

National Center for Immunization & Respiratory Diseases



# **Interim Influenza Vaccine Effectiveness against Inpatient, Emergency Department, and Outpatient Illness in the 2022–23 season**

**Data from the New Vaccine Surveillance Network (NVSN),  
Flu and Other Viruses in the Acutely Ill Network (IVY),  
& VISION Network**

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Advisory Committee on Immunization Practices

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## Preliminary results

**Three networks** to evaluate vaccine effectiveness against laboratory-confirmed influenza-associated **outpatient visits, emergency department visits, and hospitalization**

# 2022-2023 Flu Vaccine Effectiveness Methods

**Enrollees:** Have acute respiratory illness

**Dates of enrollment:** Fall 2022- Early 2023

**Design:** Test-negative design

- Comparing vaccination odds among case patients with influenza A confirmed by molecular assay versus control patients testing negative for influenza and SARS-CoV-2
- Vaccination status: receipt of any 2022–23 seasonal flu vaccine according to medical records, immunization registries, claims data, and/or self-report

**Analysis:**  $VE = (1 - \text{adjusted OR}) \times 100\%$

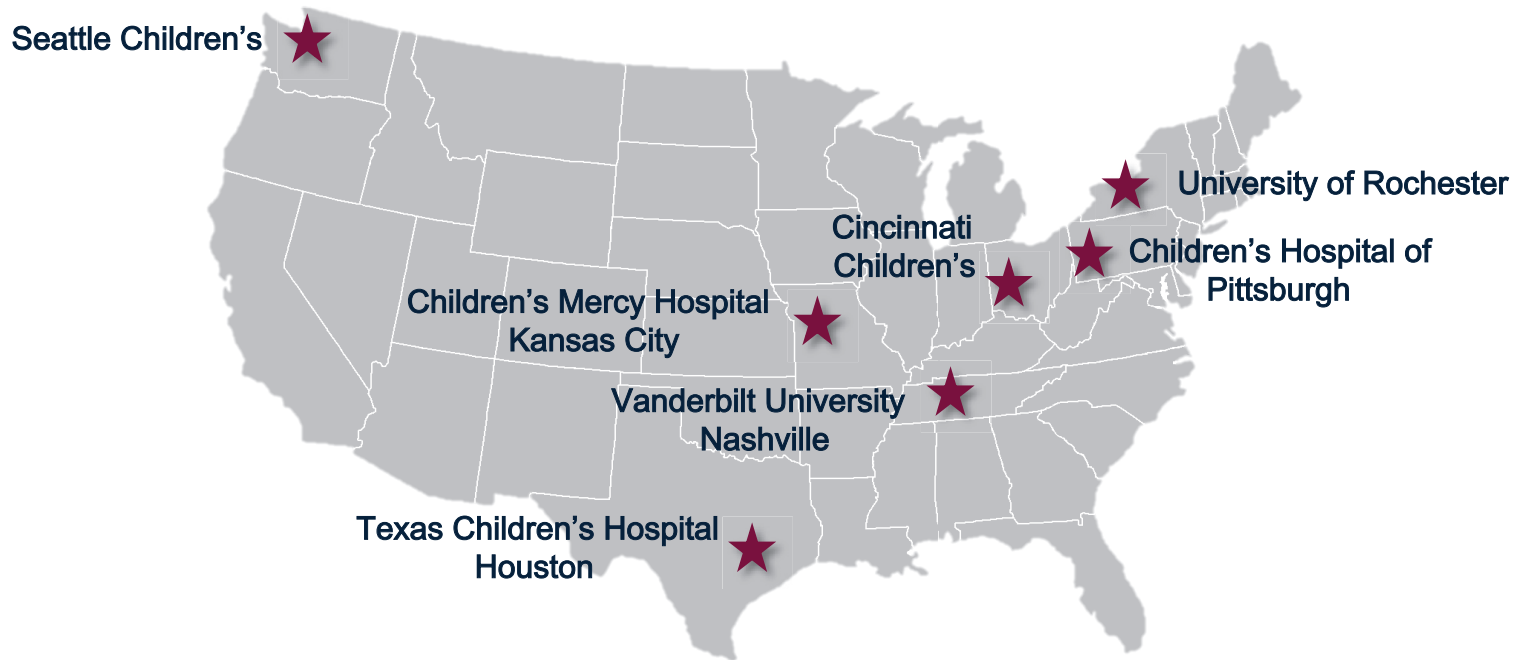


Vaccine effectiveness (VE) against influenza-associated **hospitalization** and **emergency department** visits among **children** aged 6 months – 17 years

**New Vaccine Surveillance Network (NVSN)**

Preliminary Results

# NVSN\* Pediatric Inpatient & ED Network sites, 2022-2023



\*NVSN-New Vaccine Surveillance Network



# NVSN Methods

**Enrollees:** Inpatient and ED patients aged >6 months to 17 years with acute respiratory illness within 10 days of illness onset

**Dates of enrollment:** September 13, 2022–January 25, 2023

**Design:** Test-negative design

- Comparing vaccination odds among case patients with RT-PCR confirmed influenza versus control patients testing negative for influenza and SARS-CoV-2
- Vaccination status: receipt of at least one dose of any 2022–23 seasonal flu vaccine according to medical records, immunization registries, and/or self-report

**Analysis:**  $VE = (1 - \text{adjusted OR}) \times 100\%$

- Adjustment for site, age, and calendar time of admission



Preliminary Data

## Vaccine effectiveness against laboratory confirmed influenza A\* in hospital and ED settings, September 13, 2022–January 25, 2023\*\*

	Vaccine Effectiveness							
	Influenza positive		Influenza negative <sup>1</sup>		Unadjusted		Adjusted <sup>2</sup>	
	N vaccinated /Total	(%)	N vaccinated /Total	(%)	VE %	95% CI	VE %	95% CI
<b>Influenza A</b>								
<b>All 6 mos – 17 years</b>	123/640	19	750/2256	33	52	(41 to 62)	<b>49</b>	<b>(36 to 60)</b>
<b>Inpatient</b>	19/131	15	288/913	32	63	(39 to 78)	<b>68</b>	<b>(46 to 81)</b>
<b>ED</b>	104/507	21	461/1330	35	51	(38 to 62)	<b>42</b>	<b>(25 to 56)</b>
<b>A/H3N2</b>	98/478	21	750/2256	33	48	(34 to 59)	<b>45</b>	<b>(29 to 58)</b>
<b>A/H1N1</b>	23/139	17	750/2256	33	60	(37 to 75)	<b>56</b>	<b>(28 to 72)</b>

\* Of 335 influenza-positive specimens sequenced, 250 were A(H3N2) clade 3C.2a1b.2a.2b and 32 were clade 3C.2a1b.2a.2a.1 and 38 were A(H1N1) clade 6B.1A.5a.2a.1. There were 16 coinfections with Influenza and SARS-CoV-2 that were excluded from the VE estimate.

\*\* Site specific influenza seasons were determined from local influenza activity at each site.

<sup>1</sup> Persons testing negative for both influenza and SARS-CoV-2 using molecular assays.

<sup>2</sup> Multivariable logistic regression models adjusted for site, age, and calendar time.

## Preliminary interim estimates—NVSN

- Through January 25, 2023, influenza vaccination significantly reduced laboratory confirmed medically attended influenza
  - 68% (95% CI: 46, 81) against pediatric hospitalizations
  - 42% (95% CI: 25, 56) against pediatric ED visits
- Important protection against both A/H3N2 and A/H1N1 associated illness





# New Vaccine Surveillance Network (NVSN) Contributors

- **Children's Hospital of Pittsburgh:** Marian Michaels, John Williams
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- **Cincinnati Children's:** Mary Staat
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- **Texas Children's Hospital:** Julie Boom, Leila Sahni
- **University of Rochester:** Geoffrey Weinberg, Peter Szilagyi
- **Vanderbilt University:** Natasha Halasa, Laura Stewart
- **CDC:** Samantha Olson, Callie McLean, Ashley Price, Juliana DaSilva, Angie Foust, John Barnes, Rebecca Kondor, Thomas Stark, Brendan Flannery, Carrie Reed, Ben Clopper, Ariana Perez, Heidi Moline

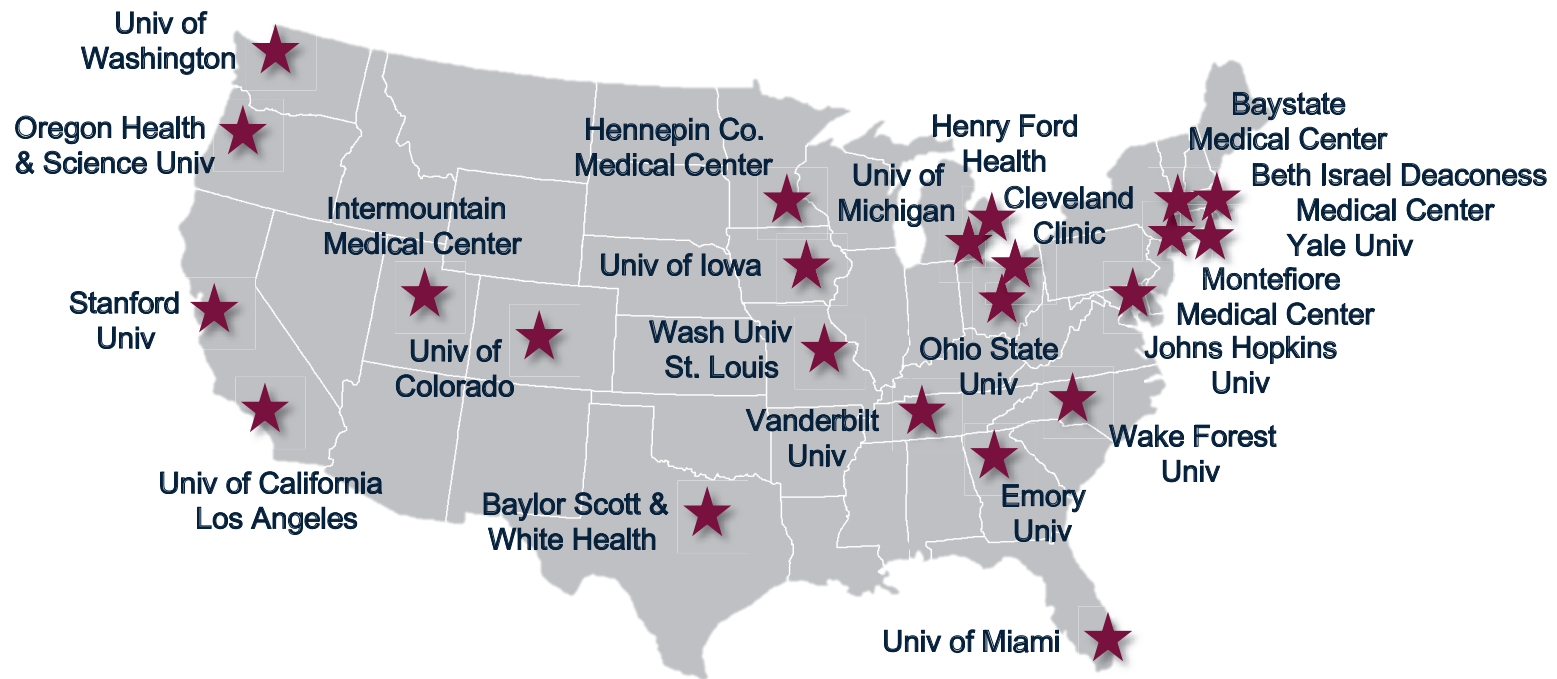


VE against influenza-associated  
**hospitalization** among patients aged  
**≥18 years**

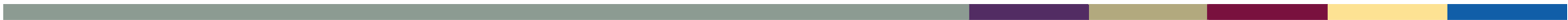
Investigating Respiratory Viruses in the  
Acutely Ill (IVY)

Preliminary Results

# IVY\* Adult Inpatient Network sites, 2022–2023



\*IVY—Investigating Respiratory Viruses in the Acutely Ill



# IVY Methods

**Enrollees:** Inpatient patients aged  $\geq 18$  years with acute respiratory illness with fever or cough  $\leq 7$  days duration

**Dates of enrollment:** October 1–December 31, 2022

**Design:** Test-negative design

- Comparing vaccination odds among influenza RT-PCR positive cases and influenza RT-PCR negative controls, excluding persons testing positive for SARS-CoV-2
- Vaccination status: receipt of at least one dose of any 2021–22 seasonal flu vaccine according to medical records, immunization registries, and/or self-report

**Analysis:**  $VE = (1 - \text{adjusted OR}) \times 100\%$

- Adjustment for census region, age, sex, race/ethnicity and month of onset



# Vaccine effectiveness against laboratory confirmed influenza A\* in inpatient settings, October 1, 2022–January 31, 2023

	Vaccine Effectiveness							
	Influenza positive		Influenza negative <sup>1</sup>		Unadjusted		Adjusted <sup>2</sup>	
	N vaccinated /Total	(%)	N vaccinated /Total	(%)	VE %	95% CI	VE %	95% CI
<b>≥18 years</b>	219/701	31	921/2130	43	40	(29 to 50)	<b>43</b>	<b>(30 to 54)</b>
<b>18–64 years</b>	84/378	22	365/1021	36	49	(33 to 61)	<b>51</b>	<b>(33 to 64)</b>
<b>≥65 years</b>	135/323	42	556/1109	50	29	(8 to 44)	<b>35</b>	<b>(13 to 52)</b>
<b>Immunocompromised<sup>3</sup></b>	45/122	37	238/474	50	42	(13 to 62)	<b>44</b>	<b>(10 to 66)</b>

\* Of 77 influenza-positive specimens sequenced, 50 were A(H3N2) clade 3C.2a1b.2a.2. and 27 were A(H1N1) clade 6B.1A.5a.2. A total of 45 influenza/SARS-CoV-2 coinfections were excluded from the VE estimate

<sup>1</sup> Persons testing negative for influenza and SARS-CoV-2 using molecular assays.

<sup>2</sup> Multivariable logistic regression models adjusted for Census region, age, sex, race/ethnicity, and month.

<sup>3</sup> Includes active solid-organ cancer, active hematologic cancer, solid-organ transplant, bone marrow/stem cell transplant, HIV infection, congenital immunodeficiency syndrome, use of an immunosuppressive medication within the past 30 days, splenectomy, graft-versus-host disease (currently or in the past), or any other condition that causes moderate or severe immunosuppression.

## Preliminary interim estimates—IVY

- Through January 31, 2023, influenza vaccination significantly reduced laboratory confirmed medically attended influenza
  - 43% (95%CI: 30% to 54%) against adult hospitalizations
- Important protection among adults aged 18-64 and  $\geq 65$  years, and immunocompromised adults



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IVY

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Beth Israel Medical Center, Boston Massachusetts  
Centers for Disease Control and Prevention (CDC), Atlanta, Georgia  
Cleveland Clinic, Cleveland, Ohio  
Emory University, Atlanta, Georgia  
Hennepin County Medical Center, Minneapolis, Minnesota  
Intermountain Medical Center, Murray, Utah  
Johns Hopkins University, Baltimore, Maryland  
Montefiore Medical Center, Bronx, New York  
Ohio State Medical Center, Columbus, Ohio  
Oregon Health and Sciences University, Portland, Oregon  
Stanford University, Stanford, California  
University of California-Los Angeles, Los Angeles, California  
University of Colorado, Aurora, Colorado  
University of Iowa, Iowa City, Iowa  
University of Miami, Miami, Florida  
University of Michigan, Ann Arbor, Michigan  
University of Washington, Seattle, Washington  
Vanderbilt University Medical Center, Nashville, Tennessee  
Wake Forest University, Winston-Salem, North Carolina  
Washington University, St. Louis, Missouri

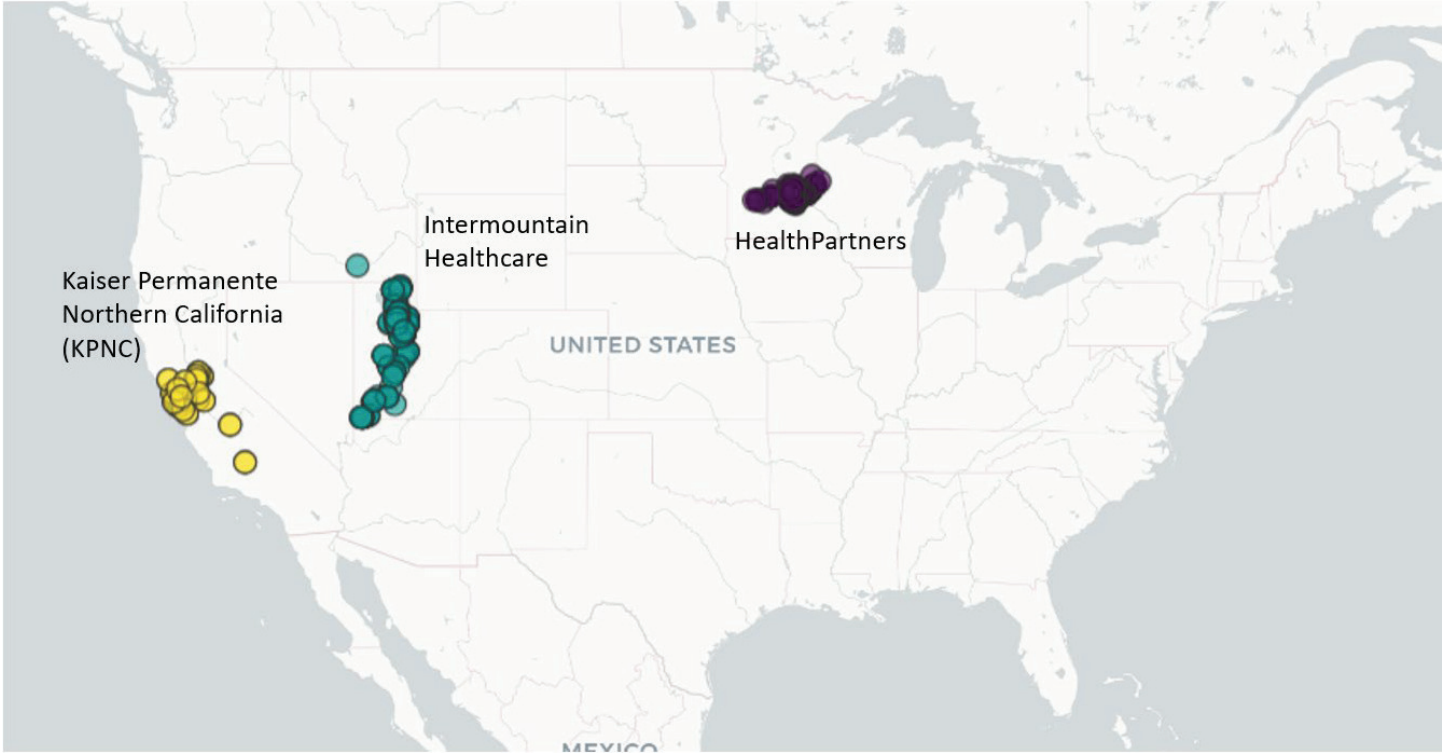
Influenza vaccine effectiveness (VE) against influenza-associated **hospitalization** and **emergency department / urgent care** visits among **adults** aged  $\geq 18$  years

**VISION Network**

Preliminary Results



# VISION Network sites, 2022-2023



# VISION Methods

**Encounters:** ED/UC or inpatient encounters among adults  $\geq 18$  years tested for influenza and with  $\geq 1$  acute respiratory illness (ARI)-associated ICD-10 discharge code

**Dates:** October 15, 2022–January 24, 2023

**Design:** Test-negative design

- Comparing vaccination odds among patients with influenza A confirmed by molecular assay versus controls who tested negative for influenza and SARS-CoV-2
- Vaccination status: receipt of any 2022–23 seasonal flu vaccine  $\geq 14$  days before index date according to medical records, immunization registries, claims data

**Analysis:**  $VE = (1 - \text{adjusted OR}) \times 100\%$

- Inverse-propensity-to-be-vaccinated weights and adjustment for patient age, study site, and calendar time



## Vaccine effectiveness against laboratory confirmed influenza A in ED/UC settings, October 15, 2022–January 24, 2023\*

	Influenza positive		Influenza negative		Vaccine Effectiveness			
	N vaccinated /Total	(% )	N vaccinated /Total	(% )	Unadjusted		Adjusted <sup>1</sup>	
					VE %	95% CI	VE %	95% CI
<b>All adults ≥18 years</b>	3278/14011	(23)	15752/43196	(36)	47	(44 to 49)	<b>44</b>	<b>(41 to 47)</b>
<b>18-64 years</b>	1600/10590	(15)	6695/27545	(24)	45	(41 to 48)	<b>46</b>	<b>(42 to 49)</b>
<b>≥65 years</b>	1678/3421	(49)	9057/15651	(58)	30	(25 to 35)	<b>39</b>	<b>(34 to 43)</b>
<b>Immunocompromised</b> <sup>2</sup>	64/179	(36)	553/1363	(41)	18	(-13 to 41)	<b>30</b>	<b>(-2 to 52)</b>

\* Site specific influenza seasons were determined when local influenza activity was seen at site on or after October 15, 2022, and end date was the date of last available encounter.

<sup>1</sup> Adjusted for patient age, study site, and calendar time.

<sup>2</sup> Defined as at least one discharge diagnosis for solid malignancy, hematologic malignancy, rheumatologic or inflammatory disorder, other intrinsic immune condition or immunodeficiency, or organ or stem cell transplant.

## Vaccine effectiveness against laboratory confirmed influenza A in Hospital settings, October 15, 2022–January 21, 2023\*

	Influenza positive		Influenza negative		Vaccine Effectiveness			
	N vaccinated /Total	(% )	N vaccinated /Total	(% )	Unadjusted		Adjusted <sup>1</sup>	
					VE %	95% CI	VE %	95% CI
<b>All adults ≥18 years</b>	671/1760	(38)	4561/9377	(49)	35	(28 to 41)	<b>39</b>	<b>(31 to 45)</b>
<b>18-64 years</b>	146/623	(23)	802/2739	(29)	26	(9 to 40)	<b>29</b>	<b>(12 to 43)</b>
<b>≥65 years</b>	525/1137	(46)	3759/6638	(57)	34	(25 to 42)	<b>42</b>	<b>(34 to 49)</b>
<b>Immunocompromised</b> <sup>2</sup>	130/297	(44)	1172/2316	(51)	24	(3 to 40)	<b>31</b>	<b>(10 to 48)</b>

\* Site specific influenza seasons were determined when local influenza activity was seen at site on or after October 15, 2022, and end date was the date of last available encounter.

<sup>1</sup> Adjusted for patient age, study site, and calendar time.

<sup>2</sup> Defined as at least one discharge diagnosis for solid malignancy, hematologic malignancy, rheumatologic or inflammatory disorder, other intrinsic immune condition or immunodeficiency, or organ or stem cell transplant.

## Preliminary interim estimates—VISION

- Through January 2023, influenza vaccination significantly reduced laboratory confirmed medically attended influenza
  - 39% (95%CI: 31, 45) against adult hospitalizations
  - 44% (95%CI: 41, 47) against adult ED or UC visits
  - VE observed across age group and immunocompromised
- Estimates higher than VE estimates against hospitalization (25%) and ED or UC visits (25%) from the 2021–22 season at the same VISION sites
- Limitations include lack of VE by influenza A subtype



# VISION Network Contributors

- **Kaiser Permanente Northern California:** Nicola Klein MD, PhD
- **Intermountain Healthcare:** Edward Stenehjem MD, MSc
- **Health Partners:** Malini DeSilva MD, MPH; Gabriella Vazquez-Benitez PhD, MSc
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- **CDC:** Mark Tenforde MD, PhD; Brendan Flannery PhD; Shikha Garg MD



# Discussion

## Summary of Three Flu VE Networks

- Across three Flu VE platforms, we observed **consistent influenza vaccine effectiveness** during the 2022-2023 season.
- Influenza **vaccination provided substantial protection** against inpatient, emergency department, and outpatient illness **among all ages**.
- Influenza **vaccination provided substantial protection among important high-risk groups** (ages 65+ and immunocompromised).





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TTY: 1-888-232-6348 [www.cdc.gov](http://www.cdc.gov)

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