End-of-season influenza vaccine effectiveness estimates for the 2014-15 season: US Influenza Vaccine Effectiveness (Flu VE) Network

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for the US Flu VE Network

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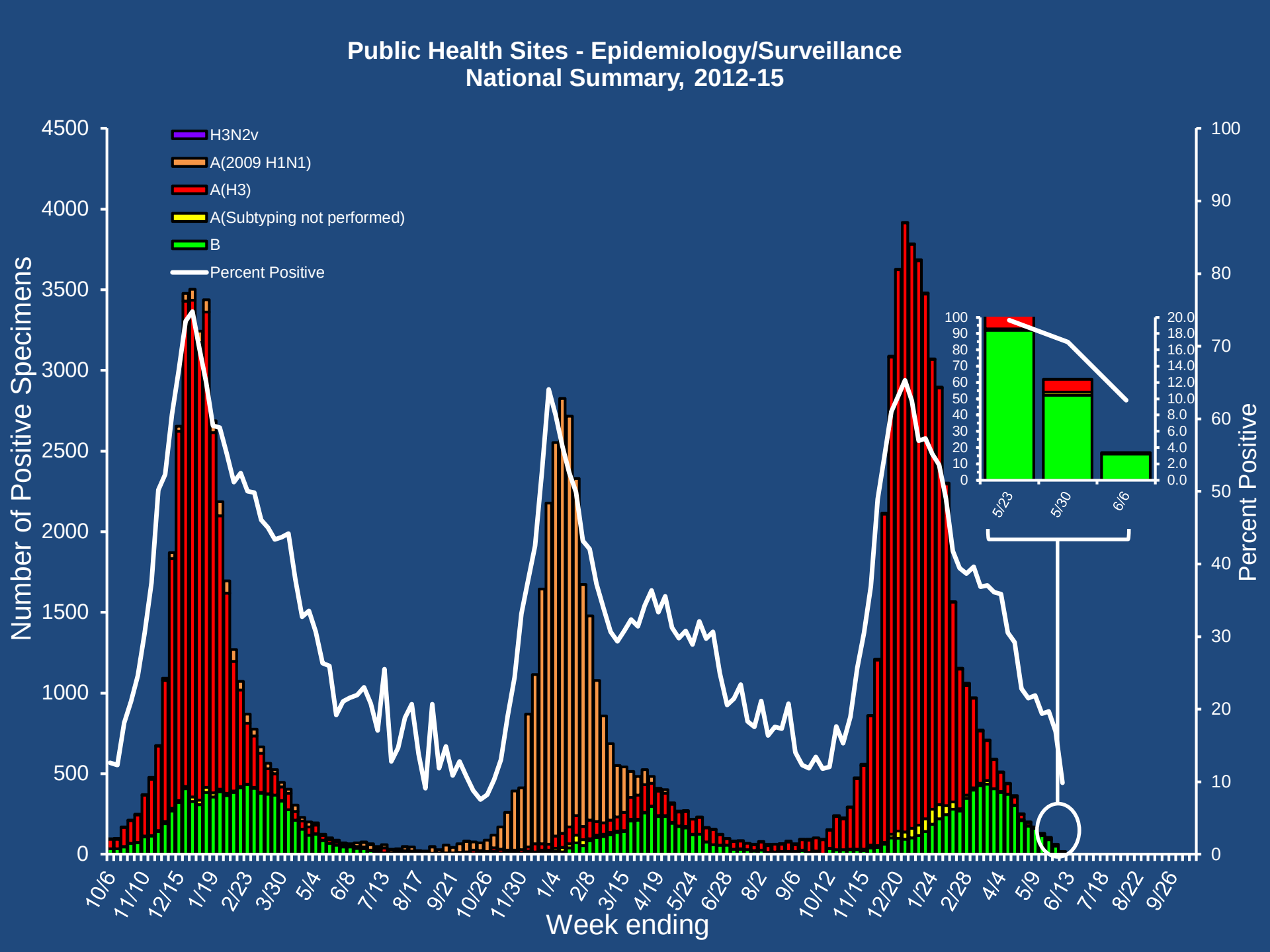
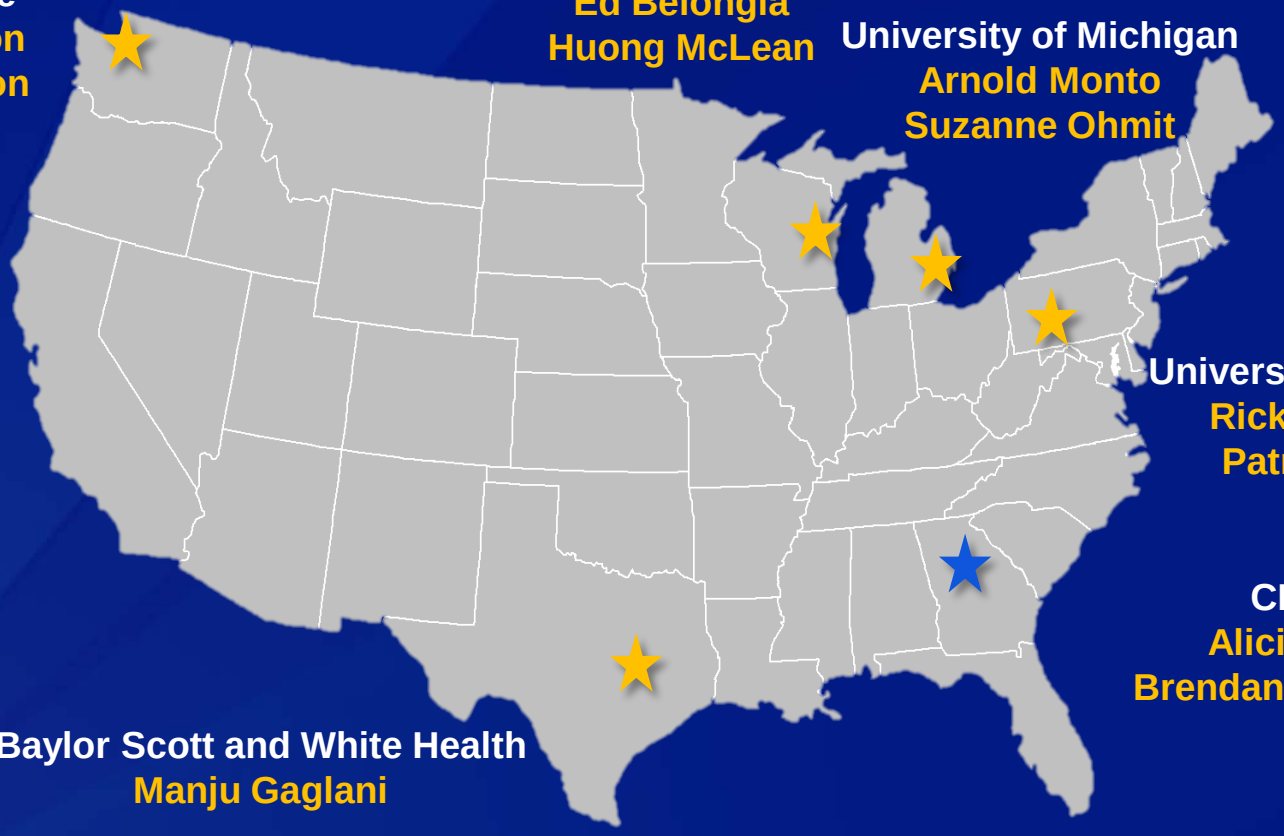

Public Health Sites - Epidemiology/Surveillance
National Summary, 2012-15
H3N2v
A(2009 H1N1)
A(H3)
A(Subtyping not performed)
B
Percent Positive
Number of Positive Specimens
Percent Positive
Week ending
4500
4000
3500
3000
2500
2000
1500
1000
500
0
100
90
80
70
60
50
40
30
20
10
0
10/6
11/10
12/15
1/19
2/23
3/30
5/4
6/8
7/13
8/17
9/21
10/26
11/30
1/4
2/8
3/15
4/19
5/24
6/28
8/2
9/6
10/12
11/15
12/20
1/24
2/28
4/4
5/9
6/13
7/18
8/22
9/26
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
5/23
5/30
6/6

US Flu VE Network: 5 Sites and Principal Investigators



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US Flu VE Network Methods

Enrollees: **Ambulatory patients aged ≥6 months with acute respiratory illness and cough – from Nov 10, 2014 – Apr 10, 2015**

Methods: **Prospective case-control study (test-negative design)**

- **Influenza infection confirmed by RT-PCR**
  - Cases: Influenza PCR-positive
  - Controls: Influenza PCR-negative
- **Vaccination status: Confirmed by medical records and registries (1 site) and self report and medical records/registries (4 sites); excludes partially vaccinated children**

Analysis: **VE = (1 – adjusted OR) x 100%**

- **Adjustment for study site, age, sex, race/Hispanic ethnicity, self-rated general health, days from illness onset to enrollment, and calendar time (2-week intervals)**

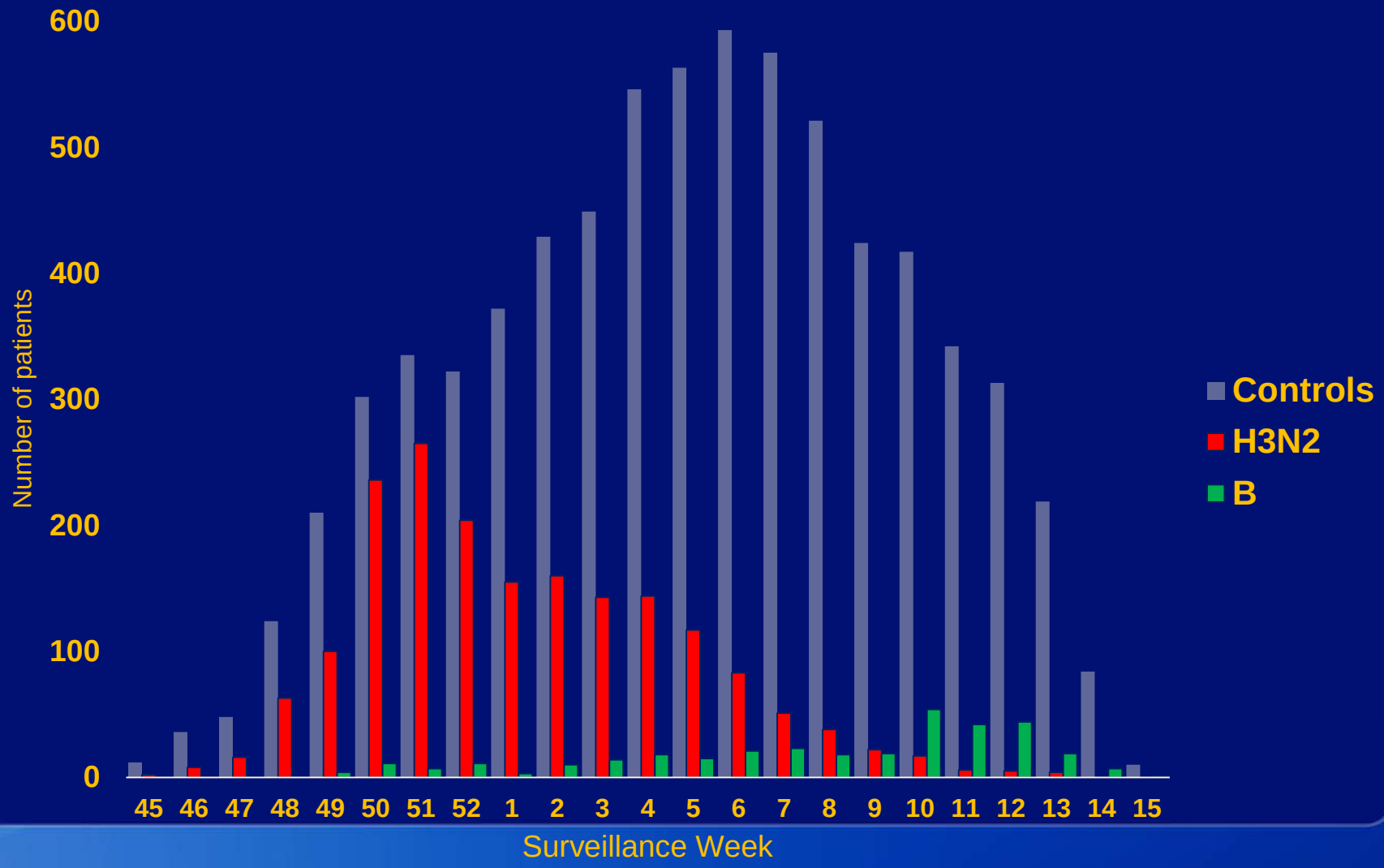
Preliminary 2014-15 end-of-season VE estimates by H3 genetic group, US Flu VE Network

- Most (>80%) A(H3N2) viruses tested at CDC were antigenically different from 2014-15 vaccine component
- Challenges with hemagglutination inhibition (HI) assay used to assess antigenic similarity to vaccine
- Increased use of genetic sequencing of H3N2 viruses—antigenic properties inferred from viruses characterized by HI
- Several genetic groups of H3N2 viruses co-circulated
- VE by genetic group: ratio of vaccination among cases to influenza-negative controls

US Flu VE Network Results

- **9,707 enrolled from Nov 10, 2014–Apr 10, 2015**
  - 3,769 patients aged 6 months-17 years; 1,208 aged ≥65 years
- **RT-PCR results: 24% influenza positive, 76% negative**
- **Influenza type/subtype:**
  - 83% influenza A—all A(H3N2)
  - 17% influenza B: 85% B-Yamagata (trivalent/quadrivalent)
15% B-Victoria lineage (quadrivalent)
- **Vaccination: 53% overall** (excluding partial vaccination)
  - Inactivated vaccines: 51% quadrivalent, 49% trivalent
  - Live-attenuated vaccine: 26% among patients aged 2-17 years
  - High dose trivalent vaccine: 9% among patients ≥65 years

Numbers of patients with medically attended acute respiratory illness enrolled at US Flu VE Network sites, by influenza RT-PCR result and surveillance week, 2014-2015 season



Adjusted VE against any influenza A and B, US Flu VE Network, 2014-15

	Influenza-positive	% vaccinated	Influenza-negative	% vaccinated	Adjusted VE	(95% CI)
Influenza A and B						
All ages	1097/2237	(49)	3866/7092	(55)	**23%**	**(14 to 31)**
Age group (yrs)						
6 mos–8	185/473	(39)	1013/1944	(52)	**27%**	**(9 to 42)**
9–17	135/394	(34)	391/958	(41)	**29%**	**(6 to 46)**
18–49	276/643	(43)	992/2212	(45)	**10%**	**(-10 to 26)**
50-64	227/379	(60)	735/1118	(66)	**27%**	**(6 to 44)**
≥65	274/348	(79)	735/860	(85)	**36%**	**(8 to 55)**

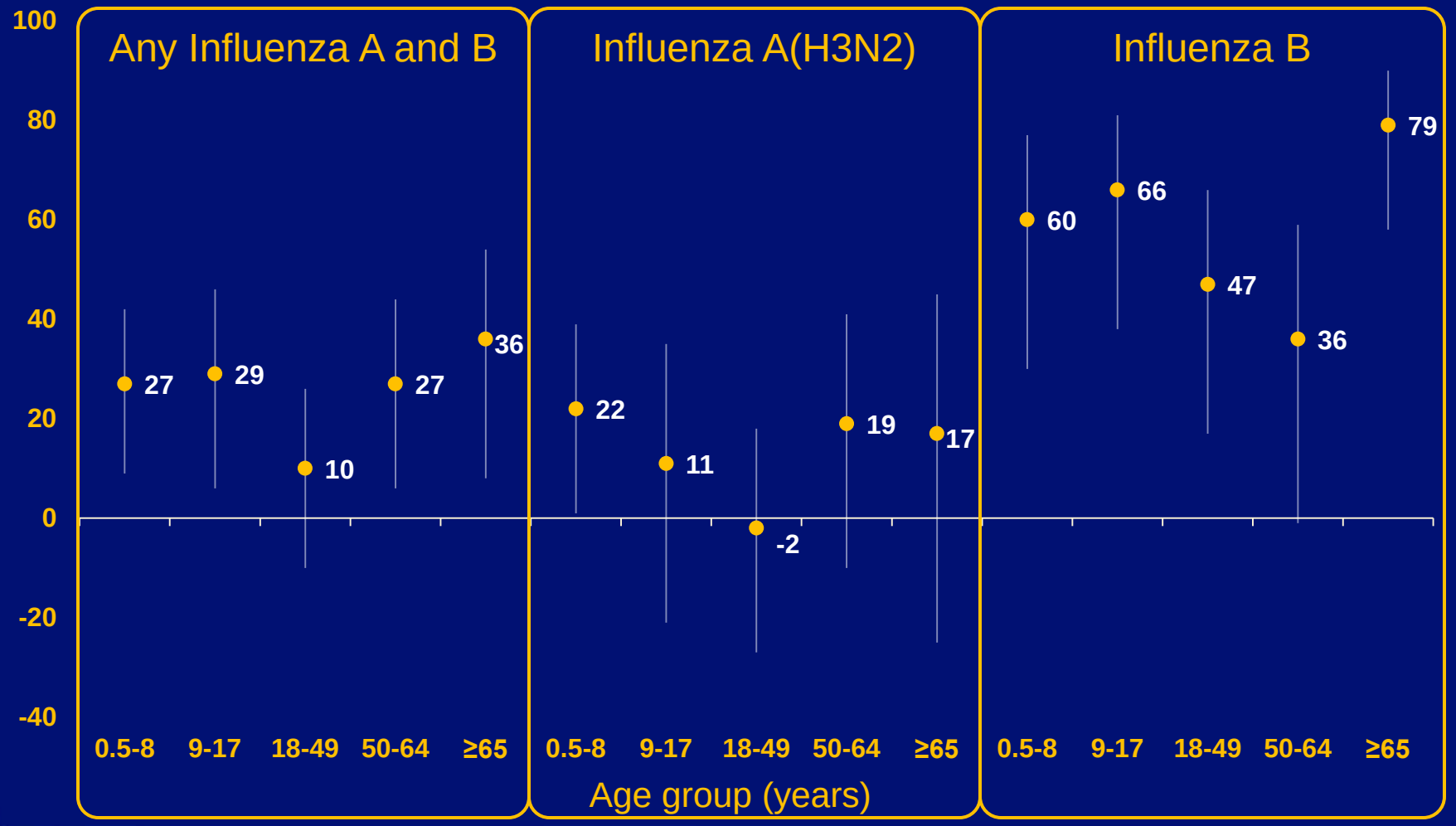
* Adjusted for study site, age (group or years), sex, race/Hispanic ethnicity, self-rated general health status, interval from illness onset to enrollment, and calendar time (biweekly intervals).

Adjusted VE for influenza vaccination by influenza A subtype and B virus lineage, US Flu VE Network, 2014-15

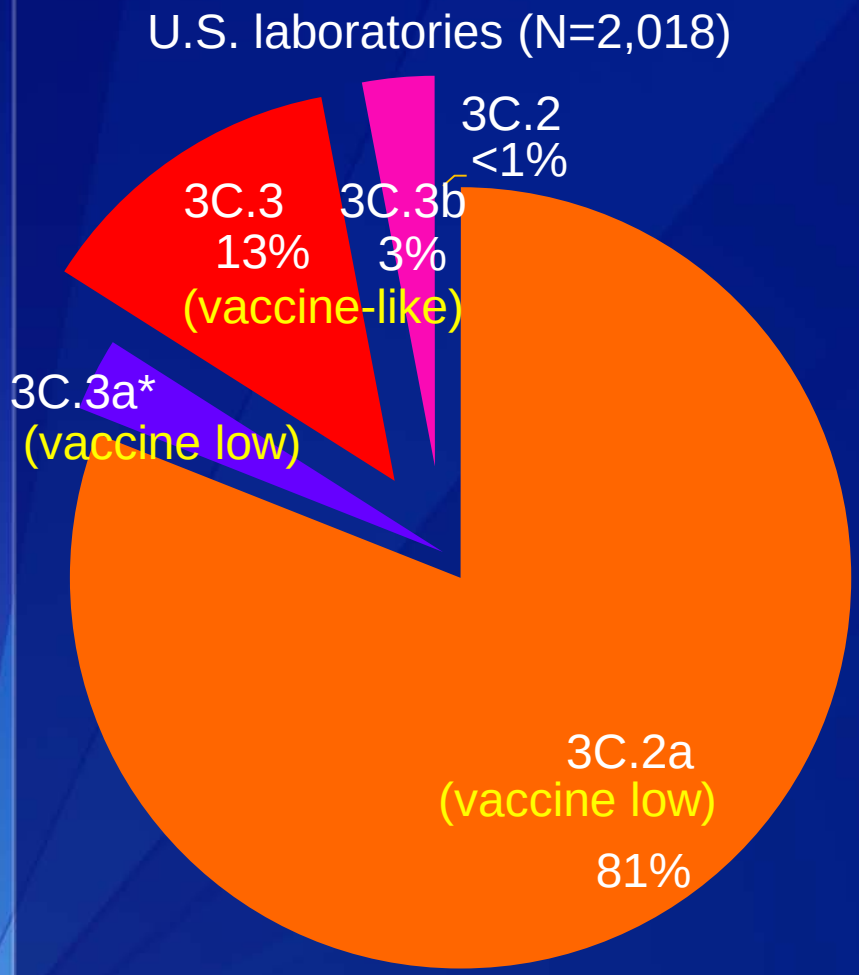
	Influenza-positive	% vaccinated	Influenza-negative	% vaccinated	Adjusted VE	(95% CI)
Influenza A (H3N2)						
All ages	941/1821	(52)	3866/7092	(55)	**13%**	**(2 to 23)**
Influenza B (Yamagata)						
All ages	125/340	(37)	3866/7092	(55)	**55%**	**(43 to 65)**
Influenza B (Victoria)						
All ages	12/47	(26)	3866/7092	(55)	**63%**	**(26 to 81)**

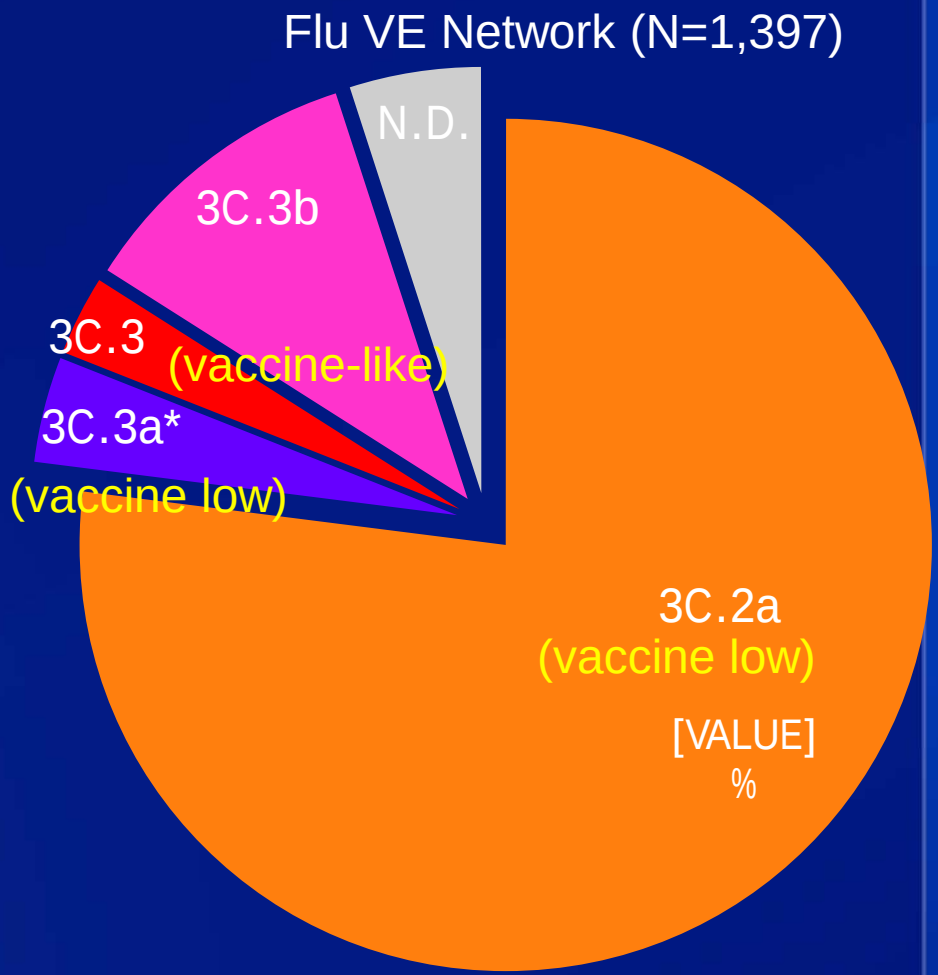
* Adjusted for study site, age, sex, race/Hispanic ethnicity, self-rated health status, days from illness onset to enrollment, and calendar time (biweekly intervals).

VE against any influenza, A(H3N2), and B by age group, US Flu VE Network, 2014-15



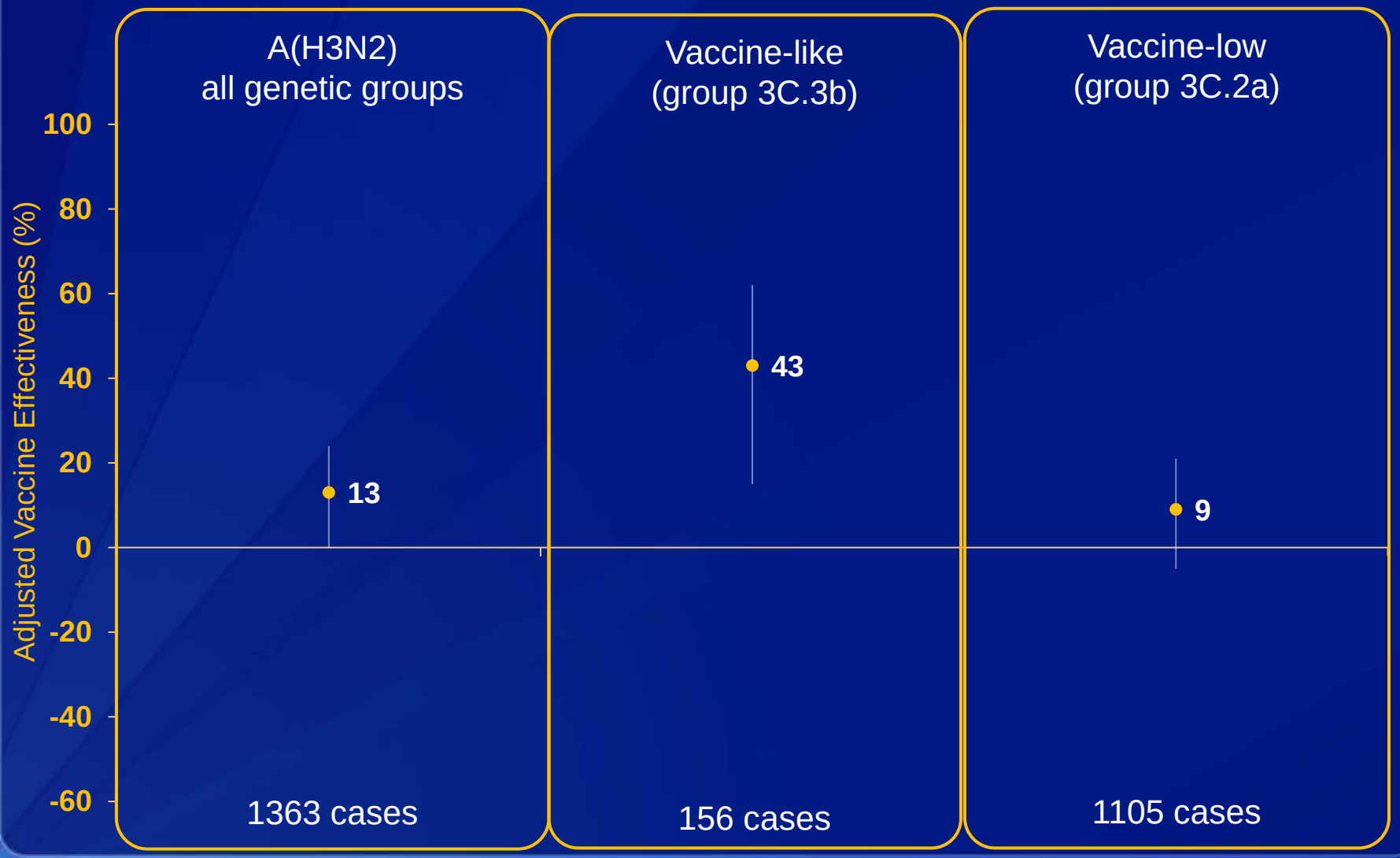
Characterization of circulating H3N2 viruses in the U.S. by HA gene sequencing, 2014-15





*Includes A/Switzerland/9714293/2013, H3N2 component of 2015-16 N Hemisphere vaccine

Adjusted VE by influenza A(H3N2) genetic group, US Flu VE Network, 2014–2015



VE against any influenza by vaccine type

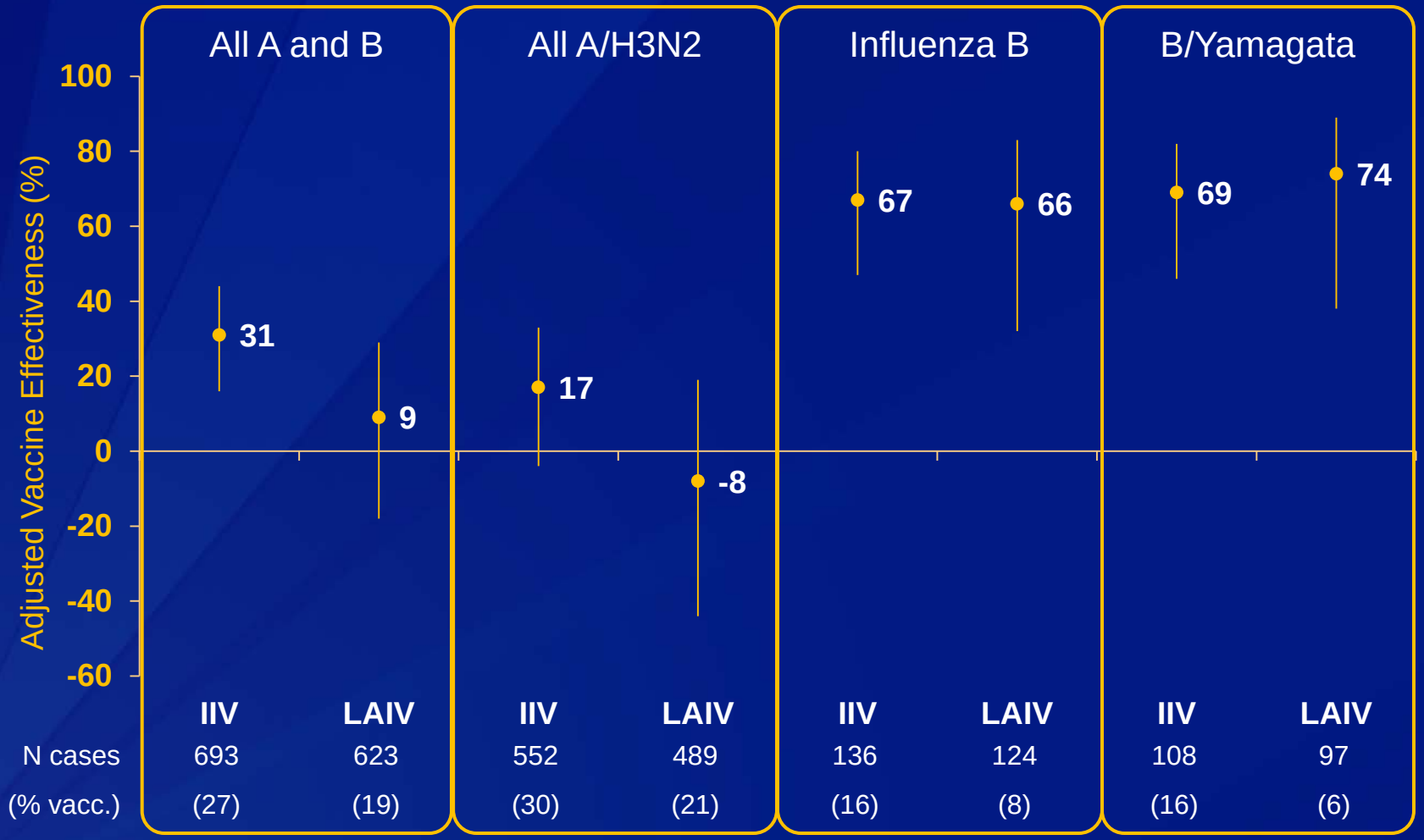
Adjusted VE against any influenza for fully vaccinated children and adolescents 2–17 years, by vaccine type, 2014-15

	Influenza-positive	% vaccinated	Influenza-negative	% vaccinated	Adjusted VE*	(95% CI)
Live attenuated (LAIV4)						
2–17 years	623	19%	1677	22%	**9%**	**(-18 to 29)**
2–8 y	316	22%	985	25%	**9%**	**(-28 to 35)**
9–17 y	307	16%	692	18%	**17%**	**(-27 to 46)**
Inactivated (IIV3/IIV4)**						
2–17 years	693	27%	2068	37%	**31%**	**(16 to 44)**
2–8 y	348	29%	1235	40%	**26%**	**(2 to 44)**
9–17 y	345	25%	833	32%	**33%**	**(9 to 51)**

*Adjustment for age (groups or years), study site, race/Hispanic ethnicity, sex, self-rated general health status, interval from onset to enrollment, and calendar time (biweekly intervals)

**40% of children who received inactivated vaccine received IIV3, 60% received IIV4

Adjusted VE by influenza type/subtype and vaccine type for fully vaccinated children and adolescents aged 2–17 years, US Flu VE Network, 2014–2015



Adjusted VE against any influenza A and B among patients aged ≥65 years by vaccine type, 2014–2015

	Influenza-positive	% vaccinated	Influenza-negative	% vaccinated	Adjusted VE*	(95% CI)
High dose (IIV3)						
≥65 years	112	20%	235	26%	**14%**	**(-72 to 57)**
Standard dose (IIV3/IIV4)						
≥65 years	317	72%	778	78%	**31%**	**(2 to 51)**
Standard dose (IIV3)						
≥65 years	193	53%	429	59%	**38%**	**(3 to 60)**

*Adjustment for age (years), study site, race/Hispanic ethnicity, sex, self-rated general health status, interval from onset to enrollment, and calendar time (biweekly intervals)

- Relative effectiveness of high dose IIV3 versus standard dose IIV3/IIV4 was not significant (adjusted OR: 0.98, 95% CI, 0.53, 1.83).

Limitations

- **Some estimates imprecise due to small numbers**
  - VE for high-dose
  - VE for live-attenuated by age group
  - VE for less common H3 genetic groups
- **Observational study design**
  - Potential for confounding due to differences in patient characteristics among vaccinated/unvaccinated, or vaccine type

Conclusions

- **Reduced VE consistent with predominance of antigenically drifted A(H3N2) viruses**
  - H3N2 accounted for 83% of influenza-positive cases at US Flu VE Network sites; majority (>80%) in genetic groups characterized as low reactors to vaccine
  - Higher VE against less prevalent vaccine-like A(H3N2) viruses and influenza B viruses
- **66-67% VE against influenza B for LAIV and IIV among children and adolescents**
- **Reduced or nonsignificant VE against A(H3N2) for LAIV and IIV in children, high dose and standard dose among ≥65 years**

US Flu VE Network

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