Department of Defense Global, Laboratory-Based, Influenza Surveillance Program Dependents Only 2014-2015 Season Vaccine Effectiveness (VE) Estimates

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Abstract

Background: Influenza prevention is recognized as a high priority in the military, as respiratory illness can devastate military readiness and is one of the most common causes of lost duty time among young adults in the military. The Department of Defense (DoD) Global, Laboratory-Based, Influenza Surveillance Program is a year-round, sentinel-based program located at the U.S. Air Force School of Aerospace Medicine (USAFSAM), Wright-Patterson AFB, Ohio. Various activities, including calculating vaccine effectiveness (VE), are conducted in support of the program's primary goals: prevent influenza infections, reduce morbidity and mortality, and ensure force health protection.

Methods: Nasal wash specimens were collected from DoD beneficiaries presenting for treatment and meeting the influenza-like illness case definition of fever ≥100.5°F and cough or sore throat, with symptom onset within 72 hours. Specimens received from DoD medical treatment facilities in the United States were tested using viral culture, quantitative reverse transcriptase polymerase chain reaction, and FilmArray®. VE estimates were calculated using a case-control method. Odds ratios were determined by logistic regression and were adjusted for age, region, and collection period (collapsed into two equal quartiles). These estimates used data only from service member dependents.

Results: The program received 6,291 specimens from 89 locations during the 2014-2015 season. Of these, 1,800 were positive for influenza A: 1,795 A(H3N2), four A(H1N1)pdm09, and one A/not subtyped. Two hundred fifty-seven specimens were positive for influenza B: 83 B/Yamagata, 34 B/Victoria, and 140 influenza B, unknown lineage. Two dual influenza co-infections were identified. The sample size for the dependents' analysis was 2,403 (869 cases and 1,534 controls). Data were analyzed by beneficiary group and vaccine type. Overall, VE estimates conferred a low level of protection at 27% [12.1, 39.0].

Conclusion: The DoD Global, Laboratory-Based, Influenza Surveillance Program has more than 90 sentinel sites and the ability to identify and sequence influenza strains from areas of the world that lack coverage by the World Health Organization or the Centers for Disease Control and Prevention. This program has access to electronic vaccination data, allowing us to perform VE estimates. Due to these unique capabilities, our data and analyses help inform the Food and Drug Administration's influenza vaccine selection annually.

Background

- Military families are stationed where new influenza strains are likely to appear, are highly mobile across the globe and could quickly spread a pandemic strain, and may live in areas that are not represented in CDC and WHO influenza surveillance networks.
- The DoD Global, Laboratory-Based Influenza Surveillance Program is year-round, service-wide, and sentinel-based with the following goals and activities:
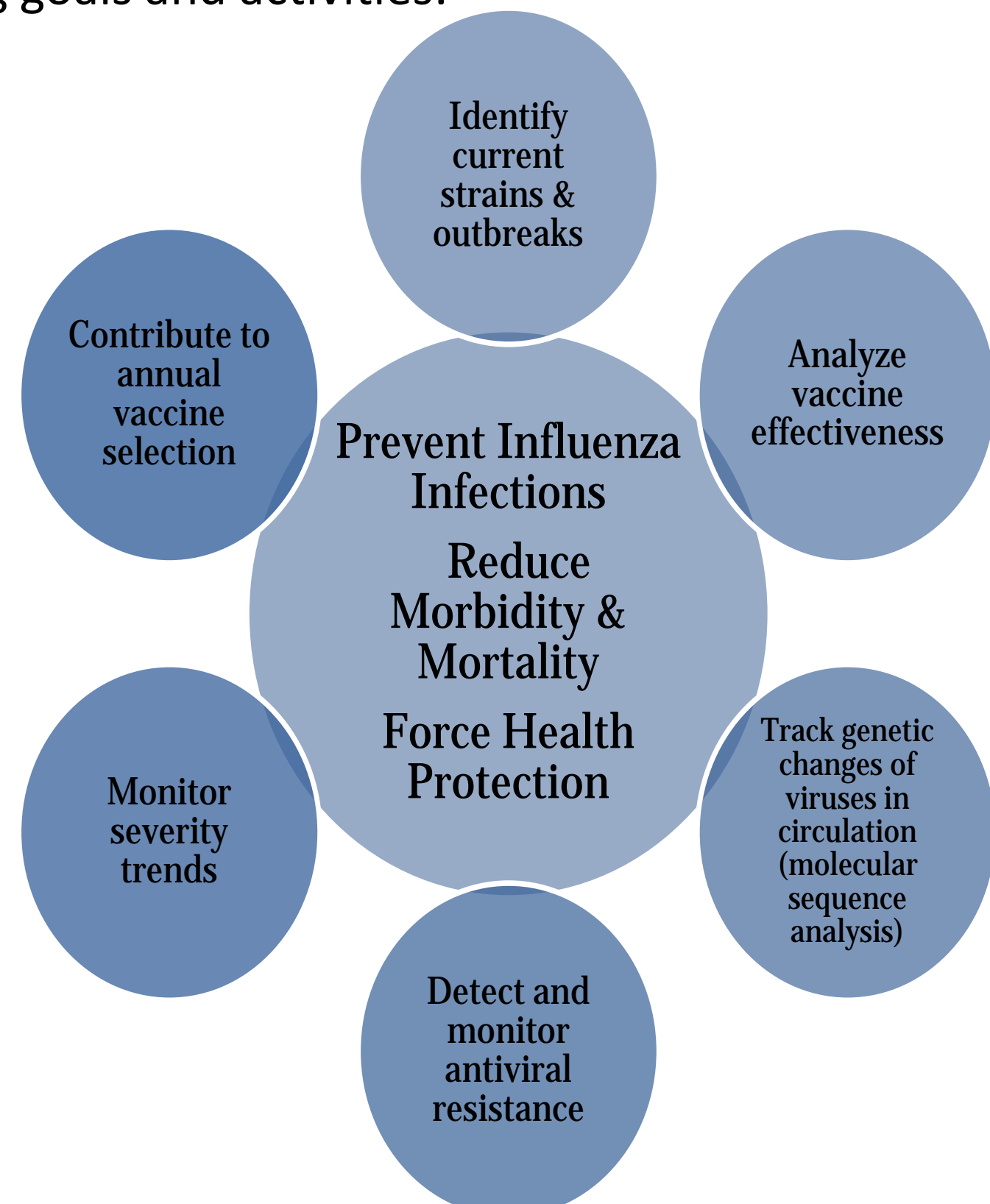
- More than 90 global sites participate in the DoD Influenza Surveillance Program at USAFSAM.
- Each site is asked to submit 6-10 respiratory specimens and questionnaires per week from each patient who meets the ILI case definition: fever ≥ 100.5°F and cough or sore throat, with symptom onset within 72 hours.

The views expressed are those of the authors and do not necessarily reflect the official policy or position of the Air Force, the Department of Defense, or the U.S. Government.

Submitting Sites for the 2014-2015 Influenza Season
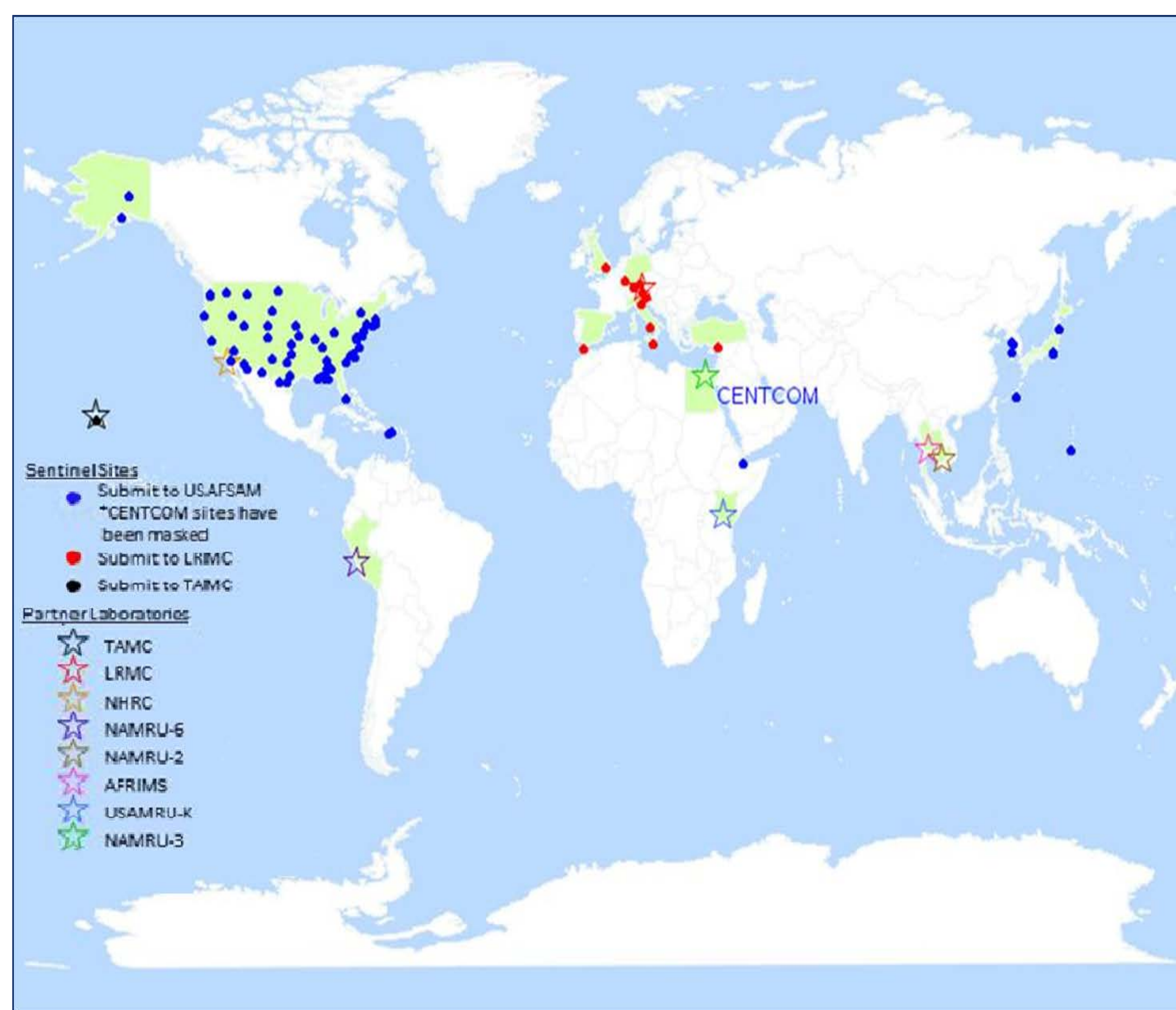
Methods

- Respiratory specimens undergo testing via reverse transcriptase polymerase chain reaction (RT-PCR) and viral culture. Specimens testing negative for influenza on RT-PCR that met the ILI case definition were tested on the BioFire FilmArray®. Some influenza specimens are chosen for molecular sequencing.
- End-of-season vaccine effectiveness (VE) estimates were calculated for DoD dependents, including retired service members. A case test-negative methodology was used. A case was defined as an individual who tested positive for influenza virus A or B on RT-PCR, culture, or FilmArray® and a control was defined as an individual with a negative test for influenza virus A or B. To concentrate on specimens collected during peak influenza season, a 10% influenza positive threshold was used.
  - Vaccine data were obtained through the Air Force Complete Immunization Tracking Application (AFCITA), and self-reported surveys.
  - An individual was considered vaccinated if the immunization occurred at least 14 days prior to specimen collection. VE was calculated using multivariable logistic regression in SAS 9.3.

Results

Cumulative Laboratory Results (N=6,291)

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Influenza A	1,800
2009 A(H1N1)pdm09 (n=4)	
A(H3N2) (n=1795)	
A/not subtyped (n=1)	
Influenza B[§]	257
B/Yamagata (n=83)	
B/Victoria (n=34)	
Dual Influenza Coinfections	2
Bacterial Pathogens	50
Non-influenza Viral Pathogens	998
Non-Influenza Coinfections	125
No Pathogen Detected	3,002
Test Not Performed[¥]	57

[§]USAFSAM does not sequence all influenza B specimens; [¥]Test may not be performed due to reasons related to specimen quality.

Specimen Submissions for All Beneficiaries

Beneficiary Status	Frequency	Percent
Active Duty	2359	37.50
Adults	1522	24.19
Children	2410	38.31
Total	6291	100

Results (continued)

Percent influenza positive by week: 2014-2015 influenza season
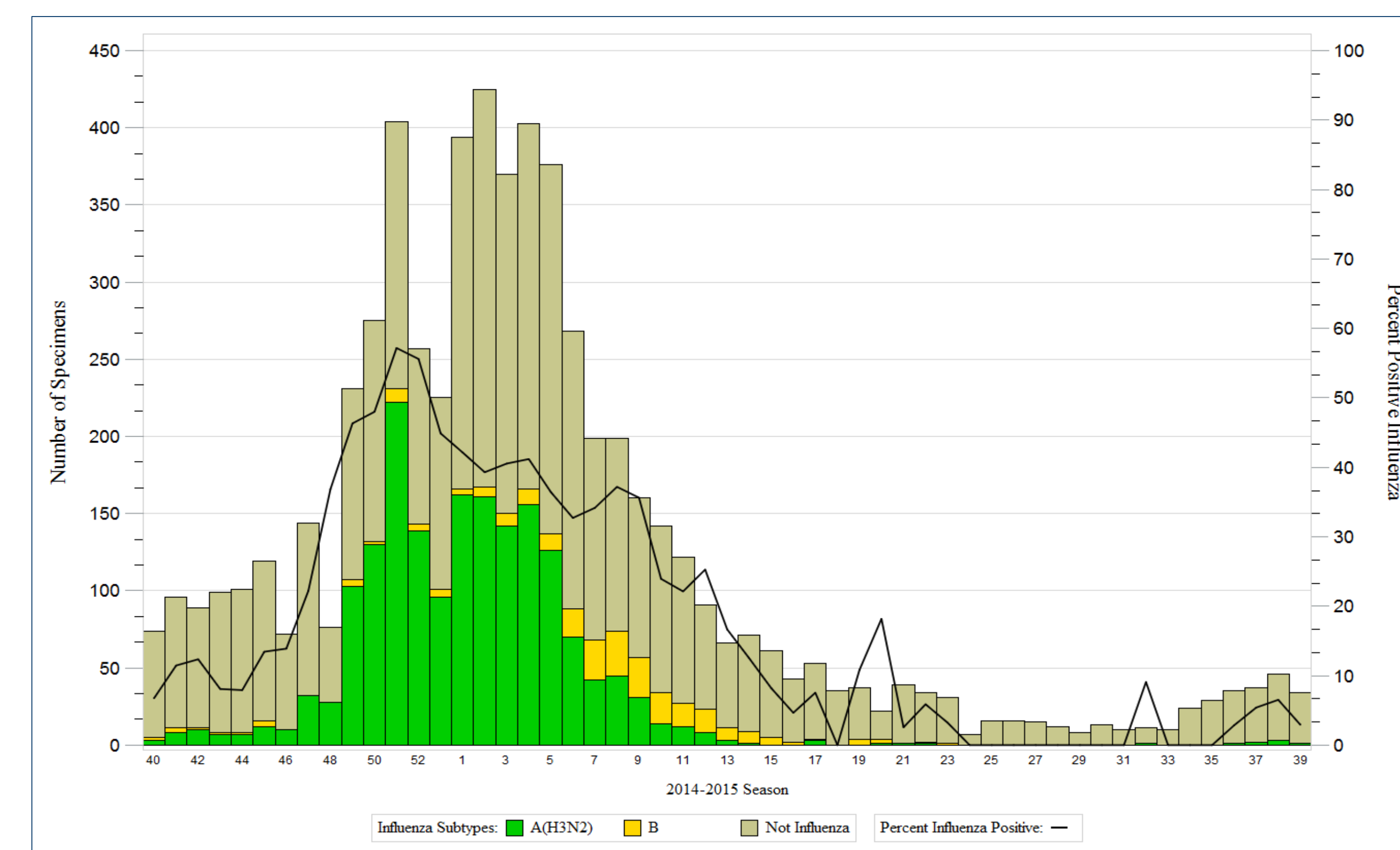
Note: Four influenza A(H1N1)pdm09 and two dual influenza coinfections were excluded from the graph due to small numbers. However, these specimens contribute to the percent positive.

Dependents Only Vaccine Effectiveness Estimates: 2014-2015 influenza season

Population	Vaccine Type	Cases (%)	Controls (%)	Crude OR	VE Crude	Adjusted OR	VE Adjusted
Children	Overall	523 (30)	927 (25)	0.57	42.90 (28.71, 54.26)	0.75	25.20 (4.74, 41.26)
	LAIV	71 (14)	96 (10)	0.65	34.94 (14.23, 50.65)	0.71	29.12 (4.44, 47.43)
	IIV	82 (16)	229 (25)	0.44	55.99 (43.13, 65.95)	0.64	36.14 (15.50, 51.75)
	Unvaccinated	370 (70)	602 (65)	Ref	Ref	Ref	Ref
Adults	Overall	346 (25)	607 (29)	0.66	34.27 (14.18, 49.66)	0.71	29.25 (6.34, 46.56)
	LAIV	12 (4)	33 (5)	0.6	40.00 (16.30, 56.99)	0.67	33.21 (5.73, 52.68)
	IIV	74 (21)	148 (24)	0.67	33.18 (12.12, 49.19)	0.73	27.12 (2.51, 45.52)
	Unvaccinated	260 (75)	426 (71)	Ref	Ref	Ref	Ref
All Dependents	Overall	869 (28)	1534 (33)	0.61	39.42 (28.18, 48.90)	0.73	26.77 (12.06, 39.02)
	LAIV	83 (10)	129 (8)	0.63	37.21 (22.35, 49.23)	0.69	30.56 (13.00, 44.57)
	IIV	156 (18)	377 (25)	0.54	45.93 (34.96, 55.06)	0.68	32.02 (16.85, 44.43)
	Unvaccinated	630 (72)	1028 (67)	Ref	Ref	Ref	Ref

OR = odds ratio; VE = vaccine effectiveness; LAIV = live attenuated influenza vaccine (LAIV4); IIV = inactivated influenza vaccine (IIV3, IIV4, ccIIV3)

Dependents include any individual treated at a military treatment facility that is not a service member (i.e., child, spouse, retiree, etc.).

Note: n (%) represents the number and percentage of vaccinated individuals from each "overall" population.

Conclusion

- Of positive influenza specimens, influenza A(H3N2) was the predominant strain during the 2014-2015 influenza season: A(H3N2): 87.1%, A(H1N1)pdm09: 0.2%, A/Not Subtyped: 0.1%, B: 12.5%, Dual Influenza: 0.1%.
- Influenza A(H3N2) viruses that were circulating this season in the U.S. were found to be 52% antigenically different than the H3N2 vaccine virus, likely contributing to lower vaccine effectiveness (VE).[1]
  - VE estimate against influenza A(H3N2) viruses according to CDC was 19% (95% CI: 7%-29%).[2]
- Overall VE estimates for DoD dependents indicated that vaccination reduced medically attended respiratory illness by nearly 27%.
- Surveillance data that are collected by the DoD Global, Laboratory-Based, Influenza Surveillance Program help determine the incidence of ILI among military populations, identify outbreaks and viruses that are currently circulating, and detect new variants or subtypes of influenza.
- Data are used to help select the composition of next season's influenza vaccine.

Acknowledgements

References

1. CDC Health Advisory Regarding the Potential for Circulation of Drifted Influenza A(H3N2) Virus. Centers for Disease Control and Prevention website. http://emergency.cdc.gov/HAN/han00374.asp. Updated December 3, 2014. Accessed March 8, 2016.
2. CDC Presents Updated Estimates of Flu Vaccine Effectiveness for the 2014-2015 Season. Centers for Disease Control and Prevention website. http://www.cdc.gov/flu/news/updated-vaccine-effectiveness-2014-15.htm. Updated March 2, 2014. Accessed March 8, 2016.