DoD Influenza Surveillance and Mid-Season Vaccine Effectiveness

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**Representing the DoD CONUS and OCONUS lab-based influenza surveillance activities

Presentation to the Vaccines and Related Biological Products Advisory Committee (VRBPAC) – 4 March 2020

“Medically Ready Force...Ready Medical Force”
Purpose: Provide a concise update to the VRBPAC on DoD influenza surveillance activities for 2018-2019

1. Program Description
2. Strain Circulation
3. Molecular Analyses
4. Vaccine Effectiveness
Breadth of DoD Influenza Surveillance

• Global Influenza Surveillance
  – Approximately 400 locations in over 30 countries
    • Military; Local government/academic
  – Extensive characterization capabilities within the DoD
    • Culture, PCR, Sequencing, Serology
  – Rapid sharing of results with CDC and/or regional WHO reference centers
    • Yearly average: ~30,000 samples collected and analyzed each year

• Comprehensive Epidemiology and Analysis Capabilities
  – 1.4 Million Active Duty records (health care utilization, immunizations, deployment, reportable diseases, etc.)
    • Produce Medical Surveillance Monthly Reports, Ad-hoc requests, Studies/analyses,
    • Weekly influenza reports
    • Vaccine safety and effectiveness studies

“Medically Ready Force...Ready Medical Force”
GEIS-Supported Influenza Surveillance Footprint

“Medically Ready Force... Ready Medical Force”
Submitting Countries and Subtype Circulation 2019-2020 Season

“Medically Ready Force...Ready Medical Force”
Subtype Circulation: North America
Number and Proportion of Specimens Positive for Influenza by Subtype

Sources: NHRC, USAFSAM

Sources: WHO GISRS
Subtype Circulation: South America

Number and Proportion of Specimens Positive for Influenza by Subtype

Source: NAMRU-6

Source: WHO GISRS
Subtype Circulation: Europe

Number and Proportion of Specimens Positive for Influenza by Subtype

Sources: LRMC/PHCE, USAFSAM

Number of Specimens

A(H1N1)  A(H3N2)  A(Not subtyped)  B  A+B  % Positive

Percent Positive

Number of Specimens

A(H1N1)  A(H3N2)  A(Not subtyped)  B  A+B  % Positive

Source: WHO GISRS
**Subtype Circulation: Middle East**

**Number and Proportion of Specimens Positive for Influenza by Subtype**

Sources: LRMC/PHCE, USAFSAM, NAMRU-3

**Sources:**

**WHO GISRS**
Subtype Circulation: East Africa

Number and Proportion of Specimens Positive for Influenza by Subtype

Source: USAMRD-K

Source: WHO GISRS
Subtype Circulation: West Africa (Ghana)

Number and Proportion of Specimens Positive for Influenza by Subtype

**Source:** NAMRU-3

**Source:** WHO GISRS

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**Number and Proportion of Specimens Positive for Influenza by Subtype**

- **A(H1N1)**
- **A(H3N2)**
- **A(Not subtyped)**
- **B**
- **A+B**

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**Source:** NAMRU-3

**Source:** WHO GISRS
Subtype Circulation: Asia

Number and Proportion of Specimens Positive for Influenza by Subtype

Sources: 65th MED BDE, AFRIMS, NAMRU-2, NHRC, USAFSAM

Source: WHO GISRS
Summary of Circulating Subtype 2019-2020 Season

• In North America DoD surveillance is similar to national trends with a predominance of Influenza B; in recent surveillance A(H1N1) predominates

• Activity during the season in South America showed a predominance of Influenza B*

• Activity in Europe shows A(H1N1) predominating

• Asia data show early predominance of A(H3N2) with recent predominance of A(H1N1)*

• In the Middle East A(H1N1) predominates

• East Africa data show nearly evenly mixed predominance of influenza B with recent predominance of A(H3N2)*

• Activity in West Africa shows A(H3N2) predominating

*Most data from tropics
DoD / USAFSAM Phylogenetic Analysis
2019-2020 Influenza Season
Medically Ready Force…Ready Medical Force

Contributors
- USAFSAM Sentinel Sites (1752)
- Deployed Locations (5)
- AFRIMS (64)
- NAMRU-2 (7)
- NHRC (93)
- USAMRD-K (14)
- Hospitalized Cases (34)

Countries
- Cambodia
- Country 1
- England
- Germany
- Italy
- Japan
- Kenya
- Mexico
- Philippines
- South Korea
- Spain
- Thailand
- United States
- Guam

Total = 1935
769 influenza A(H1N1)pdm09 specimens sequenced
All clade 6B.1A with 183P substitution, with 76.5% in subgroup 5A, 16.4% in subgroup 5B, and 7.1% in subgroup 7
15 A(H1N1)pdm09 specimens collected from hospitalized patients, with 13 (86.7%) in subgroup 5A, and 1 each in groups 5B and 7
Among 6B.1A5A viruses, 91.1% had D187A and Q189E, and 23.9% had K130N
Among 6B.1A5B viruses, 45.6% had P137S
A(H1N1)pdm09 HA Clades
Sep 2019-Jan 2020

Number of A(H1N1)pdm09 Specimens

“Medically Ready Force…Ready Medical Force”
Influenza A(H3N2)

- 158 influenza A(H3N2) specimens sequenced
- 94.3% in clade 3C.2a1b and 5.7% in clade 3C.3a
- 73.0% of the 3C.2a1b viruses had the substitution T131K (same as 2020 SH vaccine strain A(South Australia/34/2019) and 44.9% had Q197R
A(H3N2) HA Clades
Oct 2017-Jan 2020

Number of A(H3N2) Specimens


3C.2a1a 3C.2a1b 3C.2a2 3C.2a3 "Other" 3C.2a 3C.3a (V)

"Medically Ready Force...Ready Medical Force"
998 influenza B/Victoria specimens sequenced
96.6% in clade V1A.3 (3-del) and 3.4% in clade V1A.1 (2-del)
19 collected from hospitalized patients, with 18 (94.7%) in clade V1A.3 and 1 in V1A.1
Nearly all V1A.3 viruses had G133R (98.9%) and K136E (99.9%), and 49.1% had E128K
Additionally, 10 influenza B/Yamagata specimens were collected and all were clade Y3 (data not shown)
B/Victoria HA Clades
Oct 2017-Jan 2020

“Medically Ready Force...Ready Medical Force”
Surface Protein Similarity

% HA Amino Acid Similarity

% NA Amino Acid Similarity

Sep-19  Oct-19  Nov-19  Dec-19  Jan-20

A(H1N1)pdm09  A(H3N2)  B/Vic  B/Yam

"Medically Ready Force...Ready Medical Force"
"Medically Ready Force...Ready Medical Force"
Microneutralization Titers for Influenza Virus A (H1N1) samples

<table>
<thead>
<tr>
<th>Reference Virus</th>
<th>Reference Antiserum</th>
<th>A/Brisbane/2/2018</th>
<th>A/Michigan/45/2015</th>
<th>A/California/7/2009</th>
<th>Passage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(H1N1)pdm09</td>
<td>A/Brisbane/2/2018</td>
<td>20480</td>
<td>10240</td>
<td>5120</td>
<td>Egg</td>
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<tr>
<td>A(H1N1)pdm09</td>
<td>A/Michigan/45/2015</td>
<td>20480</td>
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<tr>
<td>A(H1N1)pdm09</td>
<td>A/California/7/2009</td>
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<td>1280</td>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>Test Antigen</th>
<th></th>
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<tbody>
<tr>
<td>A(H1N1)pdm09</td>
<td>A/Georgia/10013/2019</td>
<td>3620</td>
<td>2560</td>
<td>640</td>
<td>PMK</td>
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<tr>
<td>A(H1N1)pdm09</td>
<td>A/Washington/9902/2019</td>
<td>2560</td>
<td>1280</td>
<td>640</td>
<td>PMK</td>
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<tr>
<td>A(H1N1)pdm09</td>
<td>A/Colorado/9862/2019</td>
<td>2560</td>
<td>1280</td>
<td>640</td>
<td>PMK</td>
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<tr>
<td>A(H1N1)pdm09</td>
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<td>5120</td>
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<td>1280</td>
<td>PMK</td>
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<tr>
<td>A(H1N1)pdm09</td>
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<td>3620</td>
<td>1280</td>
<td>320</td>
<td>PMK</td>
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<tr>
<td>A(H1N1)pdm09</td>
<td>A/Ohio/9894/2019</td>
<td>5120</td>
<td>2560</td>
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<td>PMK</td>
</tr>
<tr>
<td>A(H1N1)pdm09</td>
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<td>2560</td>
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<tr>
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<td>3620</td>
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<td>A(H1N1)pdm09</td>
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<td>PMK</td>
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<tr>
<td>A(H1N1)pdm09</td>
<td>A/Alabama/9860/2019</td>
<td>2560</td>
<td>2560</td>
<td>453</td>
<td>SIAT1</td>
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</table>
## Microneutralization Titers for Influenza Virus A (H3N2) samples

<table>
<thead>
<tr>
<th>Reference Virus</th>
<th>A/Kanasas/14/2017</th>
<th>A/Singapore/INIMF-16-0019/2016</th>
<th>A/Hong Kong/4801/2014</th>
<th>Passage</th>
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<tbody>
<tr>
<td>A/Kanasas/14/2017</td>
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<td>160</td>
<td>1280</td>
<td>Egg</td>
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<tr>
<td>A/Singapore/INIMF-16-0019/2016</td>
<td>5120</td>
<td>10240</td>
<td>10240</td>
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<tr>
<td>A/Hong Kong/4801/2014</td>
<td>5120</td>
<td>7241</td>
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<td>Egg</td>
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<table>
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<tr>
<th>Test antigens</th>
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<tbody>
<tr>
<td>A(H3N2) A/Nevada/10019/2019</td>
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<td>160</td>
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<td>A(H3N2) A/Japan/9879/2019</td>
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<td>A(H3N2) A/Virginia/9898/2019</td>
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<td>320</td>
<td>160</td>
<td>PMK</td>
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<tr>
<td>A(H3N2) A/England/9865/2019</td>
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<td>905</td>
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<td>PMK</td>
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<td>A(H3N2) A/Maryland/9883/2019</td>
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<td>A(H3N2) A/Virginia/9899/2019</td>
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<td>320</td>
<td>640</td>
<td>PMK</td>
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<tr>
<td>A(H3N2) A/Ohio/9893/2019</td>
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<td>&lt;160</td>
<td>PMK</td>
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<tr>
<td>A(H3N2) A/Colorado/10011/2019</td>
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<td>160</td>
<td>PMK</td>
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<tr>
<td>A(H3N2) A/Washington/9903/2019</td>
<td>320</td>
<td>320</td>
<td>160</td>
<td>SIAT1</td>
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## Microneutralization Titers for Influenza Virus B samples

<table>
<thead>
<tr>
<th>Reference Antiserum</th>
<th>B/Colorado/06/2017</th>
<th>B/Phukett/3073/2013</th>
<th>Passage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference Virus</strong></td>
<td></td>
<td></td>
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<tr>
<td>B/Vic</td>
<td>B/Colorado/06/2017</td>
<td>2560</td>
<td>40</td>
</tr>
<tr>
<td>B/Yam</td>
<td>B/Phukett/3073/2013</td>
<td>80</td>
<td>1280</td>
</tr>
<tr>
<td><strong>Test Antigens</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Georgia/9912/2019</td>
<td>3620</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Kentucky/9915/2019</td>
<td>3620</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Kentucky/9914/2019</td>
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<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Kentucky/9917/2019</td>
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<tr>
<td>B/Vic</td>
<td>B/Washington/10133/2019</td>
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<td>&lt;40</td>
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<tr>
<td>B/Vic</td>
<td>B/Texas/10099/2019</td>
<td>3620</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Texas/10098/2019</td>
<td>2560</td>
<td>&lt;40</td>
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<tr>
<td>B/Vic</td>
<td>B/Nevada/10096/2019</td>
<td>2560</td>
<td>&lt;40</td>
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<td>B/Vic</td>
<td>B/Italy/9913/2019</td>
<td>3620</td>
<td>&lt;40</td>
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<tr>
<td>B/Vic</td>
<td>B/Virginia/10132/2019</td>
<td>1280</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Texas/10100/2019</td>
<td>640</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/South Carolina/10097/2019</td>
<td>1810</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Kentucky/10040/2019</td>
<td>905</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Colorado/10036/2019</td>
<td>2560</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Arizona/10034/2019</td>
<td>1810</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Yam</td>
<td>B/Nevada/9922/2019</td>
<td>&lt;40</td>
<td>2560</td>
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<tr>
<td>B/Vic</td>
<td>B/Washington/10133/2019</td>
<td>640</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Colorado/10036/2019</td>
<td>320</td>
<td>&lt;40</td>
</tr>
<tr>
<td>B/Vic</td>
<td>B/Florida/10037/2019</td>
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<td>B/Vic</td>
<td>B/Washington/10009/2019</td>
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<td>B/Vic</td>
<td>B/Washington/10010/2019</td>
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<td>&lt;40</td>
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</tbody>
</table>
Antigenic Characterization Summary

**Antigenically similar to NH 2019-20 vaccine***

**Antigenically Low to NH 2019-20 vaccine***

*Against reference viruses representing NH 2019-20 vaccine component:
- A(H1N1)pdm09 - A/Brisbane/02/2018
- A(H3N2) – A/Kansas/14/2017
- B/Yam - B/Phuket/3073/2013
- B/Vic – B/Colorado/06/2017

```
Antigenically similar to NH 2019-20 vaccine

Antigenically Low to NH 2019-20 vaccine
```

```
<table>
<thead>
<tr>
<th>Virus</th>
<th>Antigenic Similarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1N1pdm09</td>
<td>≈ 100</td>
</tr>
<tr>
<td>H3N2</td>
<td>≈ 90</td>
</tr>
<tr>
<td>B Victoria</td>
<td>≈ 80</td>
</tr>
<tr>
<td>B Yamagata</td>
<td>≈ 70</td>
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</tbody>
</table>
```
Midseason
Vaccine Effectiveness (VE) Estimates
VE Preview

• Mid-year estimates provided by:
  – AFHSB AF Satellite - US Air Force School of Aerospace Medicine (USAFSAM)
  – Naval Health Research Center (NHRC)
  – AFHSB Epidemiology and Analysis Section

• Case test-negative control studies used to estimate VE
  – All studies used case test-negative control method
  – Each influenza infection from USAFSAM and NHRC was confirmed by RT-PCR or viral culture; AFHSB also used positive rapid tests (but excluded rapid test negatives)
  – Analyses performed for influenza types and subtypes

“Medically Ready Force...Ready Medical Force”
AFHSB Air Force Satellite / USAFSAM Analyses

“Medically Ready Force...Ready Medical Force”
**DoD Beneficiaries & U.S.-Mexico Border Civilians**

- **Adjusted Estimates of Vaccine Effectiveness**
  - Population: DoD healthcare beneficiaries (excluding Service Members) and civilian populations at clinics near the U.S.–Mexico border (Border Infectious Disease Surveillance; BIDS)
  - Time period: November 3, 2019 – February 15, 2020 (Weeks 45-07)

<table>
<thead>
<tr>
<th>Analysis by influenza type/subtype</th>
<th>Analysis by population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>Overall</td>
</tr>
<tr>
<td>B</td>
<td>Children</td>
</tr>
<tr>
<td>A (any influenza A specimen)</td>
<td>Adults</td>
</tr>
<tr>
<td>A(H1N1)pdm09</td>
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</tr>
<tr>
<td>A(H3N2)</td>
<td></td>
</tr>
</tbody>
</table>

- Insufficient data for a 65+ age group & adult A(H3N2) analysis
- Adjusted for age group, time of specimen collection, location, and gender

"Medically Ready Force...Ready Medical Force"
DoD Beneficiaries & U.S.-Mexico Border Civilians

- **Laboratories Contributing Specimens for VE Analysis (n=3,745)**
  - US Air Force School of Aerospace Medicine (USAFSAM) n = 3,375
  - Landstuhl Regional Medical Center (LRMC) n = 234
  - Naval Health Research Center (NHRC) n= 136

- **Adjusted Estimates of Vaccine Effectiveness**
  - Cases: n =1,595; confirmed by RT-PCR or viral culture
  - Controls: n=2,150; test-negative
  - Vaccination rates: cases 43%, controls 57%

- Of total cases:
  - 23% were influenza B
  - 18% were influenza A(H1N1)pdm09
  - 2% were influenza A (H3N2)
  - 0.1% were influenza A/Not Subtyped

"Medically Ready Force...Ready Medical Force"
Characteristics of Cases and Controls (n=3,745)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Cases (n=1,595) No. (%)</th>
<th>Controls (n=2,150) No. (%)</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>715 (44.83)</td>
<td>828 (38.51)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Female</td>
<td>880 (55.17)</td>
<td>1,322 (61.49)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
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<tr>
<td>2-8</td>
<td>624 (39.12)</td>
<td>747 (34.74)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>9-17</td>
<td>423 (26.52)</td>
<td>378 (17.58)</td>
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<tr>
<td>18-49</td>
<td>334 (20.94)</td>
<td>584 (27.16)</td>
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<tr>
<td>50-64</td>
<td>168 (10.53)</td>
<td>274 (12.74)</td>
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<tr>
<td>65+</td>
<td>46 (2.88)</td>
<td>167 (7.77)</td>
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<tr>
<td>Month of illness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>139 (8.71)</td>
<td>447 (20.79)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>December</td>
<td>375 (23.51)</td>
<td>643 (29.91)</td>
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</tr>
<tr>
<td>January</td>
<td>732 (45.89)</td>
<td>732 (34.05)</td>
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</tr>
<tr>
<td>February</td>
<td>349 (21.88)</td>
<td>328 (15.26)</td>
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<tr>
<td>Geographic Region</td>
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<tr>
<td>Eastern CONUS</td>
<td>595 (37.30)</td>
<td>750 (34.88)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Western CONUS</td>
<td>769 (48.21)</td>
<td>918 (42.70)</td>
<td></td>
</tr>
<tr>
<td>OCONUS</td>
<td>231 (14.48)</td>
<td>482 (22.42)</td>
<td></td>
</tr>
<tr>
<td>Surveillance Hub</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LRMC</td>
<td>56 (3.51)</td>
<td>178 (8.28)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>NHRC</td>
<td>52 (3.26)</td>
<td>84 (3.91)</td>
<td></td>
</tr>
<tr>
<td>USAFSAM</td>
<td>1,487 (93.23)</td>
<td>1,888 (87.81)</td>
<td></td>
</tr>
<tr>
<td>Vaccination Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccinated</td>
<td>690 (43.26)</td>
<td>1,205 (56.05)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Unvaccinated</td>
<td>905 (56.74)</td>
<td>945 (43.95)</td>
<td></td>
</tr>
<tr>
<td>Flu</td>
<td></td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>B</td>
<td>845 (52.98)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>A(H1N1)pdm09</td>
<td>680 (42.63)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>A(H3N2)</td>
<td>66 (4.14)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>A/Not Subtyped</td>
<td>4 (0.25)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Not Flu</td>
<td>0 (0)</td>
<td>2150 (100)</td>
<td></td>
</tr>
</tbody>
</table>

CONUS=Continental United States; OCONUS=Outside Continental United States; LRMC=Landstuhl Regional Medical Center; NHRC=Naval Health Research Center; USAFSAM=United States Air Force School of Aerospace Medicine
Summary of DoD Dependents and U.S.-Mexico Border VE Results

“Medically Ready Force...Ready Medical Force”
## Adjusted VE Estimates 2019-2020

<table>
<thead>
<tr>
<th>Type</th>
<th>Population</th>
<th>Vaccine Status</th>
<th>Cases (%)</th>
<th>Controls (%)</th>
<th>Crude VE (95% CI)</th>
<th>Adjusted VE* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall</strong></td>
<td>All Dependents</td>
<td>Vaccinated</td>
<td>690 (18)</td>
<td>1205 (32)</td>
<td>40 (32, 48)</td>
<td>54 (46, 60)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>905 (24)</td>
<td>945 (25)</td>
<td>39 (28, 49)</td>
<td>47 (35, 56)</td>
</tr>
<tr>
<td></td>
<td>Children (2-17 yrs)</td>
<td>Vaccinated</td>
<td>459 (21)</td>
<td>632 (29)</td>
<td>39 (28, 49)</td>
<td>47 (35, 56)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>588 (27)</td>
<td>493 (23)</td>
<td>42 (29, 53)</td>
<td>48 (35, 59)</td>
</tr>
<tr>
<td></td>
<td>Adults (≥18)</td>
<td>Vaccinated</td>
<td>228 (15)</td>
<td>564 (36)</td>
<td>51 (43, 59)</td>
<td>51 (41, 59)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>317 (20)</td>
<td>452 (29)</td>
<td>56 (39, 68)</td>
<td>52 (31, 67)</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>All Dependents</td>
<td>Vaccinated</td>
<td>323 (11)</td>
<td>1205 (40)</td>
<td>25 (11, 36)</td>
<td>45 (33, 54)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>522 (17)</td>
<td>945 (32)</td>
<td>34 (16, 48)</td>
<td>55 (42, 66)</td>
</tr>
<tr>
<td></td>
<td>Children (2-17 yrs)</td>
<td>Vaccinated</td>
<td>255 (14)</td>
<td>632 (35)</td>
<td>51 (40, 59)</td>
<td>54 (43, 63)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>402 (23)</td>
<td>493 (28)</td>
<td>38 (20, 52)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adults (≥18)</td>
<td>Vaccinated</td>
<td>66 (5)</td>
<td>564 (47)</td>
<td>56 (39, 68)</td>
<td>52 (31, 67)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>120 (10)</td>
<td>452 (38)</td>
<td>56 (39, 68)</td>
<td>52 (31, 67)</td>
</tr>
<tr>
<td><strong>A</strong></td>
<td>All Dependents</td>
<td>Vaccinated</td>
<td>367 (13)</td>
<td>1205 (42)</td>
<td>23 (9, 36)</td>
<td>42 (29, 52)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>383 (13)</td>
<td>945 (33)</td>
<td>31 (9, 48)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Children (2-17 yrs)</td>
<td>Vaccinated</td>
<td>204 (13)</td>
<td>632 (42)</td>
<td>14 (-8, 32)</td>
<td>38 (20, 52)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>186 (12)</td>
<td>493 (33)</td>
<td>34 (16, 48)</td>
<td>55 (42, 66)</td>
</tr>
<tr>
<td></td>
<td>Adults (≥18)</td>
<td>Vaccinated</td>
<td>162 (12)</td>
<td>564 (41)</td>
<td>34 (16, 48)</td>
<td>55 (42, 66)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>197 (14)</td>
<td>452 (33)</td>
<td>34 (16, 48)</td>
<td>55 (42, 66)</td>
</tr>
<tr>
<td><strong>A(H1N1)pdm09</strong></td>
<td>All Dependents</td>
<td>Vaccinated</td>
<td>336 (12)</td>
<td>1205 (43)</td>
<td>23 (9, 36)</td>
<td>42 (29, 52)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>344 (12)</td>
<td>945 (33)</td>
<td>31 (9, 48)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Children (2-17 yrs)</td>
<td>Vaccinated</td>
<td>188 (13)</td>
<td>632 (43)</td>
<td>11 (-14, 30)</td>
<td>31 (9, 48)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>164 (11)</td>
<td>493 (33)</td>
<td>35 (16, 49)</td>
<td>56 (43, 67)</td>
</tr>
<tr>
<td></td>
<td>Adults (≥18)</td>
<td>Vaccinated</td>
<td>147 (11)</td>
<td>564 (42)</td>
<td>35 (16, 49)</td>
<td>56 (43, 67)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>180 (13)</td>
<td>452 (34)</td>
<td>35 (16, 49)</td>
<td>56 (43, 67)</td>
</tr>
<tr>
<td><strong>A(H3N2)</strong></td>
<td>All Dependents</td>
<td>Vaccinated</td>
<td>29 (1)</td>
<td>1205 (54)</td>
<td>39 (-1, 62)</td>
<td>60 (33, 76)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>37 (2)</td>
<td>945 (43)</td>
<td>39 (-1, 62)</td>
<td>60 (33, 76)</td>
</tr>
<tr>
<td></td>
<td>Children (2-17 yrs)</td>
<td>Vaccinated</td>
<td>15 (1)</td>
<td>632 (54)</td>
<td>44 (-9, 72)</td>
<td>73 (43, 87)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>21 (2)</td>
<td>493 (42)</td>
<td>44 (-9, 72)</td>
<td>73 (43, 87)</td>
</tr>
</tbody>
</table>

CI=confidence interval; VE=(1-odds ratio) x 100.

*VE Adjusted for age group, time of specimen collection, location, and gender

"Medically Ready Force...Ready Medical Force"
Summary of DoD Beneficiaries & U.S.-Mexico Border Civilians

• Overall VE was moderately protective and significant

• A(H1N1)pdm09: VE was highest among adults at 56%

• A(H3N2): VE was highest among children at 73%

• B: VE was highest among children at 54%
Service Member Vaccine Effectiveness Estimates
Service Members: Study Design

- Case / Test-negative control design
- Population: Active component Service Members
  - Army, Navy, Air Force, Marines
  - CONUS and OCONUS
- Time Period:
  - Influenza B and A(H1N1): Restricted to peak influenza months (Nov 1 – Feb 15)
  - Influenza A (any subtype) and A(H3N2): Restricted to peak Flu A months (Jan 1- Feb 15)
- Lab-confirmed flu cases: positive by rapid, RT-PCR, or culture assays
- Test-negative Controls: negative by RT-PCR or culture assays (subjects with negative rapid excluded)
- Models adjusted for sex, age category, and month of diagnosis
- Type and sub-type VE calculated, if analysis supported by data

“Medically Ready Force...Ready Medical Force”
Service Members: Vaccination Information & Case Subtypes

• Vaccination
  – IIV was the only vaccine type among the study subjects
  – 92% of subjects had prior flu vaccine in previous 5 years

• Cases
  – Influenza A (any subtype) = 1,911
  – Influenza A(H3N2) = 37
  – Influenza A(H1N1) = 347
  – Influenza B = 2,033
Service Members: Cases and Controls by Age Group

“Medically Ready Force...Ready Medical Force”
## Service Members: Interim VE Estimates 2019-2020

<table>
<thead>
<tr>
<th>Influenza Type/Subtype</th>
<th>Time Period</th>
<th>Vaccine Type</th>
<th>Cases N (%)</th>
<th>Controls N (%)</th>
<th>Crude VE (95% CI)</th>
<th>Adjusted VE (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza A (any subtype)</td>
<td>JAN-FEB</td>
<td>Vaccinated</td>
<td>1732 (91)</td>
<td>2038 (92)</td>
<td>13 (-8, 30)</td>
<td>12 (-10, 30)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>179 (9)</td>
<td>184 (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A(H1N1)</td>
<td>JAN-FEB</td>
<td>Vaccinated</td>
<td>308 (89)</td>
<td>2038 (92)</td>
<td>29 (-3, 51)</td>
<td>28 (-5, 51)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>39 (11)</td>
<td>184 (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A(H3N2)</td>
<td>NOV-FEB</td>
<td>Vaccinated</td>
<td>22 (59)</td>
<td>3699 (74)</td>
<td>49 (2, 74)</td>
<td>58 (9, 80)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>15 (41)</td>
<td>1283 (26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influenza B</td>
<td>NOV-FEB</td>
<td>Vaccinated</td>
<td>1515 (75)</td>
<td>3699 (74)</td>
<td>-1 (-14, 10)</td>
<td>31 (20, 40)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unvaccinated</td>
<td>518 (25)</td>
<td>1283 (26)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Adjusted for sex, age, and month of diagnosis

*Medically Ready Force...Ready Medical Force*
Among Service Members, the 2019-2020 influenza vaccine provided:

- Low to moderate protection against influenza B (31%)
- Moderate protection against A(H3N2) (58%)
- Non-statistically significant low protection against influenza overall (12%) and A(H1N1) (28%)
Summary of DoD VE Results

Influenza Midseason Vaccine Effectiveness 2019-2020

Overall---DoD Dependents/BIDS---54 (46, 60)
B---DoD Dependents/BIDS---51 (41, 59)
B---Service Members---31 (20, 40)
A (all subtypes)---DoD Dependents/BIDS---45 (33, 54)
A (all subtypes)---Service Members---12 (-10, 30)
A(H1N1)pdm09---DoD Dependents/BIDS---42 (29, 52)
A(H1N1)pdm09---Service Members---28 (-5, 51)
A(H3N2)---DoD Dependents/BIDS---60 (33, 76)
A(H3N2)---Service Members---58 (9, 80)

“Medically Ready Force...Ready Medical Force”
Summary of DoD VE Results

• Statistically significant VE estimates indicated an overall midseason VE of 54%
  – VE for influenza A 45%, indicating moderate protection
  – VE for influenza B ranged from 31-51%, indicating low to moderate protection
  – VE for A(H1) and ranged 42%, indicating moderate protection
  – Protection was best for A(H3) and ranged from 58-60%, indicating moderate protection
Limitations

• Generalizability
  – Subjects were medically attended; did not assess vaccine impact on less severe cases
  – Active Duty military population is highly immunized; this could have a negative impact on VE (potential method issues and biological effects such as attenuated immune response with repeated exposures)
  – Populations are younger; did not assess vaccine impact in older, high-risk populations
Vaccine Strain Recommendations

• Based on the genetic and VE data, recommendations for the 2020-2021 influenza vaccine
  – For the 2019-2020 influenza vaccine A(H1N1) component: Consider alternate to A/Brisbane/02/2018-like virus, potentially a clade 6B.1A, subgroup 5A representative virus
  – For the 2019-2020 influenza vaccine A(H3N2) component: Consider transition to H3N2 3C.2a1b clade virus
  – For the 2019-2020 influenza vaccine B/Victoria component: Consider replacement of B/Colorado/06/2017-like virus with representative 3-deletion virus
  – The above three influenza strains are recommended for the trivalent vaccine, and for the quadrivalent vaccine to include these three in addition to the B/Yamagata component: maintain the B/Phuket/3073/2013-like virus
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Ms. Hee Eun Kim

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COL Norm Waters
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“Medically Ready Force...Ready Medical Force”
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SSgt Ashley Serrano
SrA Dalton Barrie
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Ms. Alexis Oetting

“Medically Ready Force...Ready Medical Force”

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