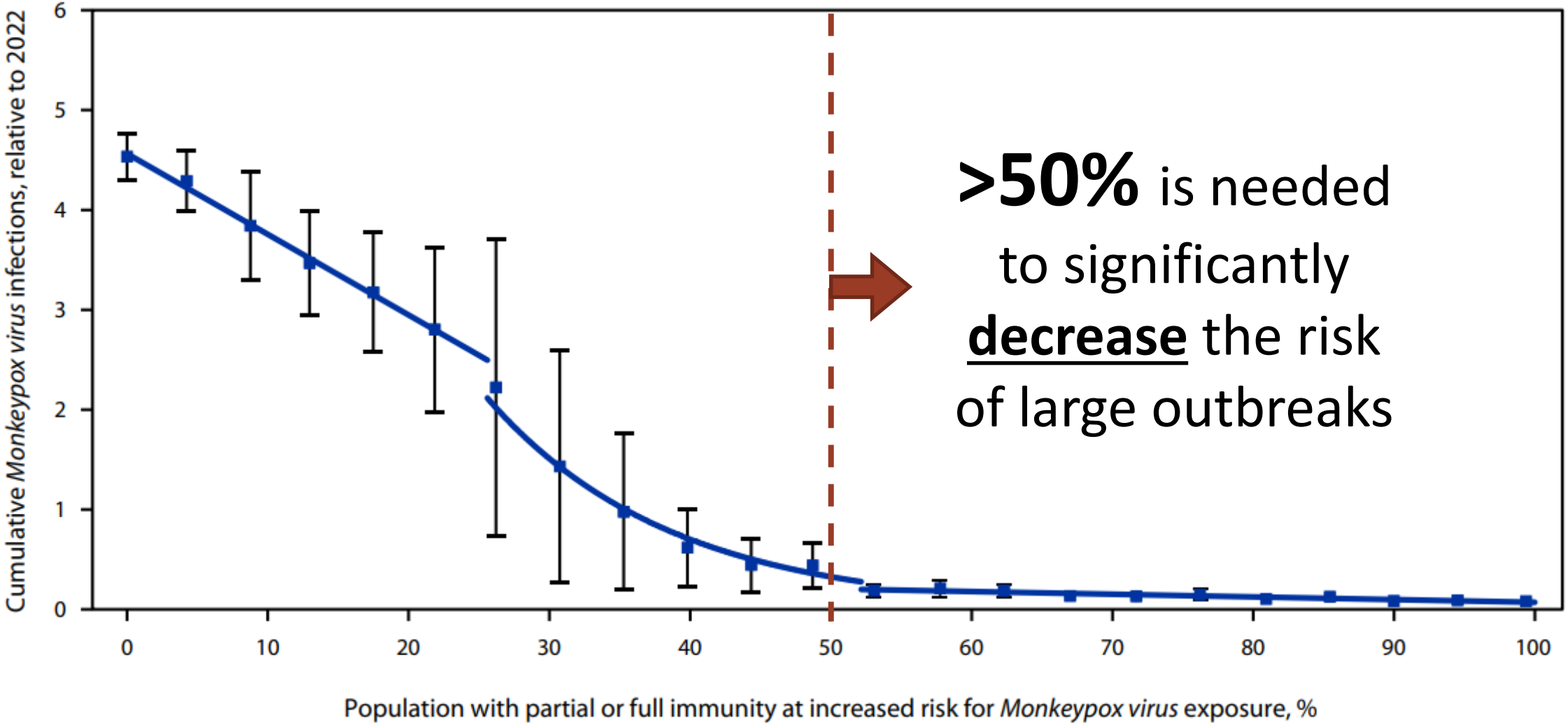


Pollock ED. MMWR Morb Mortal Wkly Rep 2023;72:568–573.

JYNNEOS Vaccine Safety Monitoring

- CDC vaccine safety monitoring is ongoing using two surveillance systems:
  - Vaccine Adverse Event Reporting System (VAERS)
  - Vaccine Safety Datalink (VSD)
- V-safe data collection for mpox vaccines was available from November 2022 through March 21, 2023

JYNNEOS Vaccine Safety Findings Summary

- The adverse events most commonly reported to VAERS have been injection site symptoms (redness, swelling, pain, itching)
- Uncommon, but expected, adverse events that have been reported to VAERS include:
  - Syncope: 49 reports per million doses administered
  - Anaphylaxis: 2 reports per million doses administered
- Myocarditis and pericarditis are adverse events of special interest
  - Observed rates are consistent with expected background rates

JYNNEOS Vaccine Safety Conclusions

- VAERS and VSD data do not suggest an increased risk for myocarditis or pericarditis following JYNNEOS, but the possibility of a small risk cannot be excluded
- The frequencies of local and systemic reactions reported to v-safe after mpox vaccine were similar to those reported in clinical trials
- No new or unexpected safety concerns have been identified

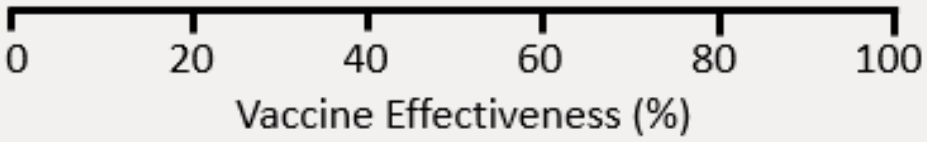
Epic Cosmos Study: Methods

- **Data Source:** Epic's electronic health record (EHR) platform, Cosmos, which includes records from >173 million patients across the U.S.
- **Design:** Case-control analysis, matched 1:4 based on week of index event, HHS region, and gender identity
  - **Cases**: Patients with an mpox diagnosis or positive orthopoxvirus or MPXV laboratory result from 8/15 - 11/19/2022
  - **Controls:** Patients with an incident HIV diagnosis or HIV pre-exposure prophylaxis (PrEP) prescription from 8/15 - 11/19/2022
- **Analysis:**
  - **Vaccine effectiveness (VE) estimated** using conditional logistic regression
  - **Adjusted for** age, race/ethnicity, social vulnerability index, immunocompromising conditions
  - **Stratified by** route of administration and immunocompromised status

Epic Cosmos Case-Control Study: VE for 1-Dose and 2-Dose JYNNEOS vaccination

	Cases (n=2,913)	Controls (n=8,319)	Adjusted* VE (95% CI)
Overall VE, 1-dose JYNNEOS	**146**	**1000**	**36% (22–47)**
No immunocompromising conditions	102	932	41% (25–53)
Subcutaneous administration			
Intradermal administration			
Immunocompromised			
Overall VE, 2-dose JYNNEOS	**25**	**335**	**66% (47–78)**
No immunocompromising conditions	14	312	76% (58–87)
Heterologous administration	8	150	75% (48–88)

Not sufficiently powered for this analysis



*Adjusted for age, race/ethnicity, social vulnerability index, and immunocompromising conditions. Cases/controls matched on week of index event, HHS region, gender identity.

https://www.nejm.org/doi/full/10.1056/NEJMoa2215201?query=featured_home

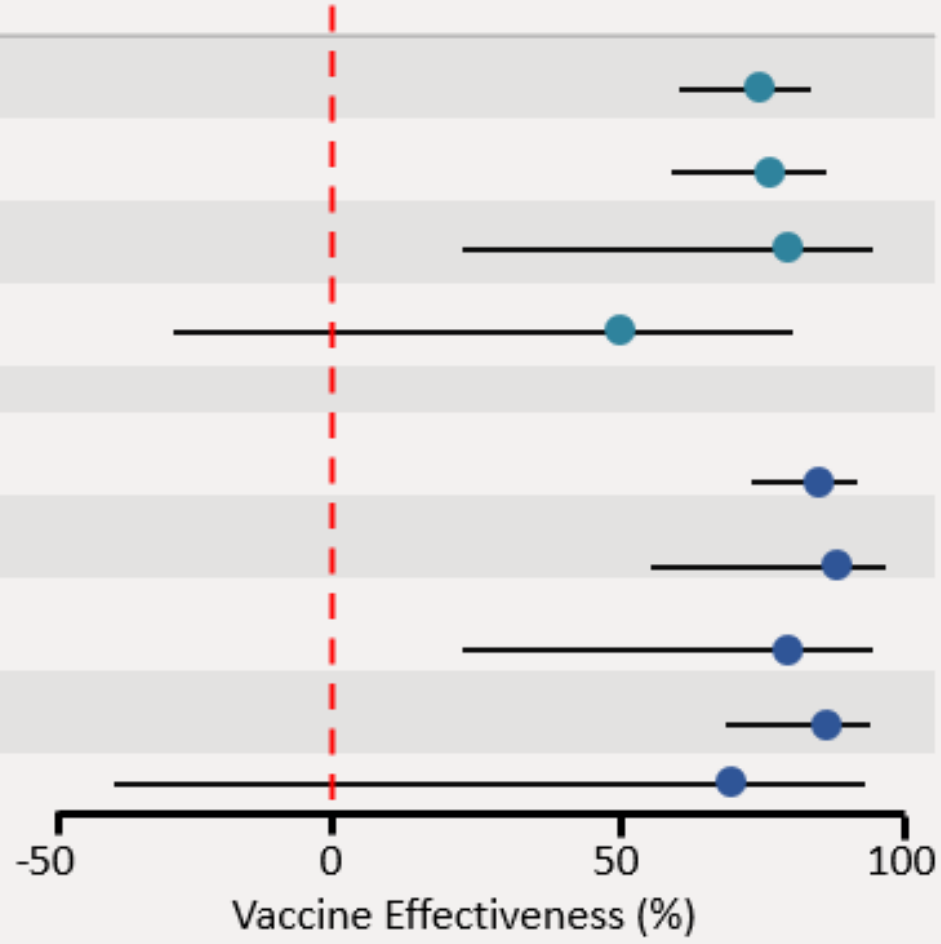
Multi-jurisdictional Case-Control Study: Methods

- **Design:** Case-control study
- **Population:** Men who have sex with men; ages 18-49; 12 U.S. jurisdictions
- **Methods:**
  - **Cases** identified from jurisdictions' probable and confirmed mpox case lists
  - **Controls** identified from healthcare settings providing HIV PrEP or sexually transmitted infection (STI) clinics
  - Demographics, exposure history, and vaccination history collected using electronic surveys
  - Vaccination status confirmed by state immunization registries
- **Analysis:**
  - **VE estimated** using conditional logistic regression
  - **Adjusted for** age, race/ethnicity, immunocompromising conditions
  - **Stratified by** route of administration and immunocompromised status

Multi-jurisdictional Case-Control Study Results: VE for 1-Dose and 2-Dose JYNNEOS vaccination

	Cases (n=167)	Controls (n=256)	Adjusted* VE (95% CI)
Overall VE, 1-dose JYNNEOS	**58**	**237**	**75% (61–89)**
Subcutaneous administration	38	159	77% (60–87)
Intradermal administration	18	76	81% (56–91)
Immunocompromised	22	52	51% (-28–81)
Overall VE, 2-dose JYNNEOS	**28**	**178**	**86% (74–92)**
Subcutaneous administration	7	27	89% (56–97)
Intradermal administration	5	25	80% (23–95)
Heterologous administration	16	125	87% (69–95)
Immunocompromised	9	31	70% (-38–94)

*Adjusted for age, race/ethnicity, immunocompromised status, reported close contact with a confirmed/suspected mpox case in 3 weeks prior to index event, and month of index event



https://www.cdc.gov/mmwr/volumes/72/wr/mm7220a3.htm?s_cid=mm7220a3_w

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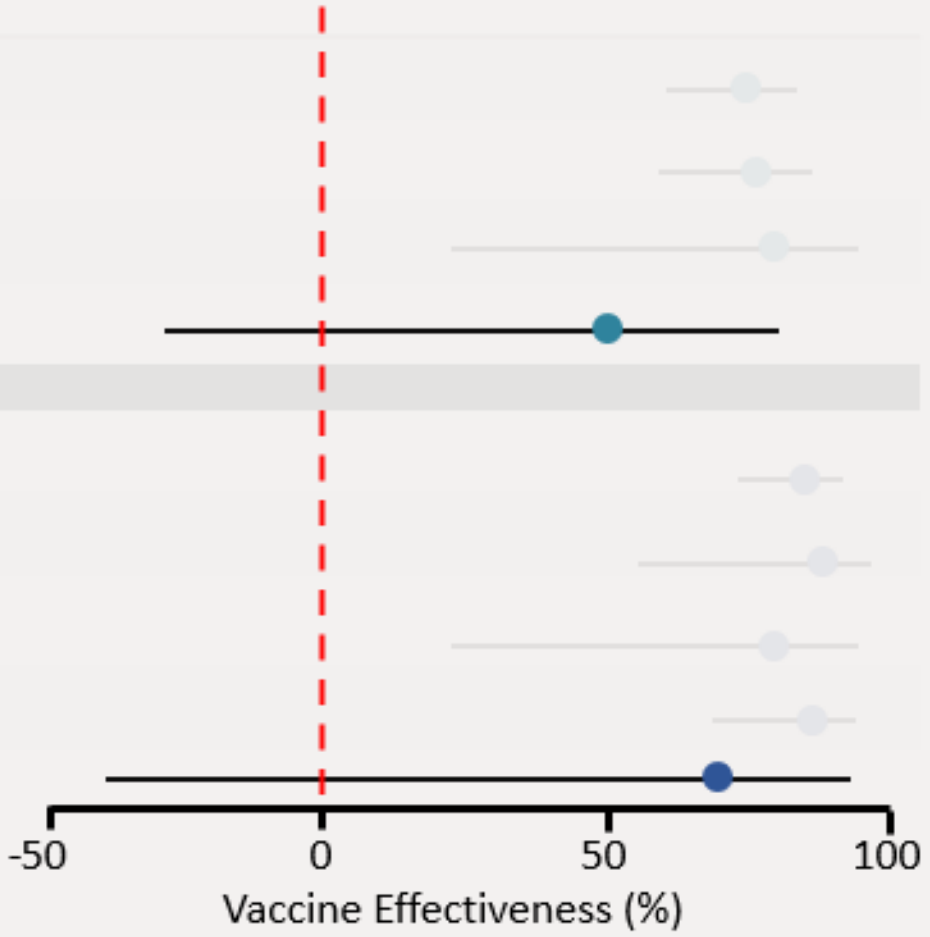

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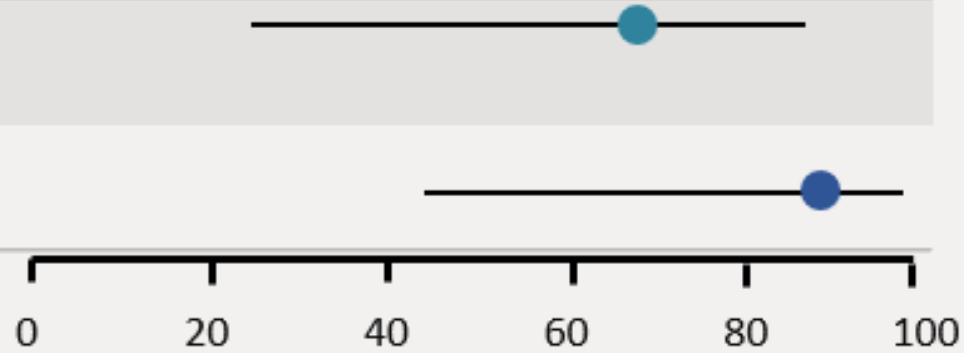
https://www.cdc.gov/mmwr/volumes/72/wr/mm7220a3.htm?s_cid=mm7220a3_w

New York State Case-Control Study: Methods

- **Design:** Case-control study
- **Data source:** Linkage of case surveillance to immunization registry in New York State, excluding New York City
- **Population:** males at birth aged ≥18 years
- **Methods:**
  - **Cases**: Adult male mpox cases during July 24 – October 31, 2022
  - **Controls**: Adult male STI cases (rectal gonorrhea or primary syphilis) during July 24 – October 31, 2022
  - Vaccination status obtained from immunization registries
- **Analysis:** Conditional logistic regression model adjusted for week of diagnosis, race, age, region within state

New York State Case-Control Study Results: VE for 1-Dose and 2-Dose JYNNEOS vaccination

	cases (n=252)	controls (n=255)	Adjusted* VE (95% CI)
Overall VE, 1-dose JYNNEOS	10	23	68% (25–87)
Overall VE, 2-dose JYNNEOS	2	19	89% (44–98)

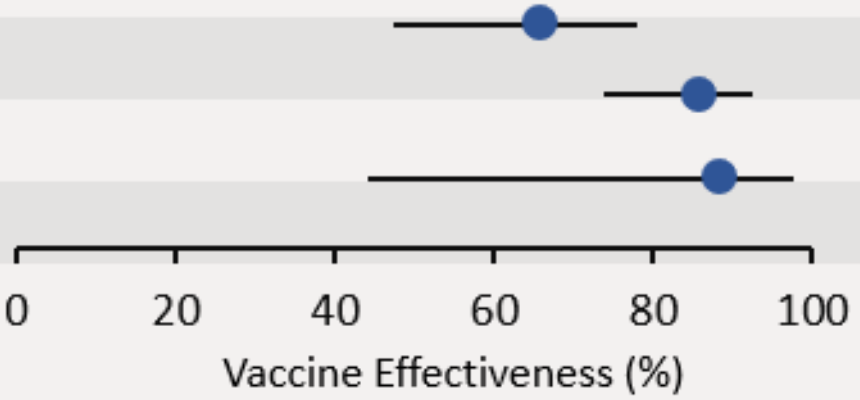


*Adjusted for age, race/ethnicity, week of diagnosis, and geographic region

https://www.cdc.gov/mmwr/volumes/72/wr/mm7220a4.htm

VE against mpox ranges from 36%–75% for 1-Dose and 66%–89% for 2-Dose JYNNEOS vaccination

	Cases	Controls	Adjusted* VE (95% CI)
1-dose JYNNEOS			
Epic Cosmos case-control study	146	1000	36% (22–47)
Multi-jurisdictional case-control study	58	237	75% (61–84)
New York State case-control study	10	23	68% (25–86)
2-dose JYNNEOS			
Epic Cosmos case-control study	25	335	66% (47–78)
Multi-jurisdictional case-control study	14	122	86% (74–89)
New York State case-control study	2	19	89% (44–98)



Vaccine effectiveness of JYNNEOS against mpox

- JYNNEOS vaccine is effective at reducing risk of mpox disease
- Protection provided by both 1 and 2 doses of JYNNEOS vaccine
- Highest protection provided by 2 doses, regardless of route of administration
- Further research needed to evaluate whether immunocompromised status modulates VE
- Further research needed to understand the duration of protection

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