

# DoD Influenza Surveillance and Mid-Season Vaccine Effectiveness

Armed Forces Health Surveillance Division (AFHSD)

Naval Health Research Center (NHRC)

United States Air Force School of Aerospace Medicine (USAFSAM)

DoD Global Respiratory Pathogen Surveillance Program Partners

**Presentation to the Vaccines and Related Biological Products Advisory Committee  
(VRBPAC) – 5 March 2021**

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



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# Briefing Outline



**Purpose: Provide an update to the VRBPAC on DoD influenza surveillance activities for 2020 -2021**

1. Program Description
2. DoD Strain Circulation
3. **Limited** Molecular Analyses
4. Vaccine Effectiveness **in US Service Members**

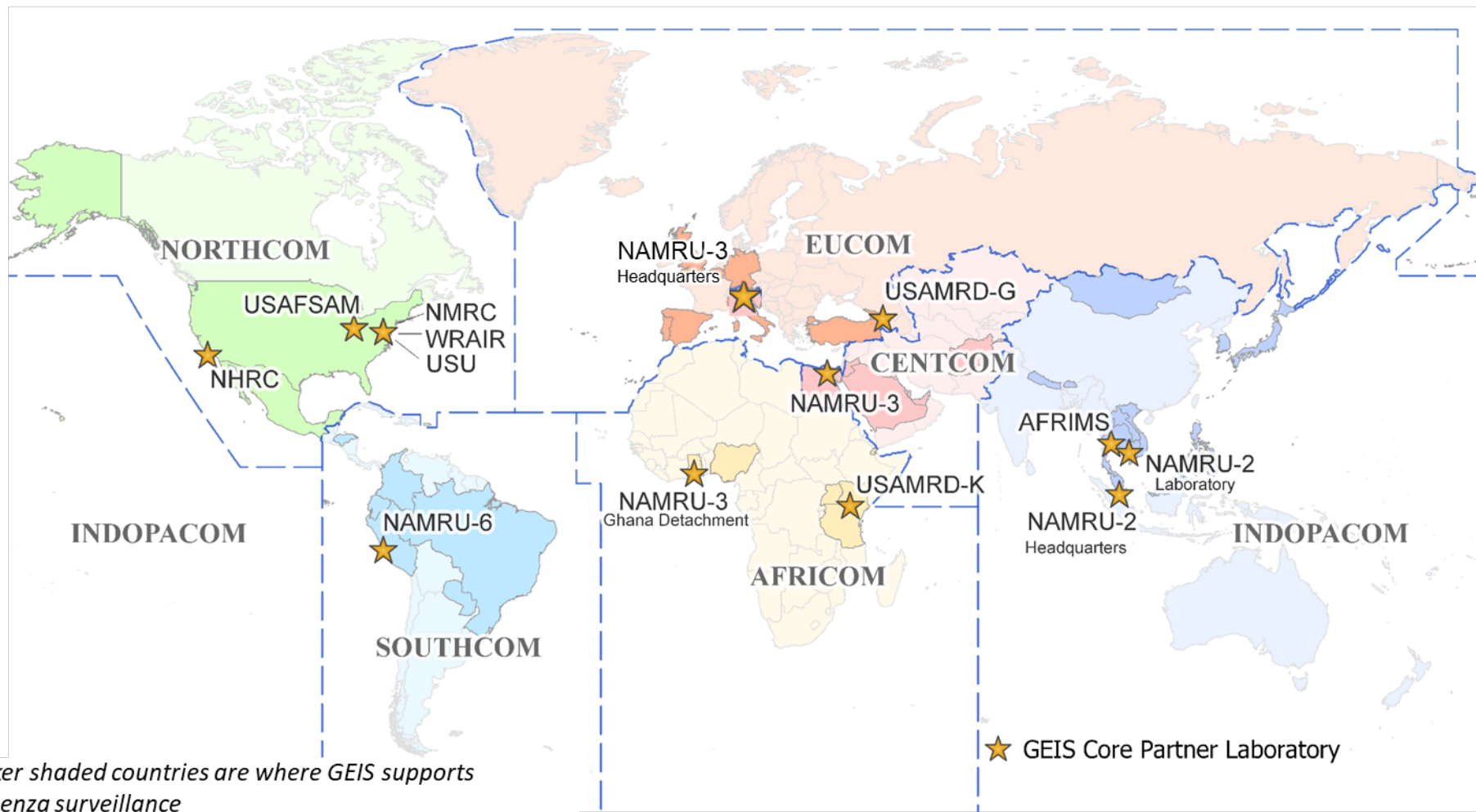
# Breadth of DoD Influenza Surveillance



- **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**
  - 1.33 Million Active Duty records (health care utilization, immunizations, deployment, reportable diseases, etc.)
    - Produce Medical Surveillance Monthly Report (MSMR), ad-hoc requests, studies/analyses,
    - Weekly influenza reports
    - Vaccine safety and effectiveness studies

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# GEIS-Supported Influenza Surveillance Footprint



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# DoD Influenza Subtype Circulation



- **Common themes for the 2020-2021 season**
  - ALL laboratories and nations affected by the SARS-CoV-2 pandemic
  - Extensive restrictions and lockdowns (as well as high viral transmissibility) resulted in reagent shortages, shipping delays, staffing reductions, and low enrollment
  - Shift to testing and assay validation for SARS-CoV-2 over influenza
  - Surveillance estimates for DoD on the next few slides are dramatically lower than usual, and data was unable to be obtained for some countries
- **Country-specific examples**
  - Peru: nationwide shutdowns
  - Kenya/Tanzania: delay in shipments of reagents
  - Republic of Georgia: border shutdown

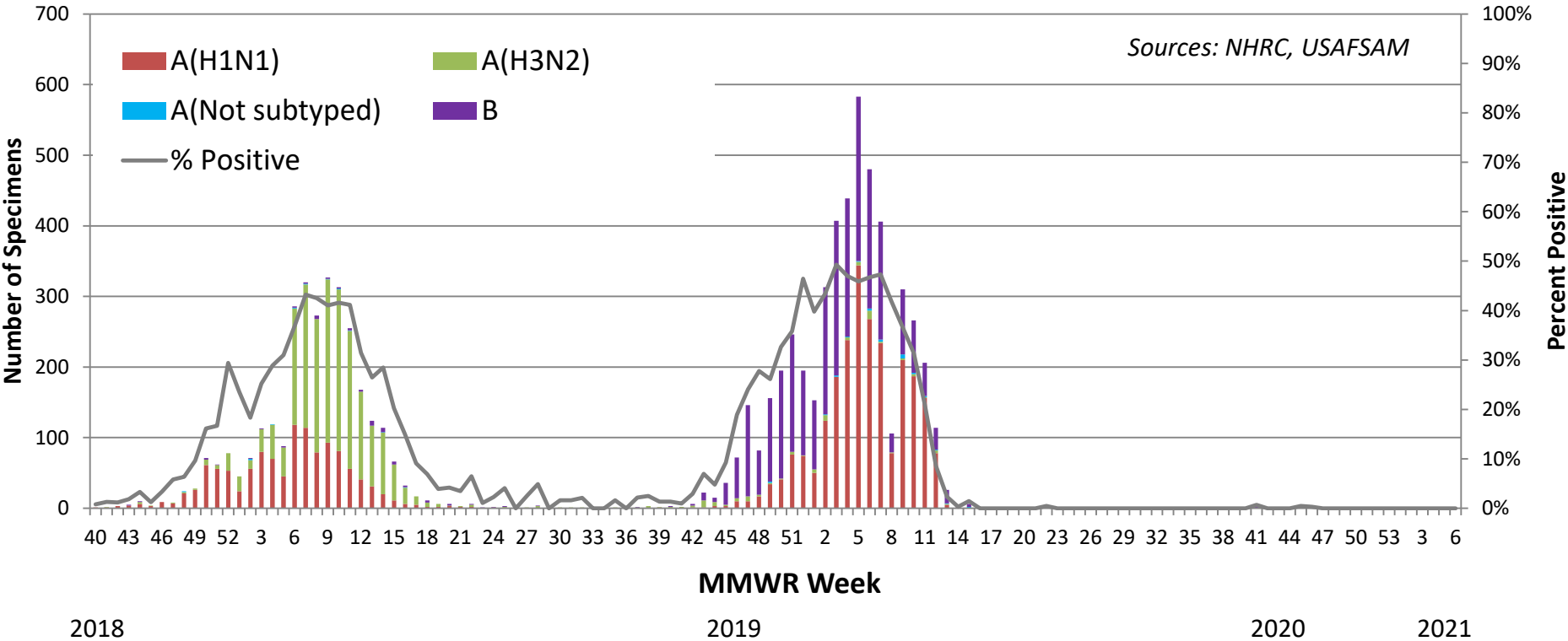
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# Subtype Circulation: North America



Number and Proportion of Specimens Positive for Influenza by Subtype

**PANDEMIC: Jan 2020 - present**



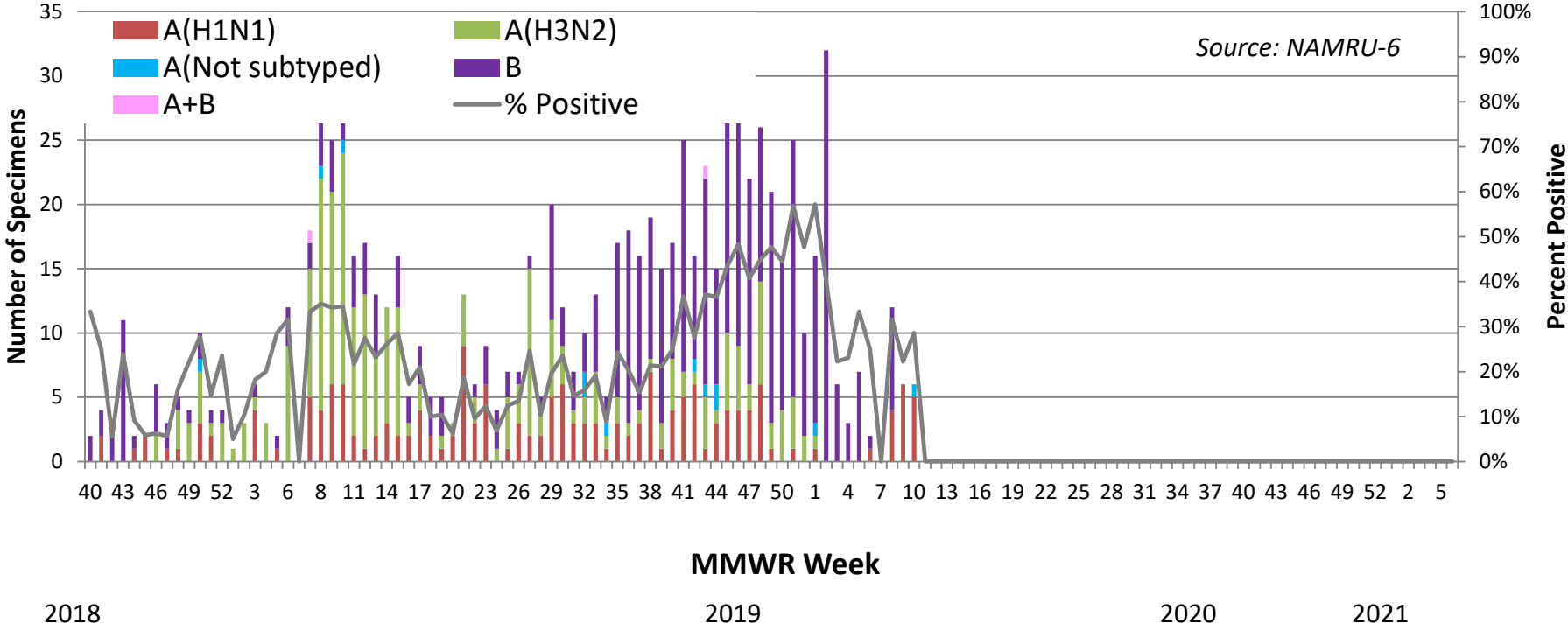
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# Subtype Circulation: South America



Number and Proportion of Specimens Positive for Influenza by Subtype

**PANDEMIC: Jan 2020 - present**



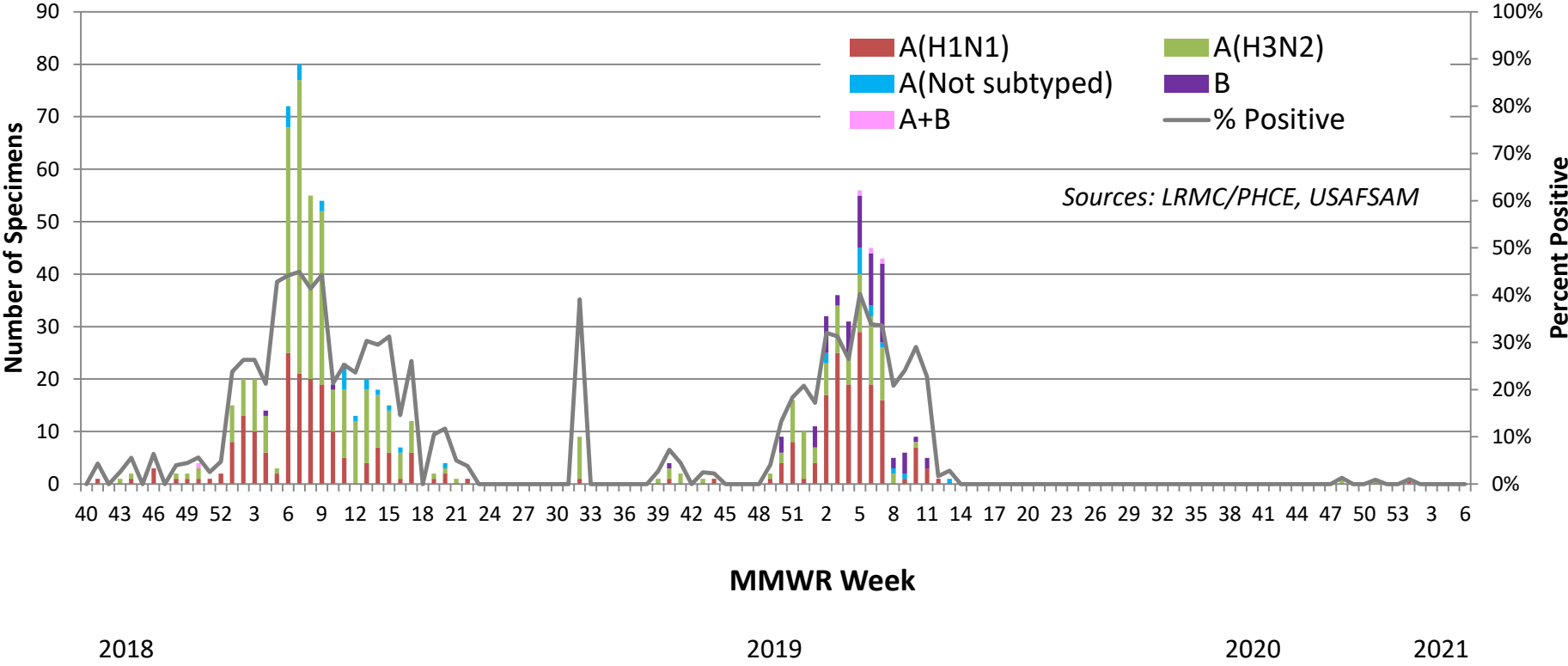
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# Subtype Circulation: Europe



Number and Proportion of Specimens Positive for Influenza by Subtype

**PANDEMIC: Jan 2020 - present**



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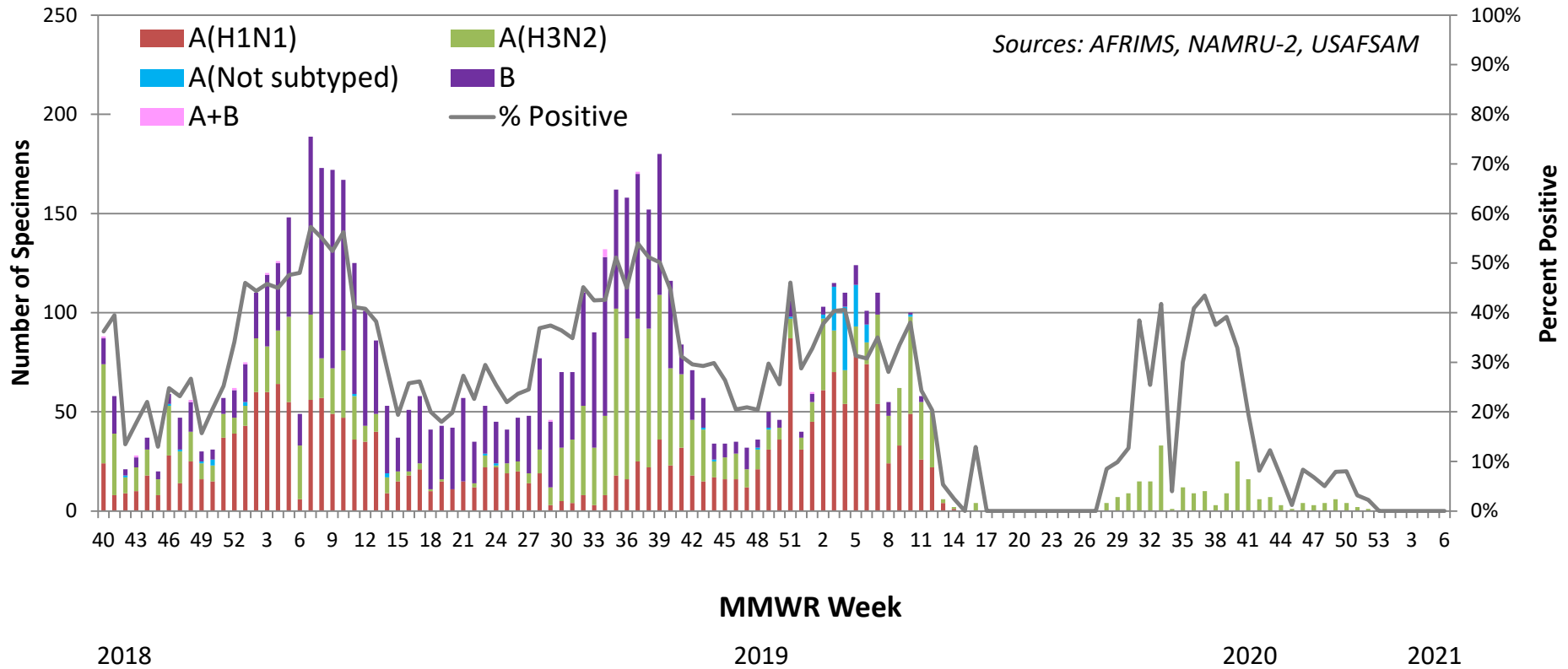


# Subtype Circulation: Asia



Number and Proportion of Specimens Positive for Influenza by Subtype

**PANDEMIC: Jan 2020 - present**



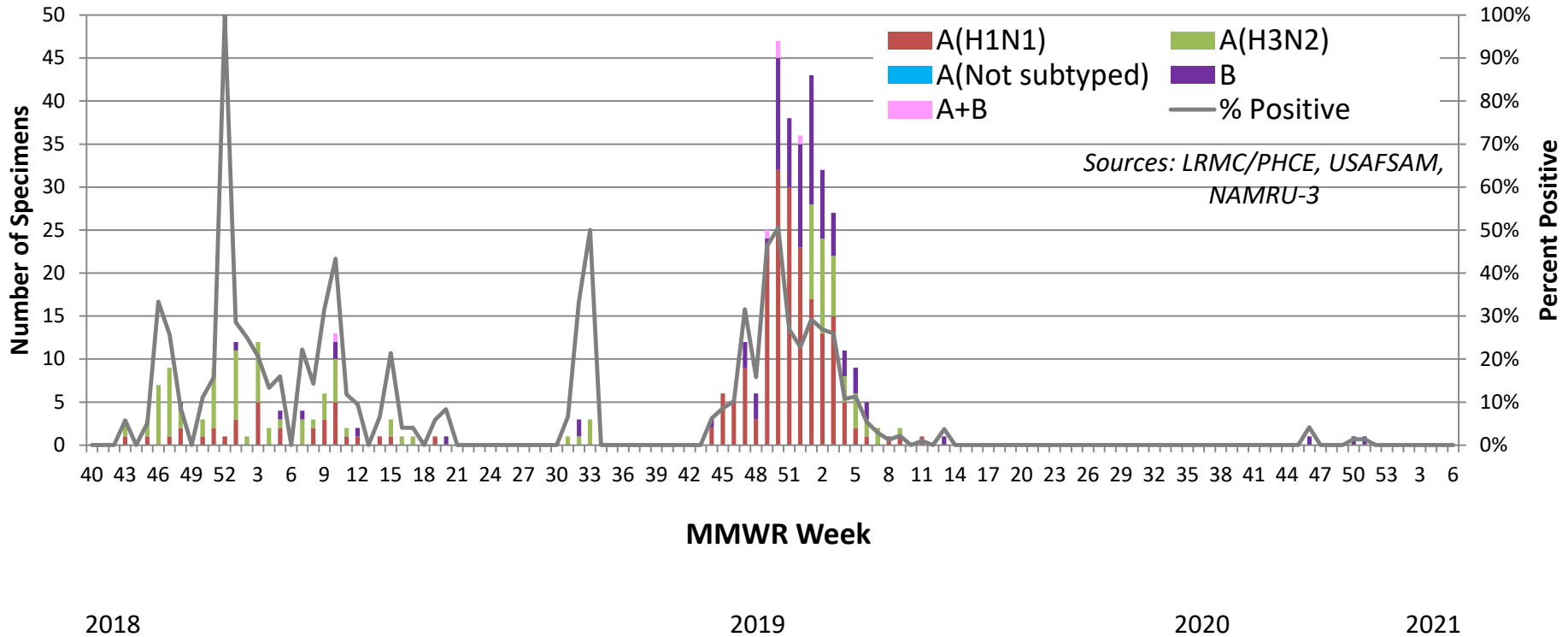
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# Subtype Circulation: Middle East



Number and Proportion of Specimens Positive for Influenza by Subtype

**PANDEMIC: Jan 2020 - present**



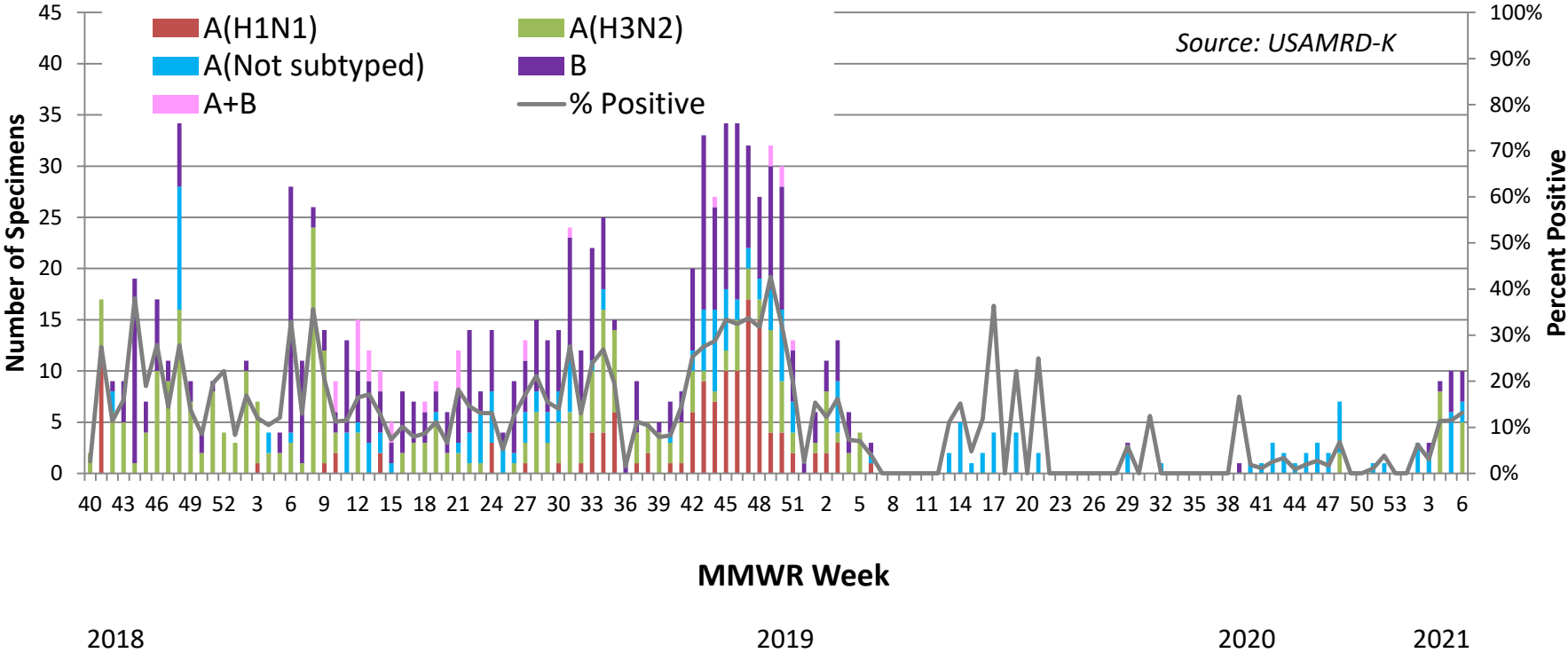
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# Subtype Circulation: East Africa



Number and Proportion of Specimens Positive for Influenza by Subtype

**PANDEMIC: Jan 2020 - present**



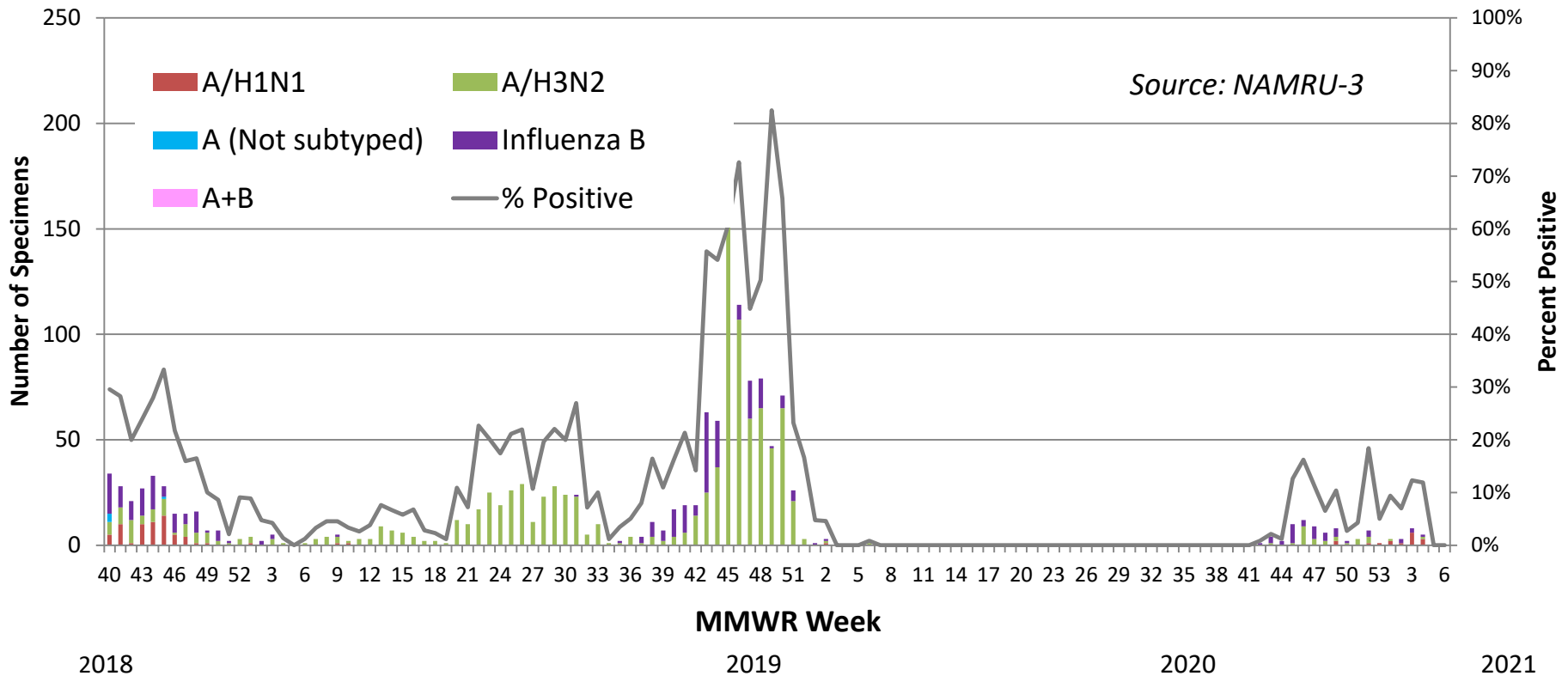
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# Subtype Circulation: West Africa (Ghana)



Number and Proportion of Specimens Positive for Influenza by Subtype

**PANDEMIC: Jan 2020 - present**



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# Summary of Circulating Subtype 2020-2021 Influenza Season



- Influenza surveillance has been **limited** during the 2020-2021 season and positivity is much lower compared to previous seasons
  - **North America:** no positive cases reported in the past several weeks
  - **South America:** no positive cases reported in the past several weeks
  - **Europe:** reduced testing with few **influenza A** cases
  - **Asia:** shows **A(H3N2)** predominating at lower levels in weeks 29-42, but disappearing after week 52
  - **Middle East:** limited testing with sparse **influenza B**
  - **East Africa:** shows **influenza A** predominating at lower levels with **influenza B** beginning to circulating after week 5
  - **West Africa:** shows **A(H3N2)** and **influenza B** predominating at lower levels compared to previous season

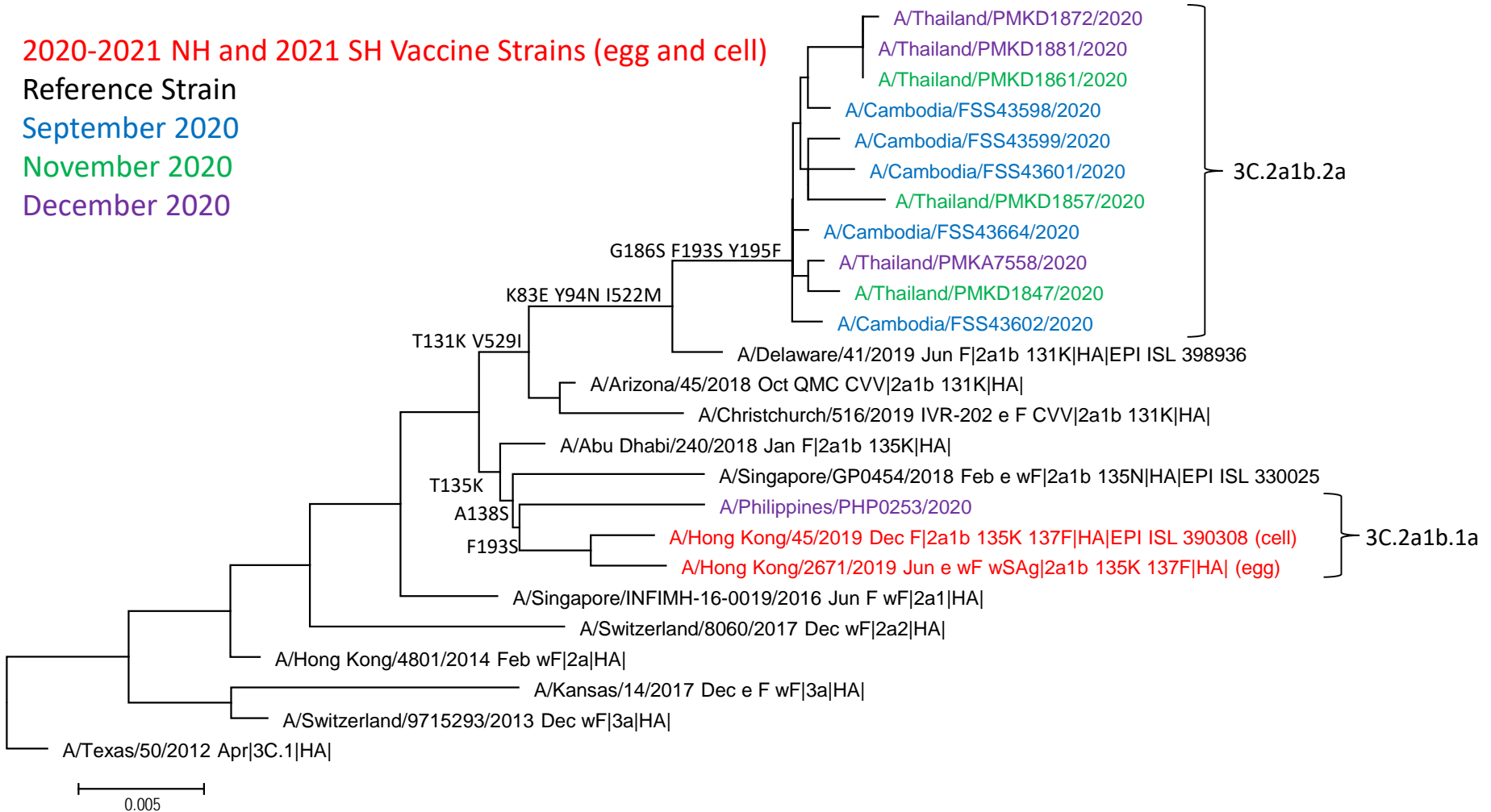
# **DoD / USAFSAM Phylogenetic Analysis 2020-2021 Influenza Season**

# 2020-2021 A(H3N2) HA Phylogenetic Tree (n=12)



2020-2021 NH and 2021 SH Vaccine Strains (egg and cell)

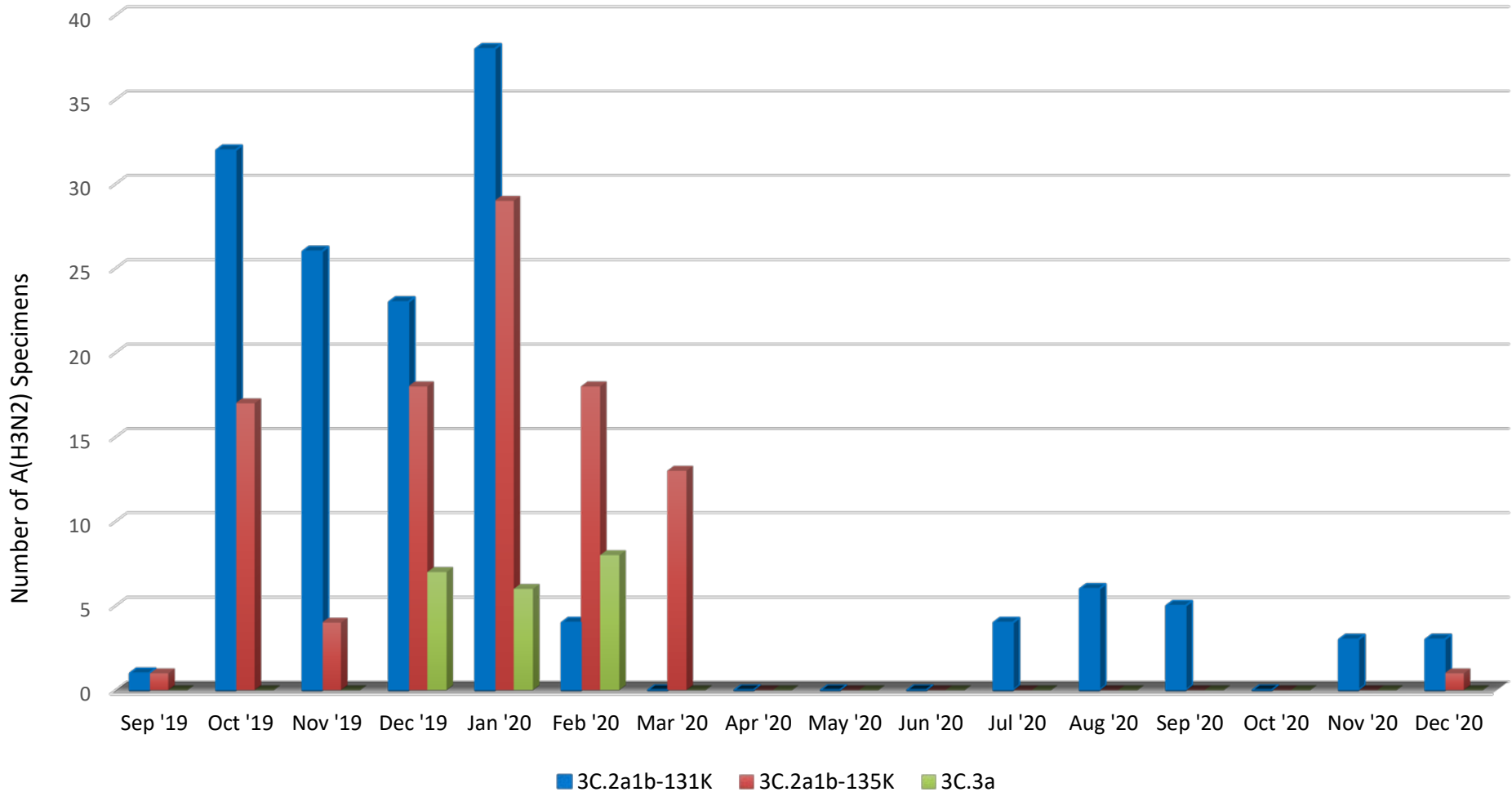
Reference Strain  
September 2020  
November 2020  
December 2020



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# A(H3N2) HA Clades

## Sep 2019-Dec 2020



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# Discussion



- Influenza rates were very low in the 2020-2021 season, resulting in only 12 influenza A(H3N2) sequences from the INDOPACOM region available for analysis
- All influenza A(H3N2) HA sequences resided in the 3C.2a1b clade with the majority (92%) in subgroup T131K (3C.2a1b.2a) with the remaining sequence in the T135K group (3C.2a1b.1a)
- The WHO strain recommendation for the 2021-2022 Northern Hemisphere influenza vaccine A(H3N2) component, A/Cambodia/e0826360/2020 for the egg-based and cell- or recombinant-based vaccine, inhibit viruses in the 3C.2a1b.1a and 3C.2a1b.2a clades well
- No influenza A(H1N1)pdm09, B/Victoria, or B/Yamagata sequence data were available for the 2020-2021 season, however the strain clades circulating in the USAFSAM/DoD data at the end of the 2019-2020 season were consistent with the WHO strain recommendations for the 2021-2022 Northern Hemisphere influenza vaccine

# Vaccine Strain Recommendations



Based on both the 2019-2020 and 2020-2021 seasons, our genetic data align well with the following WHO recommendations for the 2021-2022 Northern Hemisphere influenza vaccine:

- For the 2021-2022 influenza vaccine A(H1N1) component: A/Victoria/2570/2019-like virus for the egg-based vaccine and A/Wisconsin/588/2019-like virus for the cell- or recombinant-based vaccine
- For the 2021-2022 influenza vaccine A(H3N2) component: A/Cambodia/e0826360/2020-like virus for the egg-based and cell- or recombinant-based vaccine
- For the 2021-2022 influenza vaccine B/Victoria component: B/Washington/02/2019 for the egg-based and cell- or recombinant-based vaccines
- 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, B/Phuket/3073/2013-like virus for the egg-based and cell- or recombinant-based vaccines

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# **DoD / AFHSD Service Member Vaccine Effectiveness (VE) Estimates**

# Analysis Overview



- Mid-year estimates provided by:
  - AFHSD AF Satellite - US Air Force School of Aerospace Medicine (USAFSAM)
  - Naval Health Research Center (NHRC)
  - AFHSD Epidemiology and Analysis Section (E&A)
- 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; AFHSD also used positive rapid tests (but excluded rapid test negatives)
  - Analyses performed for influenza types and subtypes

# Study Design



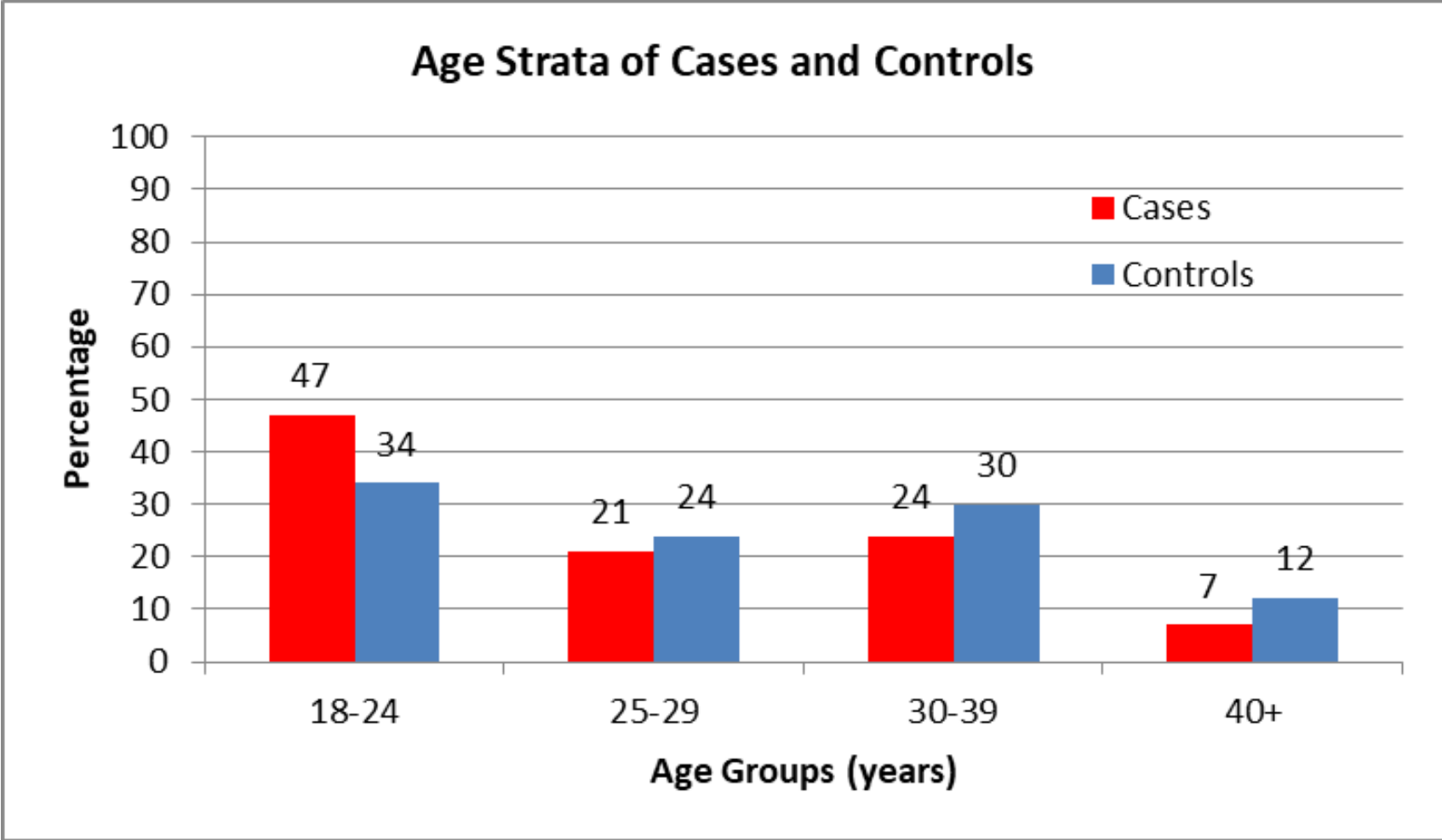
- Case / Test-negative control design
- Population: Active component Service Members
  - Army, Navy, Air Force, Marines
  - CONUS and OCONUS
- Time Period: October 4, 2020 – February 13, 2021
- Lab-confirmed flu cases: positive by rapid, RT-PCR, or culture assays
- Test-negative Controls: negative by RT-PCR or culture assays (subjects with negative rapid excluded)
- Models adjusted for sex, age category, prior vaccination, and month of diagnosis
- Overall and type-specific VE calculated (data did not support sub-type analysis)

# Vaccination Information & Case Subtypes



- Vaccination
  - IIV was the only vaccine type among the study subjects
  - 95% of subjects had prior flu vaccine in previous 5 years
- Cases
  - Influenza A (any subtype) = 219
  - Influenza A(H3N2) = 0
  - Influenza A(H1N1) = 1
  - Influenza B = 171

# Cases and Controls by Age Group



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# Interim VE Estimates 2020-2021



Influenza Type	Vaccination Status	Cases N (%)	Controls N (%)	Crude VE (95% CI)	Adjusted VE (95% CI)*
Any Influenza	Vaccinated	141 (38)	7049 (56)	54 (43, 62)	29 (9, 44)
	Unvaccinated	234 (62)	5432 (44)		
Influenza A	Vaccinated	74 (34)	7049 (56)	61 (48, 70)	15 (-18, 39)
	Unvaccinated	145 (66)	5432 (44)		
Influenza B	Vaccinated	74 (43)	7049 (56)	41 (20, 57)	40 (16, 57)
	Unvaccinated	97 (57)	5432 (44)		

\*Adjusted for sex, age, and month of diagnosis



# Summary of DoD VE Results



- Statistically significant VE estimates indicated an overall midseason VE of **29% in Service members only**
  - VE for influenza B was 40%, indicating moderate protection
  - VE for influenza A was low, but not statistically significant (15%)
  - VE was unable to be calculated for other populations due to insufficient case numbers

- 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

# Acknowledgements



## AFHSD

COL Douglas Badzik  
COL James Stein  
CAPT Guillermo Pimentel  
CDR Mark Scheckelhoff  
Dr. Angelia Cost  
Dr. Jose "Toti" Sanchez  
Ms. Zheng Hu  
Ms. Ashley Treharne  
Ms. Alexis Oetting  
Dr. Sara Bazaco  
Ms. Lindsay Morton  
Dr. Kathleen Creppage

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Ms. Sarah Purves  
Ms. Lisa Shoubaki  
Ms. Caroline Smith  
Mr. Jeffrey Thervil  
Mr. Gregory Wolff

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Dr. Marita Silva  
Dr. Giselle Soto  
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Ms. Carolina Guevara

## NHRC

LT Nathaniel Christy  
Dr. Chris Myers  
Ms. Carrie Falgout  
Mr. Christian Hansen  
Ms. Erin Hansen

# Acknowledgements



## USAFSAM

Lt Col Anthony Robbins  
Capt Amy Bogue  
SSgt Dominic Anderson  
SSgt Brandon Ray  
SSgt Ashley Seaton  
SSgt Ashley Serrano  
SrA Dalton Barrie  
Dr. Anthony Fries  
Dr. Elizabeth Macias  
Ms. Pamela Bentley  
Mr. Matthew Couch  
Ms. Kathleen Davenport  
Ms. Carol Garrett  
Mr. William Gruner  
Mr. James Hanson  
Mr. Matthew Levine  
Mr. Andrew Martin  
Ms. Renee Mayhew  
Mr. Donald Minnich  
Ms. Dannielle Parlett  
Ms. Marie Powell  
Mr. Andrew Rhinevault  
Mr. Matthew Sanders  
Mr. David Sia  
Ms. Aleta Yount

## USAMRD-A

Maj Gen (Dr.) Denis Janga  
LTC John Distelhorst  
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Dr. Denis Byarugaba  
Dr. Bernard Erima  
Dr. Hannah Kibuuka  
Dr. Chesnodi Kulanga  
Dr. Gerald Misinzo  
Dr. Fred Wabwire-Mangen  
Ms. Janet Majanja  
Mr. Derrick Mimbe

## CA and County Depts of Health

Dr. Olivia Arizmendi  
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## CDC-BIDS

Dr. Kathleen Moser  
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## Central Public Health Lab, Jordan

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## Jordan Royal Medical Services

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# Questions?



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