



25 Years of Varicella Vaccination Program in the United States: Health and Economic Impact during 1995–2019

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Varicella: from rite of passage to vaccine-preventable disease.

- Historically, varicella was considered disease of little consequence, too mild to warrant prevention
- Mid-1950s: first reported fatal varicella cases in children treated with newly introduced immunosuppressive therapy unmasked the lethal potential of the varicella-zoster virus (VZV)¹



Child with leukemia who died of varicella, ~1970 (courtesy of Dr. Anne Gershon)

¹Cheatham et al. Am J Pathol 1956; 32:1015-35.

Varicella: from rite of passage to vaccine-preventable disease.

Iatrogenic immunosuppression:
systemic steroid therapy, organ
transplant, childhood cancer

- Leukemia cured in 80% of children but many died of varicella before immune reconstitution

US trials in children with leukemia demonstrated vaccine efficacy and safety²

- Subsequent studies showed safety and efficacy in healthy children and adults



1960s/70s



1974

Varicella vaccine (Japan), VZV attenuated, healthy children and adults and children with leukemia in remission¹

- Initial controversy in the U.S.: risk for latency and persistence of immunity



1980s



1995

Varicella vaccine licensed in the U.S.

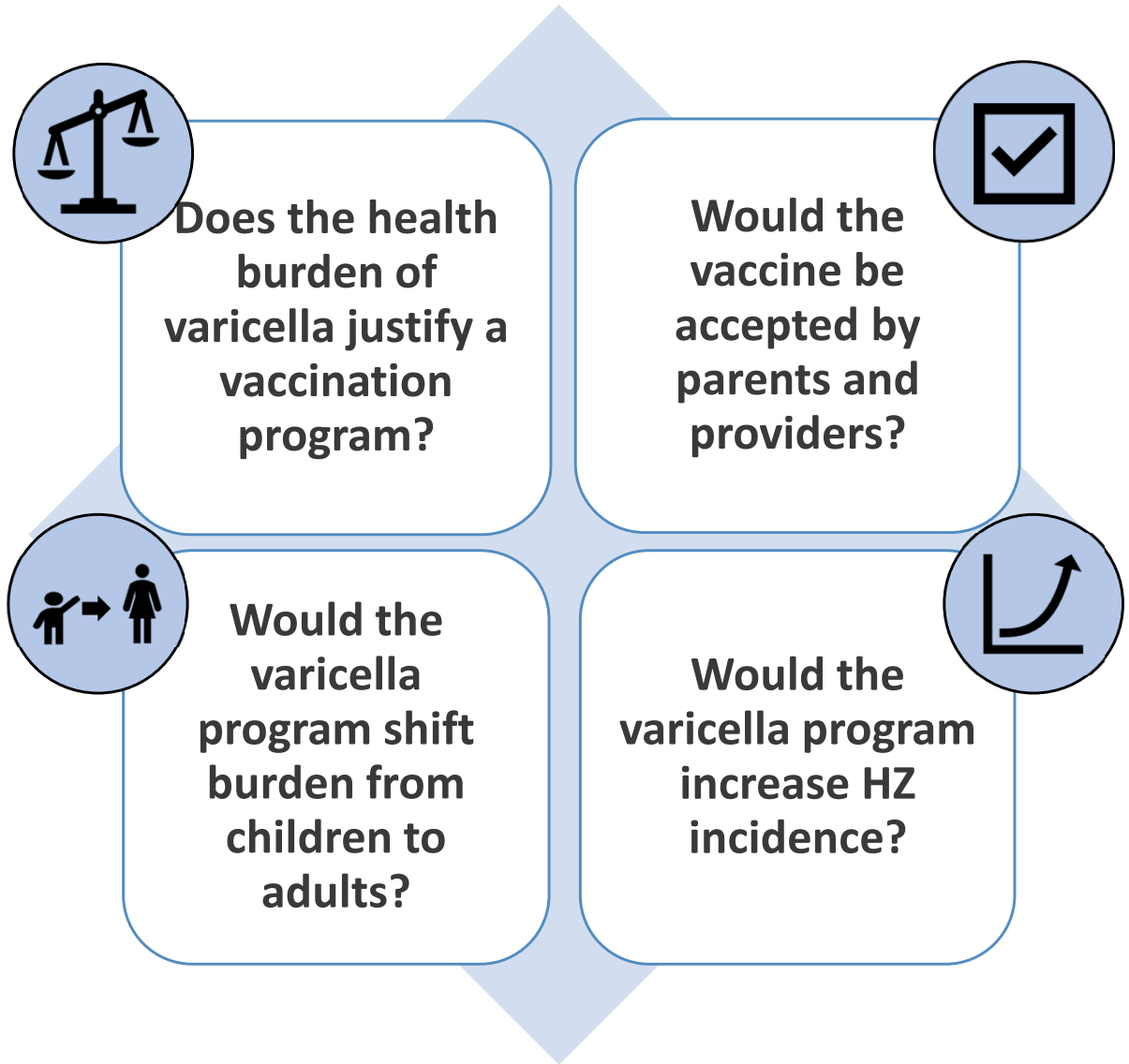
- First country with a routine varicella vaccination program

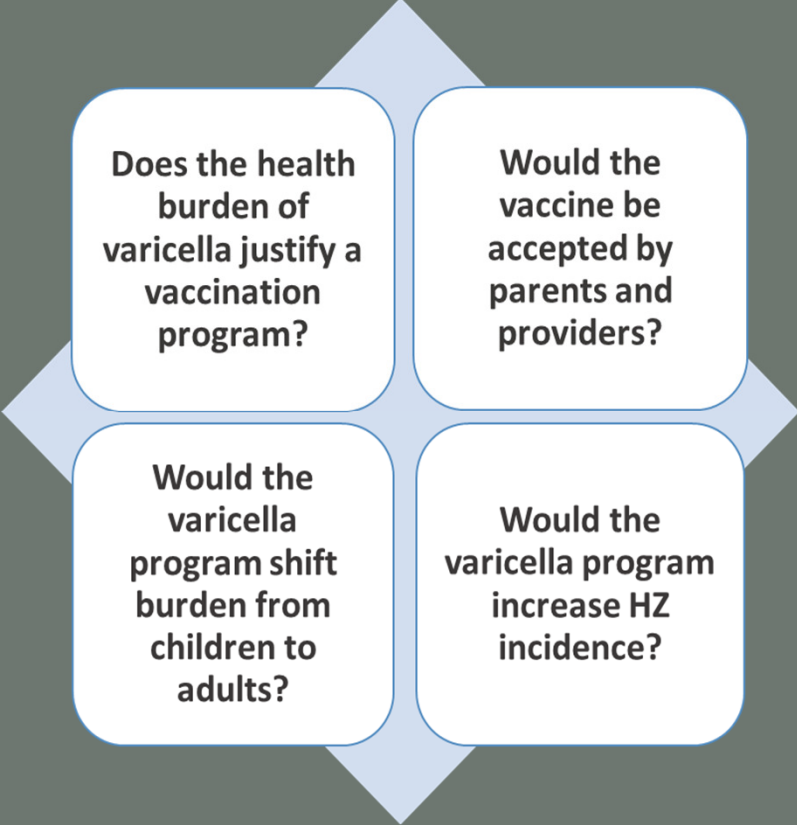
Gershon et al. JID 2021. Marin et al. JID 2022. In press.

¹Takahashi et al. Lancet 1974

²Gershon et al. JAMA 1984.

Debate around the time of varicella vaccine recommendations





Does the health burden of varicella justify a vaccination program?

Would the vaccine be accepted by parents and providers?

Would the varicella program shift burden from children to adults?

Would the varicella program increase HZ incidence?

U.S. Varicella Vaccination Program

Before vaccine, varicella represented a significant health burden (medical and societal) in the United States.

Annual average, pre-vaccine

- Cases ~4 million
- Hospitalizations ~10,500–13,500
- Deaths ~100–150
- Congenital varicella syndrome ~44
- Greatest disease burden in children
 - >90% cases, 70% hospitalizations, 50% deaths



Varicella vaccine policy in the United States

- **1995: Routine one-dose**

- One dose routinely at age 12–18 months with catch-up vaccination of older children
- Two doses for susceptible persons aged ≥ 13 years

- **2007: Policy changed to routine 2-dose**

- 1st dose at age 12–15 months
- 2nd dose at age 4–6 years
- Catch-up vaccination of persons who had received one dose
- Vaccination of all eligible persons without evidence of immunity



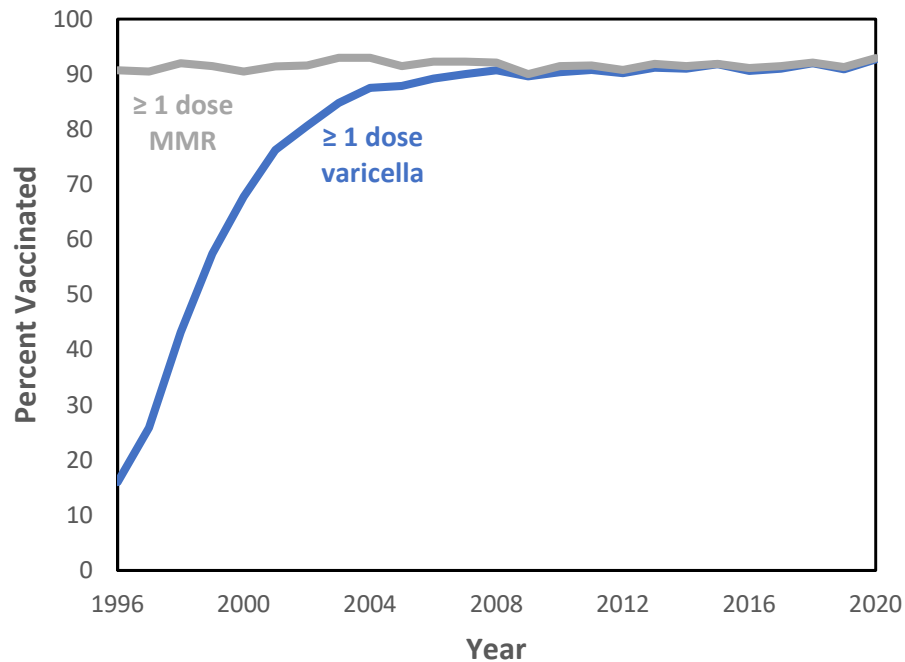
Rationale for policy change

- Low-level community transmission continued
- Outbreaks in highly 1-dose vaccinated school populations (smaller, less frequent)

Program implementation was highly successful.

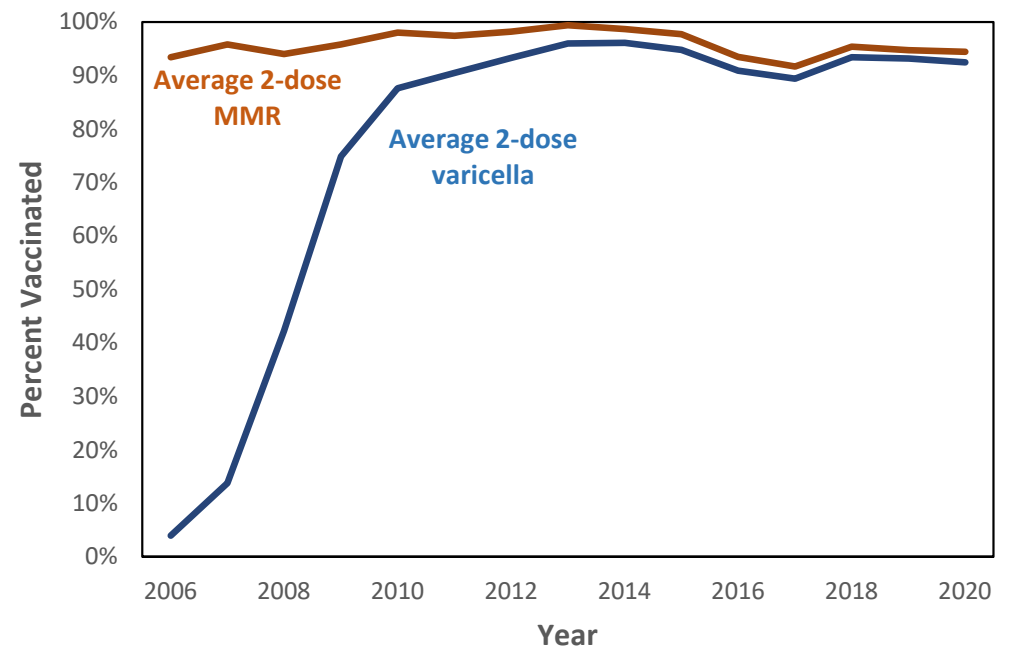
Vaccination coverage for ≥ 1 dose varicella and ≥ 1 dose MMR, children age 19–35 months, US 1996–2020

Data Source: National Immunization Survey



Vaccination coverage for ≥ 2 doses varicella and ≥ 2 doses MMR, children by age 7 years — 6 US states, 2006–2020

Data Source: Immunization Information System



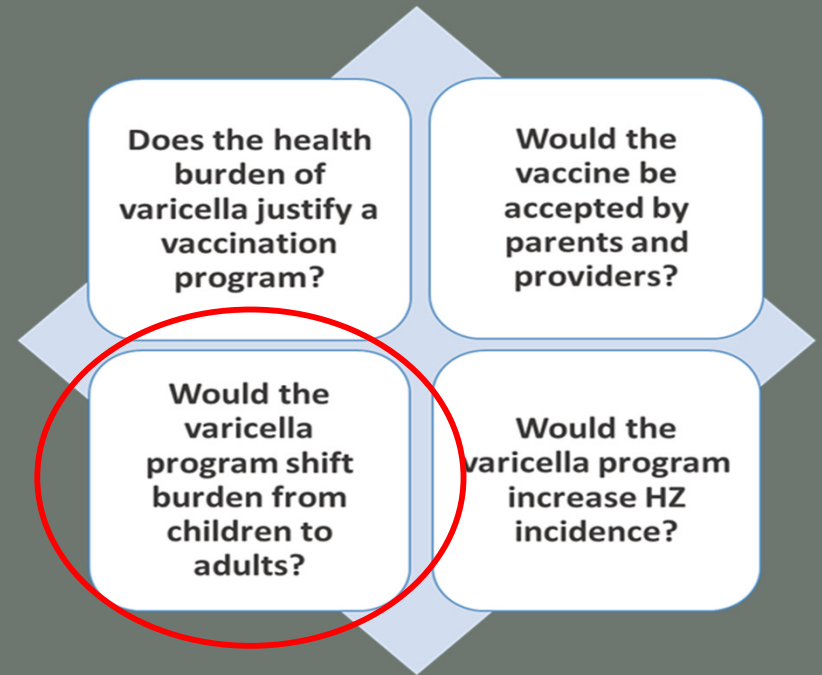
Post-licensure vaccine effectiveness among children

Varicella Endpoint	1 dose VE	2 dose VE
Varicella of any severity	82% (Meta-analysis)	92% (Meta-analysis)
Moderate and Severe disease	97% (Median)	
Severe* disease	100% (range= 97-100)	

HIV+ children (2 doses, 1 study)- **82%** (95% CI 24%–100%)¹

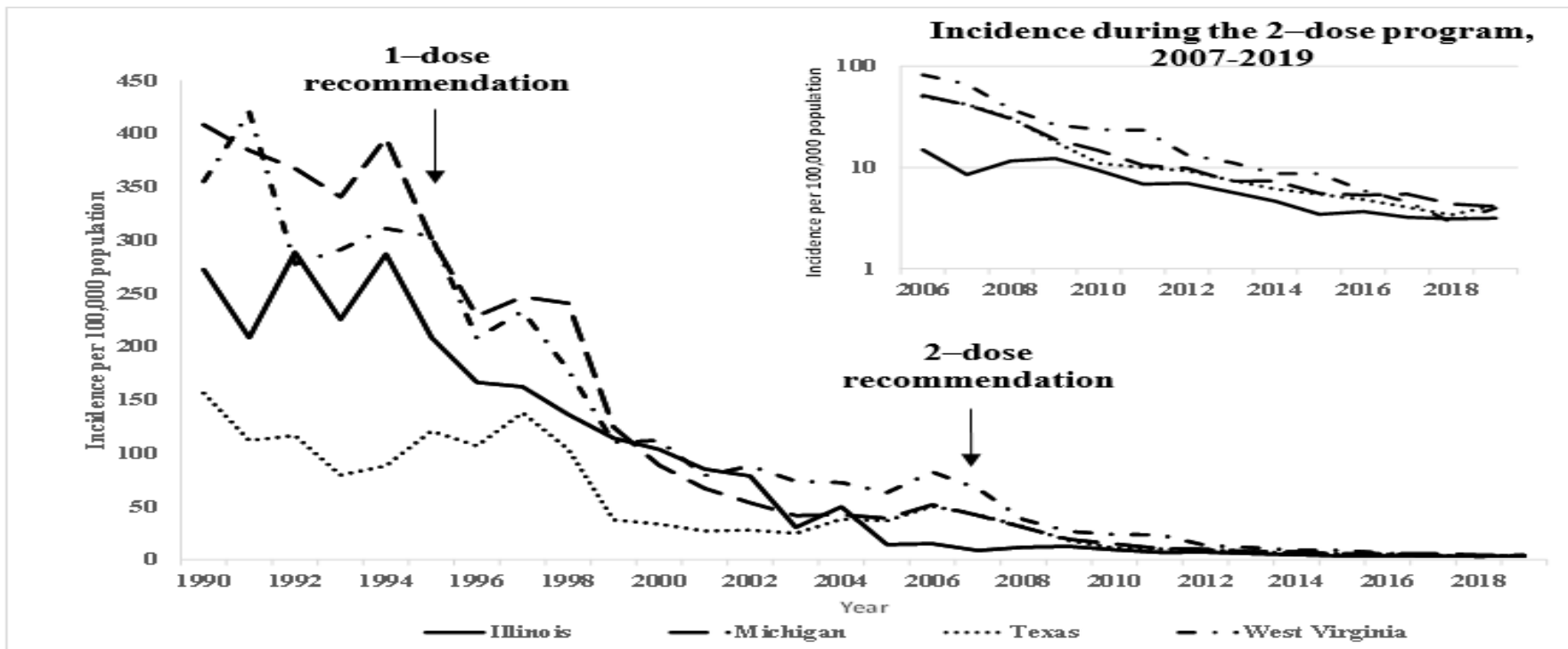
*Definitions: 1) Varicella with >500 lesions or a complication requiring physician visit; 2) disease severity scale used in clinical trials: # lesions, fever, systemic signs and subjective assessment of illness

Marin et al. Pediatrics 2016. ¹Son et al. JID 2010.



Impact of 25 Years of the U.S. Varicella Vaccination Program on Varicella

Varicella incidence* declined >97%, 1990–2019.

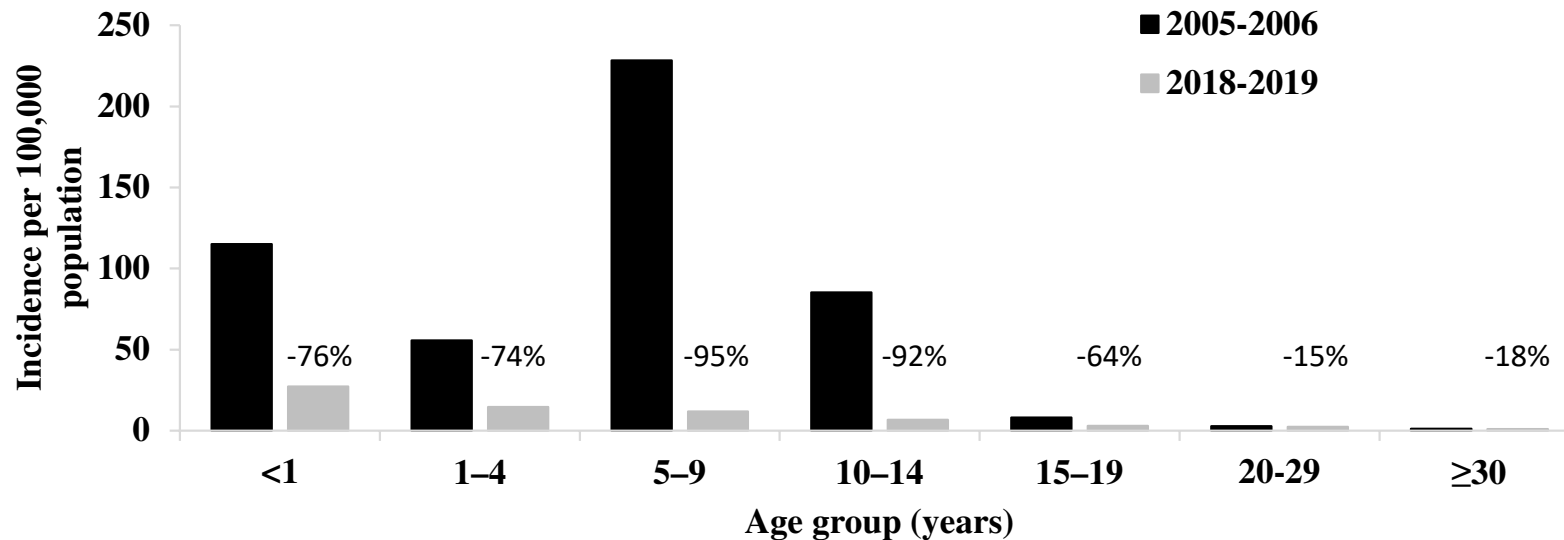


*4 states with consistent reporting of cases to the National Notifiable Diseases Surveillance System.

Marin et al. JID, 2022.

Varicella incidence declined in all age groups during the 2-dose program*.

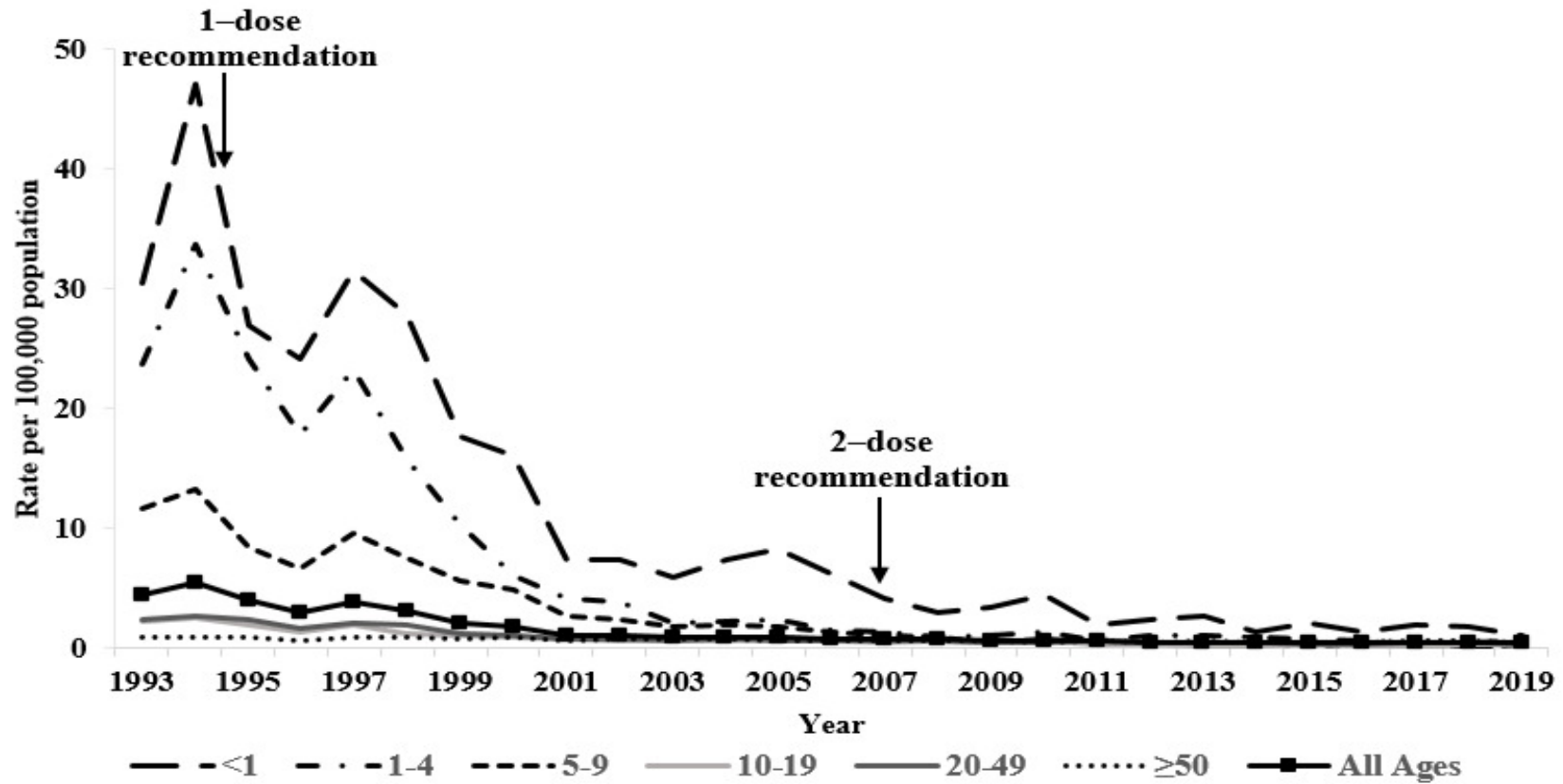
In 7 states with consistent reporting, the number of outbreaks declined 82%[§]



*29 states and the District of Columbia reported age data during 2005–2006 (end of 1-dose program) and 38 during 2018–2019 (mature 2-dose program); National Notifiable Diseases Surveillance System data; **Marin et al. JID 2022.**

[§]Outbreak: ≥5 varicella cases; **Leung et al. JID 2022.**

Varicella hospitalizations declined 90% during 1993–2019.



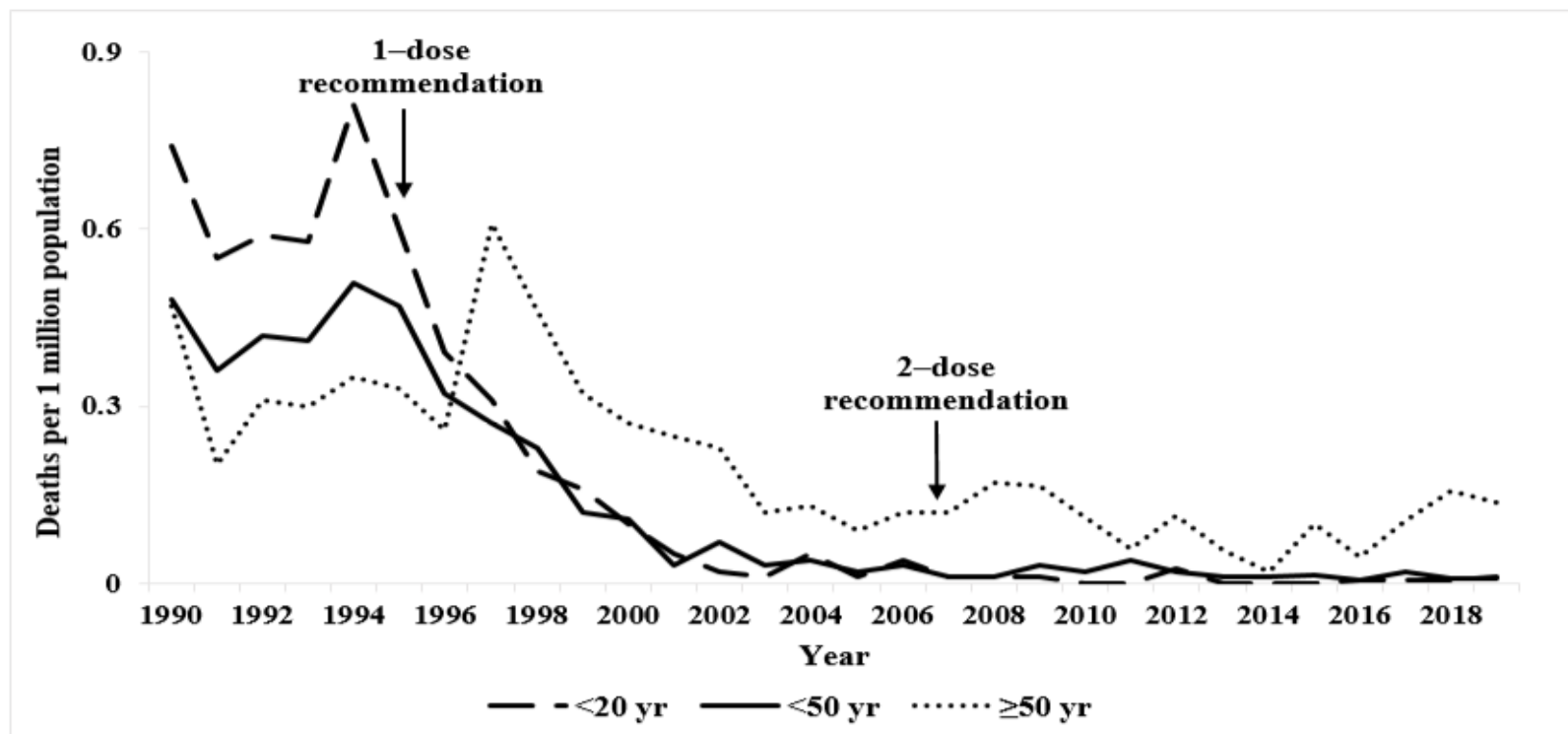
Marin et al. JID 2022. Data: HCUP National Inpatient Sample (NIS).

>10,500 hospitalizations are prevented now annually, including >1,250 among infants.

Age Group	Average annual no. hospitalizations 1993-95	Average annual no. hospitalizations 2018-19	Decline in hospitalization rate
<1	1,338	55	-96%
1-4	4,309	80	-98%
<20	8,574	285	-97%
<50	11,573	783	-94%
All ages	12,189	1,390	-90%

Varicella mortality declined 89% during 1990–2019.

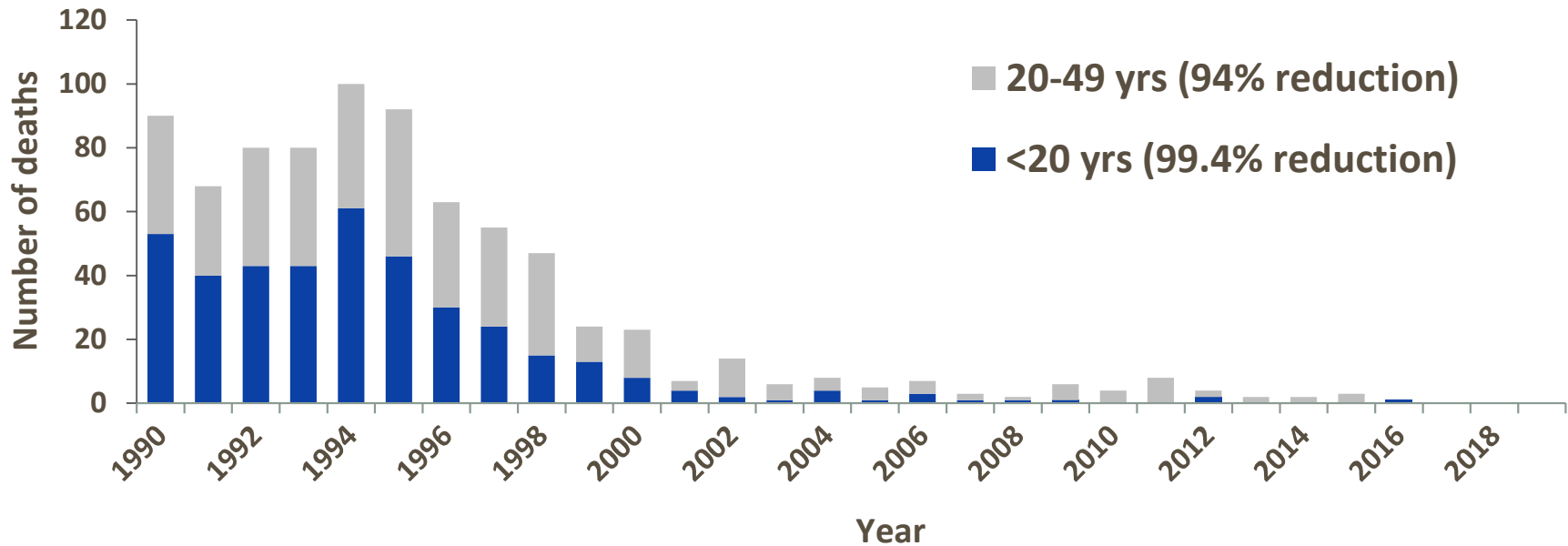
Most of the decline occurred during the 1-dose program.



Varicella as the underlying cause of death. National Center for Health Statistics data.
Marin et al. JID 2022.

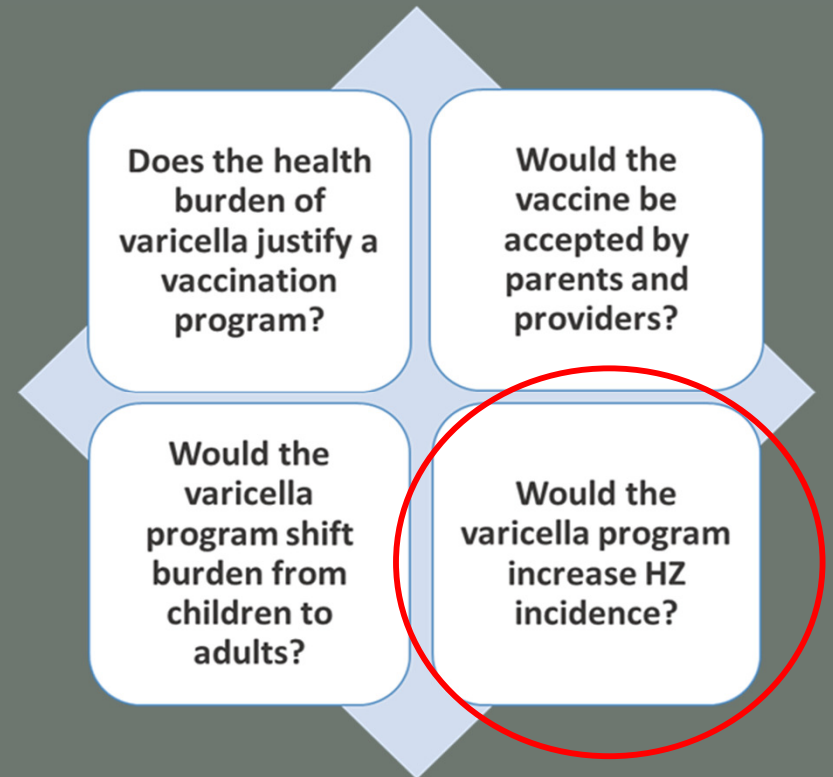
Deaths practically eliminated among <20-year-olds.

Deaths with varicella as the underlying cause,
persons aged <50 years-old, 1990-2019



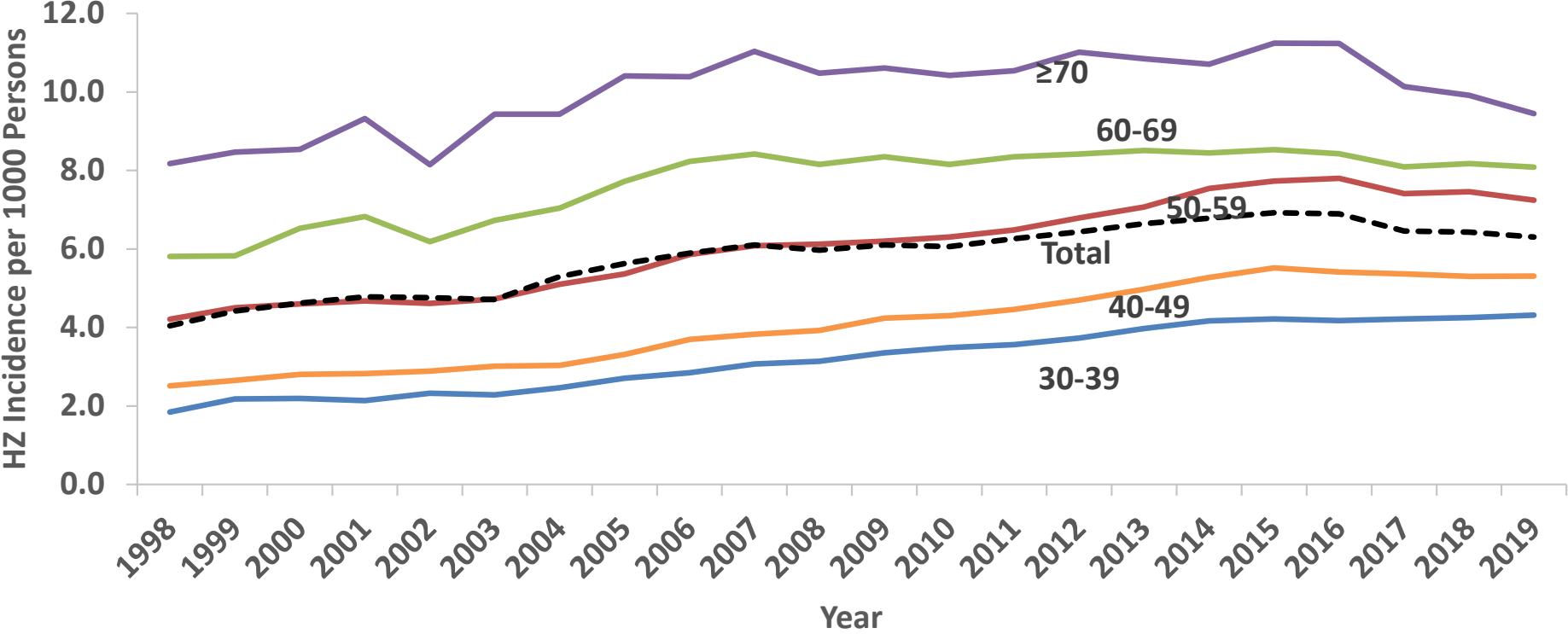
No varicella deaths (underlying or contributing) reported in the <20 years age group in 2011, 2013, 2014, 2017, 2018. Data: National Center for Health Statistics

Marin et al. JID 2022.

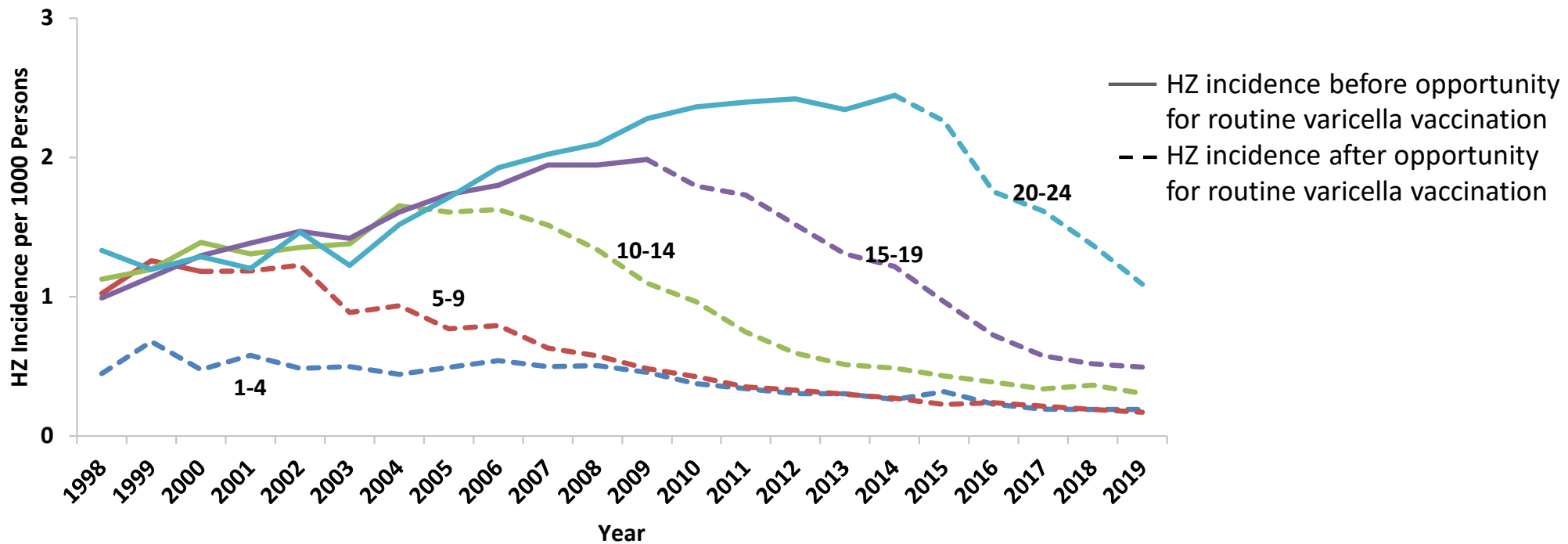


Herpes Zoster Trends During the U.S. Varicella Vaccination Program

In persons aged ≥ 30 years, HZ incidence increased during the earlier study years, with decelerations in later years.

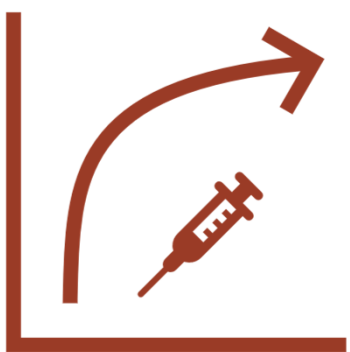


In children and young adults, HZ incidence declined in a step-wise pattern once each age group was comprised by persons born during the varicella vaccination program.




US varicella vaccination resulted in substantial disease prevention and societal savings over 25 years of program implementation.

Effective, safe, and accepted vaccine



High vaccine coverage reached


Prevented morbidity & mortality



91 million cases



238,000 hospitalizations



1,933-2,446 deaths

Highly cost saving



\$23.4 billion

in net societal savings

No increase in HZ due to varicella program





Reduced HZ incidence in children/adolescents

The varicella vaccination program in the US: 25 years of saving lives and preventing illness

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Infectious Diseases Society of America

 hivma
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Thank You

For more information, contact CDC
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