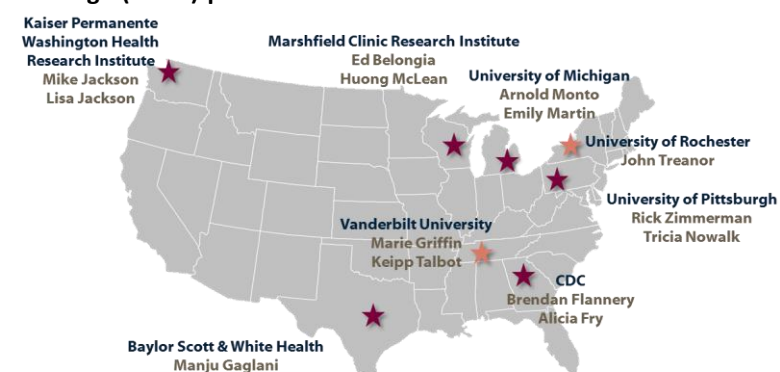


# Effectiveness of Seasonal Influenza Vaccines Against Influenza A(H3N2) Illness Among Children Aged <18 Years, US Flu VE Network, 2010-2018

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## Background

- U.S. Influenza Vaccine Effectiveness Network (US Flu VE Network) enrolls patients aged ≥6 months to evaluate seasonal influenza vaccine effectiveness against RT-PCR confirmed influenza
- Interim estimates of 2017-18 vaccine effectiveness (VE) against influenza A(H3N2)-related illness suggested better VE among young children than among older children and adolescents
- We investigated VE by age among children aged 6 months – 17 years during A(H3N2)-predominant seasons from 2010-2018



## US Flu VE Network Methods

**Enrollees:** Outpatients aged ≥6 months – 17 years with acute respiratory illness with cough ≤7 days duration

**Design:** Test-negative case-control design

- Odds of vaccination among patients with PCR-confirmed influenza (cases) vs PCR-negative patients (controls)

**Vaccination Status:** Fully-vaccinated children according to ACIP recommendations

- Receipt of inactivated flu vaccine according to medical records, immunization registries

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

- Logistic regression adjusted for study site, age, high-risk conditions and calendar time (2 week intervals)

- Stratified by season, age group

**VE by year of age:** Ages <1 to 17 years

- Age in years modeled as linear tail-restricted spline with 4 knots based on percentiles
- Logistic model including interaction term: year of age x vaccination status

## Results

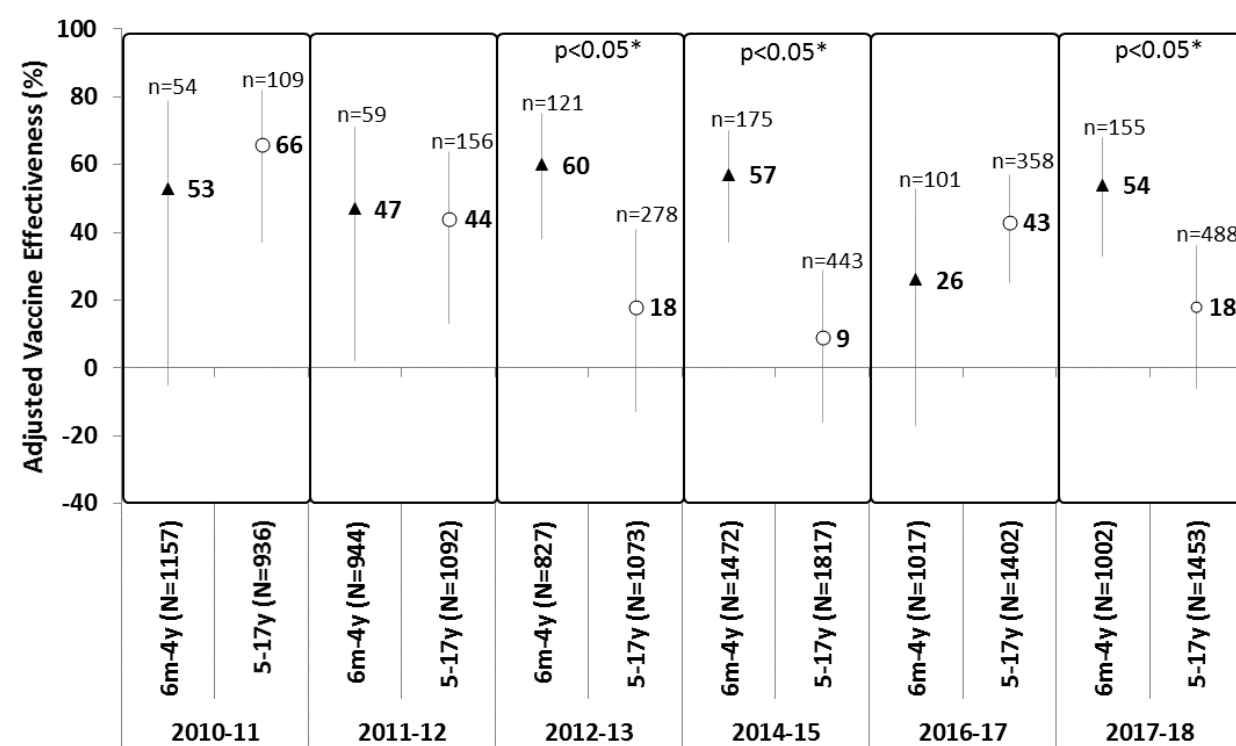
### US Flu VE Network patients aged 6m – 17y by influenza test result — H3N2 influenza seasons, 2010-2018

Characteristic	Influenza PCR result			
	H3N2-positive (%)	Flu-negative (%)		
Season	2010-11	163 (8)	1929 (92)	
	2011-12	215 (11)	1821 (89)	
	2012-13	399 (21)	1501 (79)	
	2014-15	618 (19)	2671 (81)	
	2016-17	459 (19)	1960 (81)	
	2017-18	643 (26)	1812 (74)	
Study site*	Michigan	593 (18)	2708 (82)	
	New York	45 (15)	198 (81)	
	Pennsylvania	340 (15)	1997 (85)	
	Tennessee	20 (3)	596 (97)	
	Texas	440 (13)	3068 (87)	
	Washington	226 (10)	2136 (90)	
	Wisconsin	768 (18)	3447 (82)	
	Gender	Male	1301 (14)	7844 (86)
		Female	1229 (14)	7441 (86)
	Mean age, years (std)		8.0 (4.8)	6.2 (5.0)
Any high-risk condition	Yes	618 (14)	3858 (86)	
	No	1912 (14)	11427 (86)	
Current season vaccinated	Yes	802 (10)	7199 (90)	
	No	1728 (18)	8086 (82)	

\*Included 4 sites (MI, NY, TN, WI) in 2010-11 and 5 sites (MI, PA, TX, WA, WI) since 2011-12.

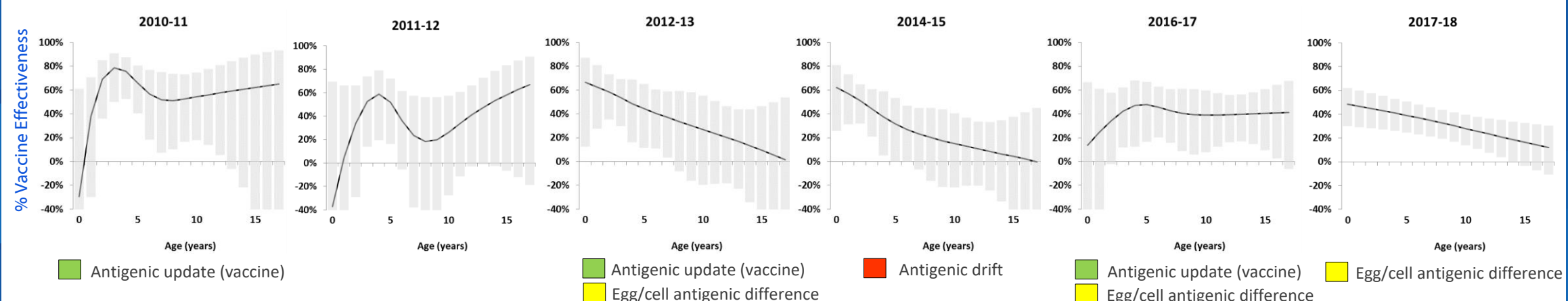
## Vaccine effectiveness

### VE against A(H3N2)-related illness among young children (aged 6 months-4 years) and older children (5-17 years), by H3N2 season



Number of A(H3N2) positive cases shown above confidence limits. \*P-value for difference between age-group specific VE.

## Inactivated vaccine effectiveness against A/H3N2 viruses by subject year of age, by season



## Summary

- Inactivated influenza vaccine provided moderate protection against A(H3N2)-related illness among young children in most H3N2 seasons
- In 3 seasons (including 2017-18), VE estimates against A(H3N2) illness were significantly higher in young children compared to older children
- Pattern of H3N2 VE varied by year of age: not consistently high among youngest children
- Differences in VE among younger vs older children observed in some but not all seasons with antigenic difference between egg-adapted H3N2 vaccine and cell culture-derived reference virus (below)
- Serologic studies needed to investigate age-related differences in vaccine responses in children and adolescents
- Additional analyses planned to examine effects of repeated vaccination on VE against A(H3N2)-related illness

## H3N2 vaccine component and predominant circulating H3N2 viruses, highlighting antigenic differences

Season	H3N2 Vaccine component	Predominant circulating H3N2 viruses
2010-11	A/Perth/16/2009	A/Perth/16/2009-like
2011-12	A/Perth/16/2009	A/Perth/16/2009-like
2012-13	A/Victoria/361/2011-egg	A/Victoria/361/2011 cell-like
2014-15	A/Texas/50/2012	A/Hong Kong/4801/2014 (3C.2a) cell-like
2016-17	A/Hong Kong/4801/2014 (3C.2a)-egg	A/Hong Kong/4801/2014 (3C.2a) cell-like
2017-18	A/Hong Kong/4801/2014 (3C.2a)-egg	A/Hong Kong/4801/2014 (3C.2a) cell-like

Legend:   
■ Antigenic update (vaccine)   
■ Egg/cell antigenic difference   
■ Antigenic drift

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