



Influenza Vaccine Effectiveness, 2016-17

US Flu VE Network

&

**US Hospitalized Adult Influenza Vaccine Effectiveness Network
(HAIVEN)**

Jill Ferdinands, PhD

CDC Influenza Division

Meeting of the Advisory Committee on Immunization Practices (ACIP)

June 21, 2017

Objectives

- Review end-of-season estimates of 2016-17 influenza vaccine effectiveness (VE) from US Flu VE Network (outpatient flu, all ages)
- Introduce US Hospitalized Adult Influenza Vaccine Effectiveness Network (HAIVEN) (inpatient flu, adults) and present preliminary 2016-17 VE estimates

UUSUS Flu VE Network VE Estimates, 2016-17

OUTPATIENT
ALL AGES

US Flu VE Networks 2016-2017 Outpatients All Ages

US Flu VE Network and principal investigators

**Kaiser Permanente
Washington Health
Research Institute**
Mike Jackson
Lisa Jackson

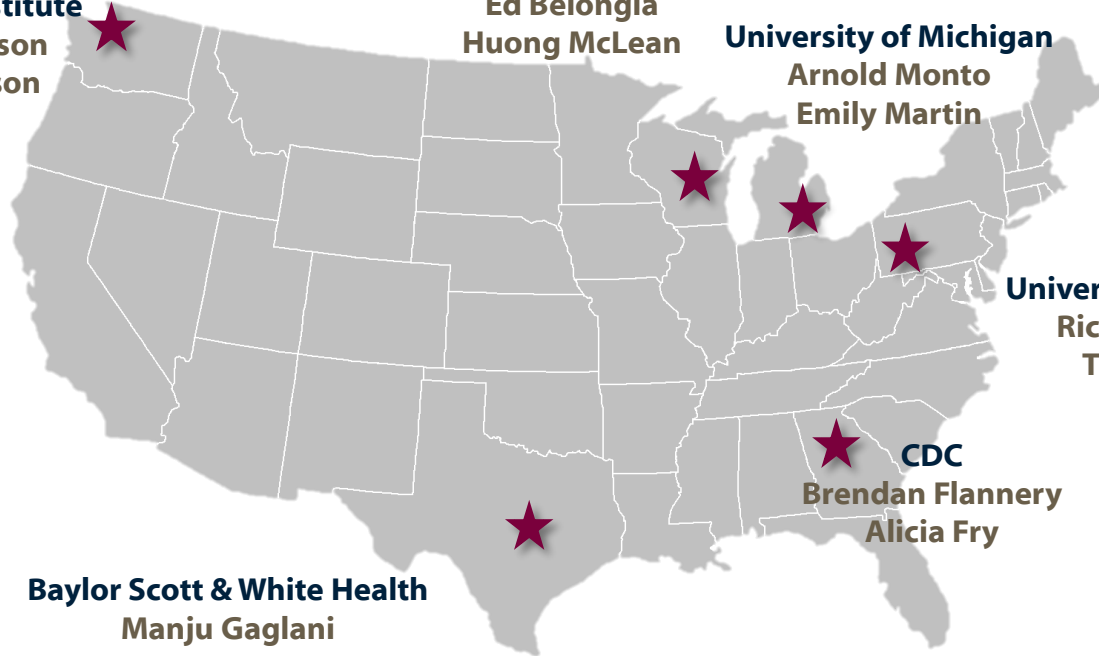
Marshfield Clinic Research Institute
Ed Belongia
Huong McLean

University of Michigan
Arnold Monto
Emily Martin

University of Pittsburgh
Rick Zimmerman
Tricia Nowalk

CDC
Brendan Flannery
Alicia Fry

Baylor Scott & White Health
Manju Gaglani



US Flu VE Network Methods

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

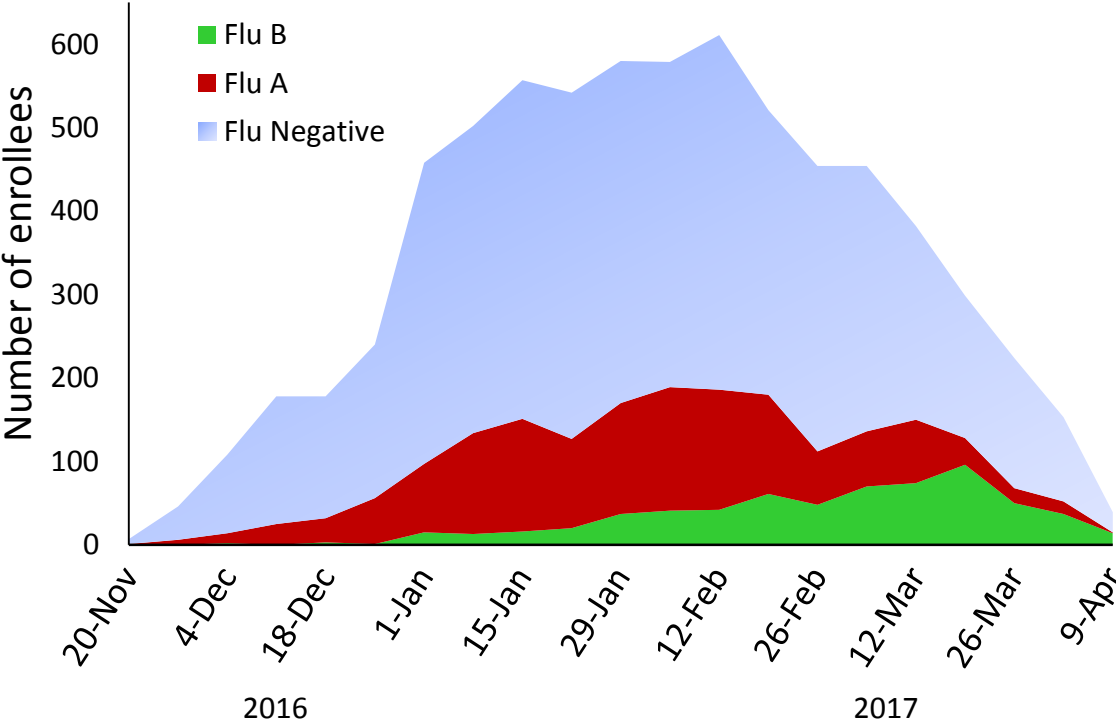
Design: Test-negative case-control design

- Odds of PCR-confirmed influenza among vaccinated compared to unvaccinated enrollees
- Vaccinated: at least one dose of 2016–17 flu vaccine according to medical records, immunization registries, and/or self-report with date and location

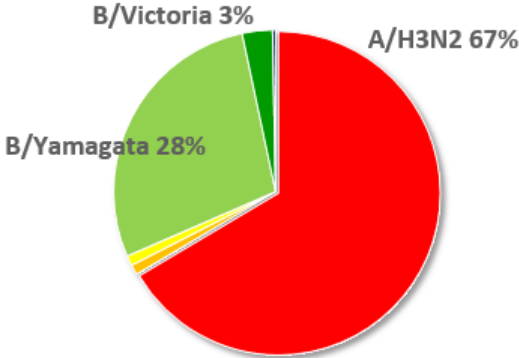
Analysis: $VE = (1 - \text{adjusted OR}) \times 100\%$

- Adjusted for site, age, sex, race/ethnicity, self-rated general health status, days from onset to enrollment, and calendar time of onset

US Flu VE Enrollment, 2016–17 (N=7205)



Cases by subtype (N=2052)*



* Cases in analytic dataset (after exclusions)

US Flu VE Network: Vaccine effectiveness against influenza A/B, 2016–17

	Influenza positive		Influenza negative		Vaccine Effectiveness			
	N vaccinated/Total (%)		N vaccinated/Total (%)		Unadjusted		Adjusted*	
Any influenza A or B virus					VE %	95% CI	VE %	95% CI
<i>All ages</i>	883/2052	(43)	2761/5153	(54)	35	(27 to 41)	42	(35 to 48)
<i>Age group (yr)</i>								
6 mo–8 yr	106/353	(30)	709/1318	(54)	63	(53 to 71)	61	(49 to 70)
9–17	123/402	(31)	245/606	(40)	35	(15 to 50)	35	(13 to 61)
18–49	203/529	(38)	716/1629	(44)	21	(3 to 35)	19	(-1 to 34)
50–64	203/442	(46)	537/909	(59)	41	(26 to 53)	42	(26 to 55)
≥65	248/326	(76)	554/691	(80)	21	(-8 to 43)	25	(-5 to 46)

* Multivariate logistic regression models adjusted for site, age, sex, race/ethnicity, self-rated general health status, days from illness onset to enrollment, and calendar time of illness onset

US Flu VE Network: Vaccine effectiveness by subtype, 2016–17

	Influenza positive		Influenza negative		Vaccine Effectiveness			
					Unadjusted		Adjusted*	
	N vaccinated/Total	(%)	N vaccinated/Total	(%)	VE %	95% CI	VE %	95% CI
<u>Influenza A/H3N2</u>								
<i>All ages</i>	619/1349	(46)	2761/5153	(54)	27 (17 to 35)		34 (24 to 42)	
<i>Age group (yr)</i>								
6 mo–8 yr	71/203	(35)	709/1318	(54)	54 (37 to 66)		51 (33 to 65)	
9–17	78/258	(30)	245/606	(40)	36 (13 to 53)		31 (3 to 50)	
18–49	143/352	(41)	716/1629	(44)	13 (-10 to 31)		12 (-13 to 32)	
50–64	145/299	(49)	537/909	(59)	35 (15 to 50)		34 (12 to 50)	
≥65	182/237	(77)	554/691	(80)	18 (-17 to 43)		25 (-10 to 48)	
<u>Influenza A/H1N1pdm09</u>								
<i>All ages</i>	8/26	(31)	2761/5153	(54)	61 (11 to 83)		54 (-11 to 81)	

* Multivariate logistic regression models adjusted for site, age, sex, race/ethnicity, self-rated general health status, days from illness onset to enrollment, and calendar time of illness onset

US Flu VE Network: Vaccine effectiveness by B lineage, 2016–17

	Influenza positive		Influenza negative		Vaccine Effectiveness			
					Unadjusted		Adjusted*	
	N vaccinated/Total	(%)	N vaccinated/Total	(%)	VE %	95% CI	VE %	95% CI
<u>Influenza B</u>								
<i>All ages</i>	238/650	(37)	2761/5153	(54)	50	(41 to 58)	56	(47 to 64)
<u>Influenza B/Yamagata</u>								
<i>All ages</i>	215/579	(37)	2761/5153	(54)	49	(39 to 57)	55	(45 to 63)
<u>Influenza B/Victoria</u>								
<i>All ages</i>	21/63	(33)	2761/5153	(54)	57	(27 to 74)	60	(31 to 77)

* Multivariate logistic regression models adjusted for site, age, sex, race/ethnicity, self-rated general health status, days from illness onset to enrollment, and calendar time of illness onset

HAIVEN VE Estimates, 2016-17

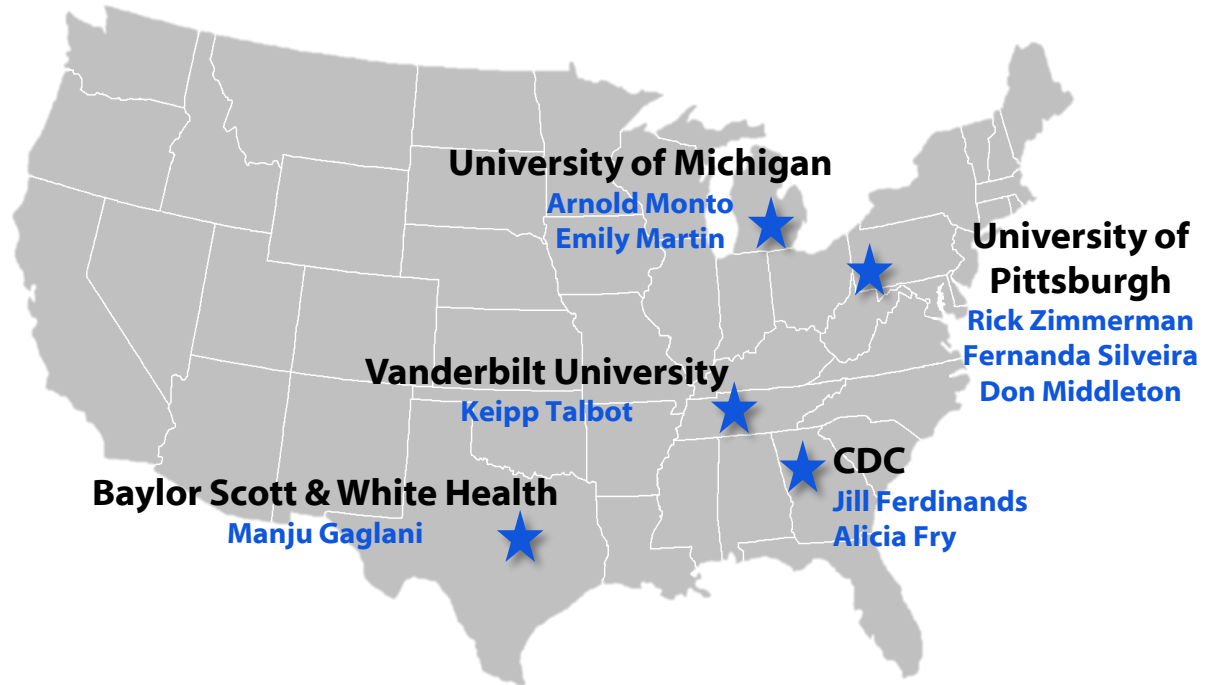
HAIVEN VE Estimates, 2016-17

INPATIENT

INPATIENT
ADULTS
ADULS

US Hospitalized Adult Influenza Vaccine Effectiveness Network (HAIVEN)

- CDC-funded study to estimate effectiveness of influenza vaccine for prevention of influenza hospitalizations among adults
- 2015-16 was pilot year with 7 hospitals
- 2016-17 through 2019-20 enrollment at 10 hospitals with 5000+ acute care beds



HAIVEN Methods

Similar to US Flu VE Network

Enrollees: Adults aged ≥ 18 years old hospitalized for < 72 hr with acute respiratory illness with cough ≤ 10 days duration

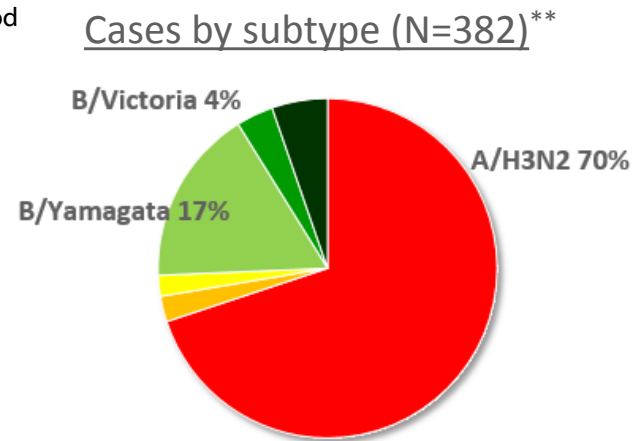
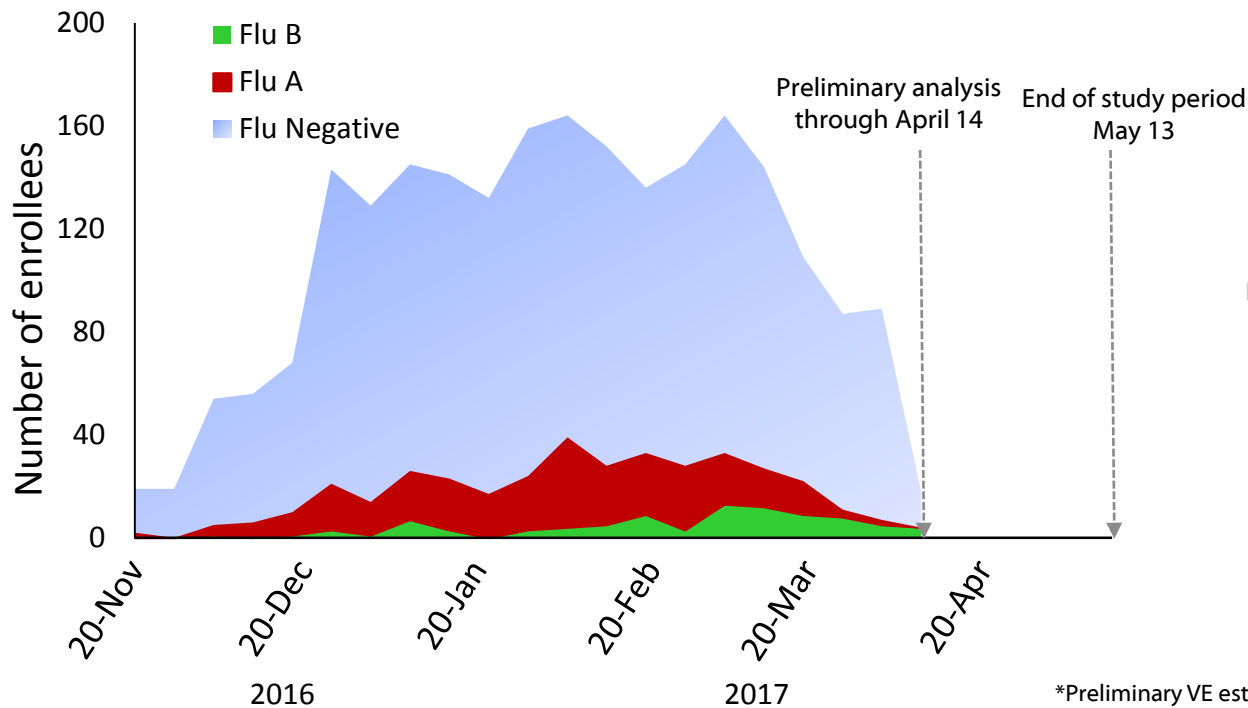
Design: Test-negative case-control design

- Odds of PCR-confirmed influenza among vaccinated compared to unvaccinated enrollees
- Vaccinated: At least one dose of 2016–17 flu vaccine ≥ 14 days prior to illness onset by patient self-report

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

- Adjusted for site, age, sex, race/ethnicity, days from onset to enrollment, calendar time of onset, number of hospitalizations in past year, frailty, and home oxygen use

HAIVEN Enrollment, 2016–17* (N=2275)



*Preliminary VE estimates include HAIVEN enrollees through April 14, 2017

** Cases in analytic dataset (after exclusions)

HAIVEN: Vaccine effectiveness against influenza A/B, 2016–17 (preliminary)

	Influenza positive		Influenza negative		Vaccine Effectiveness			
	N	N vaccinated/Total (%)	N vaccinated/Total (%)		Unadjusted		Adjusted*	
Any influenza A or B virus	N	N vaccinated/Total (%)	N vaccinated/Total (%)		VE %	95% CI	VE %	95% CI
<i>Age ≥18 yr</i>	2275	235/382 (62)	1302/1893 (69)		27	(9, 42)	30	(11 to 46)
<i>Age group (yr)</i>								
18-49	510	37/78 (47)	240/432 (56)		28	(-17, 56)	23	(-29 to 54)
50-64	787	59/107 (55)	441/680 (65)		33	(-1, 56)	31	(-6 to 55)
≥65	978	139/197 (71)	621/781 (80)		38	(12, 57)	37	(8 to 57)

* Multivariate logistic regression models adjusted for site, age group, sex, race/ethnicity, days from illness onset to specimen collection, calendar time of illness onset, home oxygen use, frailty score, and number of self-reported hospitalizations in the past year

HAIVEN:

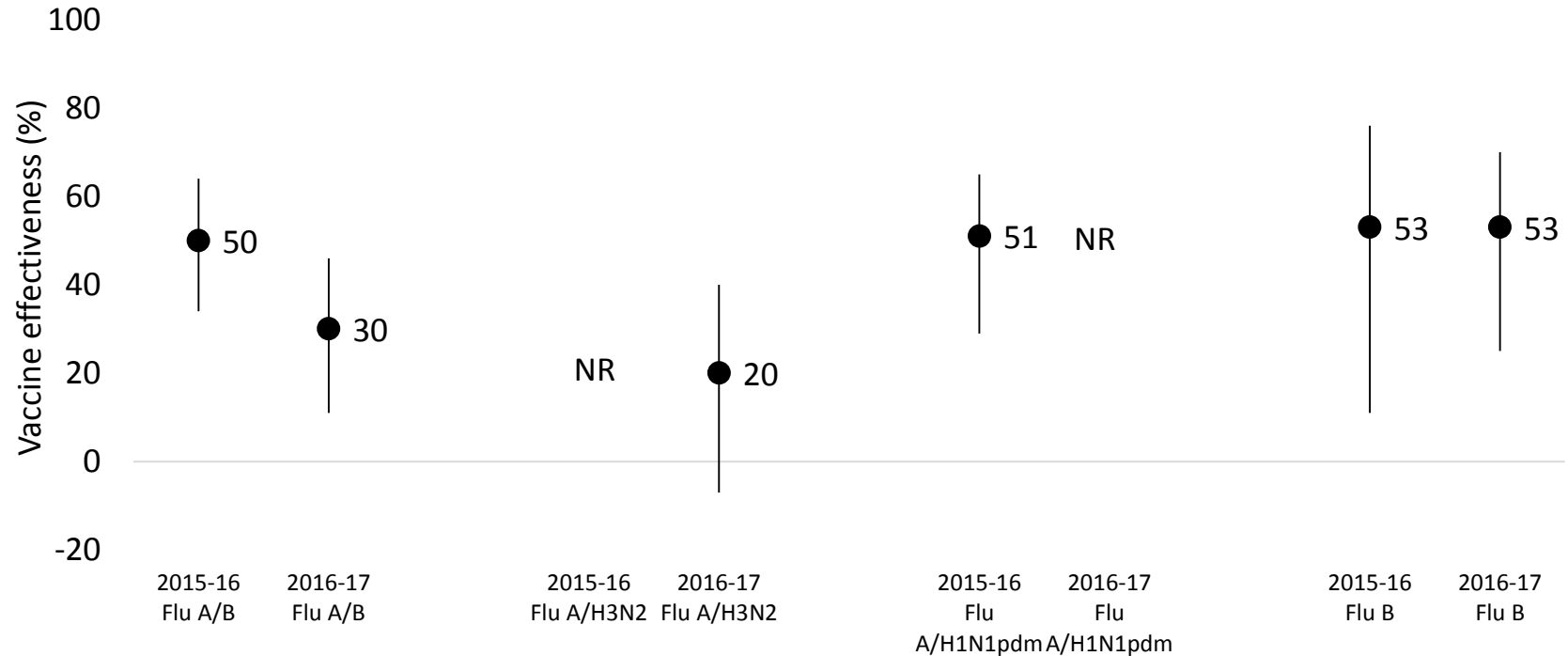
Vaccine effectiveness by virus type, 2016–17 (preliminary)

	N	Influenza positive		Influenza negative		Vaccine Effectiveness			
		N vaccinated/Total	(%)	N vaccinated/Total	(%)	Unadjusted		Adjusted*	
						VE %	95% CI	VE %	95% CI
<u>Influenza A/B</u>									
<i>Age ≥18 yr</i>	2275	235/382	(62)	1302/1893	(69)	27	(9, 42)	30 (11 to 46)	
<u>Influenza A/H3N2</u>									
<i>Age ≥18 yr</i>	2167	177/274	(65)	1302/1893	(69)	17	(-8, 37)	20 (-7 to 40)	
<u>Influenza B</u>									
<i>Age ≥18 yr</i>	1984	49/91	(54)	1302/1893	(69)	47	(19, 65)	53 (25 to 70)	

* Multivariate logistic regression models adjusted for site, age group, sex, race/ethnicity, days from illness onset to specimen collection, calendar time of illness onset, home oxygen use, frailty score, and number of self-reported hospitalizations in the past year

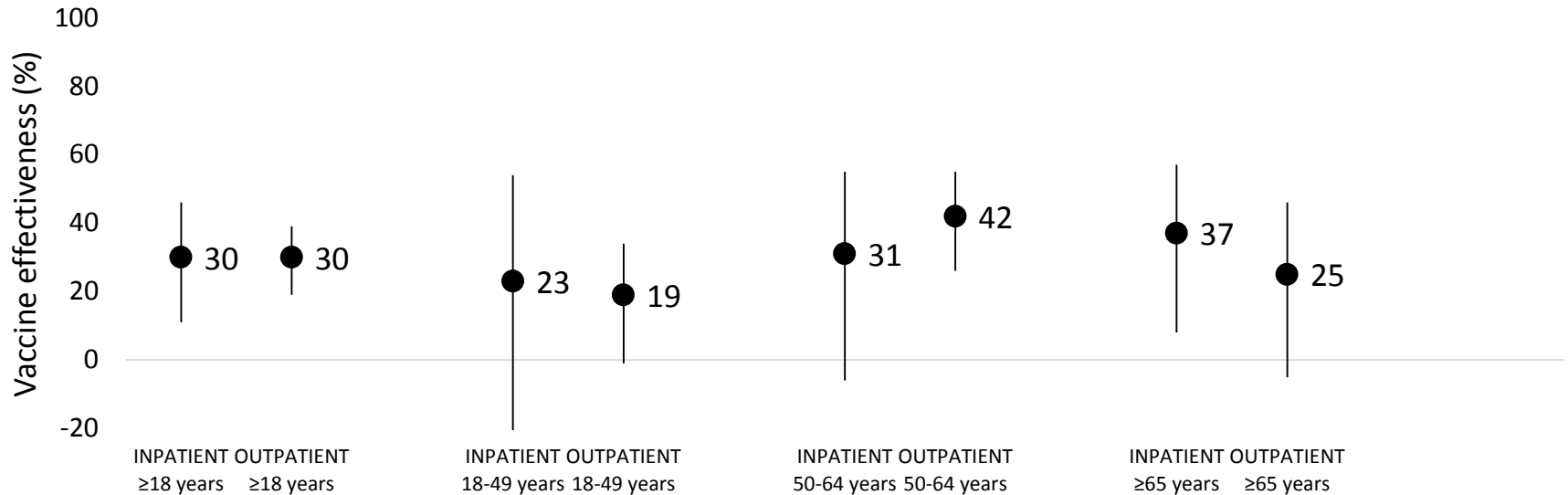
HAIVEN:

Vaccine effectiveness by virus type, 2015-16 and 2016-17



NR = not reported

Vaccine effectiveness against PCR-confirmed influenza A/B in HAIVEN¹ (inpatient) and US Flu VE Network² (outpatient) by adult age group, 2016-17



¹ Multivariate logistic regression models adjusted for site, age group, sex, race/ethnicity, days from illness onset to specimen collection, calendar time of illness onset, home oxygen use, frailty, and number of hospitalizations in past year

² Multivariate logistic regression models adjusted for site, age, sex, race/ethnicity, self-rated general health status, days from onset to specimen collection, and calendar time of illness onset

Summary

- Vaccine reduced outpatient influenza visits by 42% for influenza A and B viruses and by 34% for influenza A/H3N2 viruses
- Vaccine effectiveness was similar to previous A/H3N2 predominant seasons when vaccine was antigenically like circulating influenza viruses
- Vaccine offered significant protection against influenza hospitalizations
 - Vaccine reduced influenza hospitalizations by 30% among all adults and by 37% among adults ≥ 65 years of age (influenza A and B viruses)
 - Results are preliminary and may change when final dataset is available

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

