

Surveillance Systems & Epidemiology of Influenza in India

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Influenza Surveillance system in India

- **Integrated Disease Surveillance Program-
National Centre for Disease Control**
- **Department of Health Research- Virology
Research and Diagnostic Laboratory network**
- **Indian Council of Medical Research-National
Institute of Virology (funded by GHSA)**

IDSP Influenza network



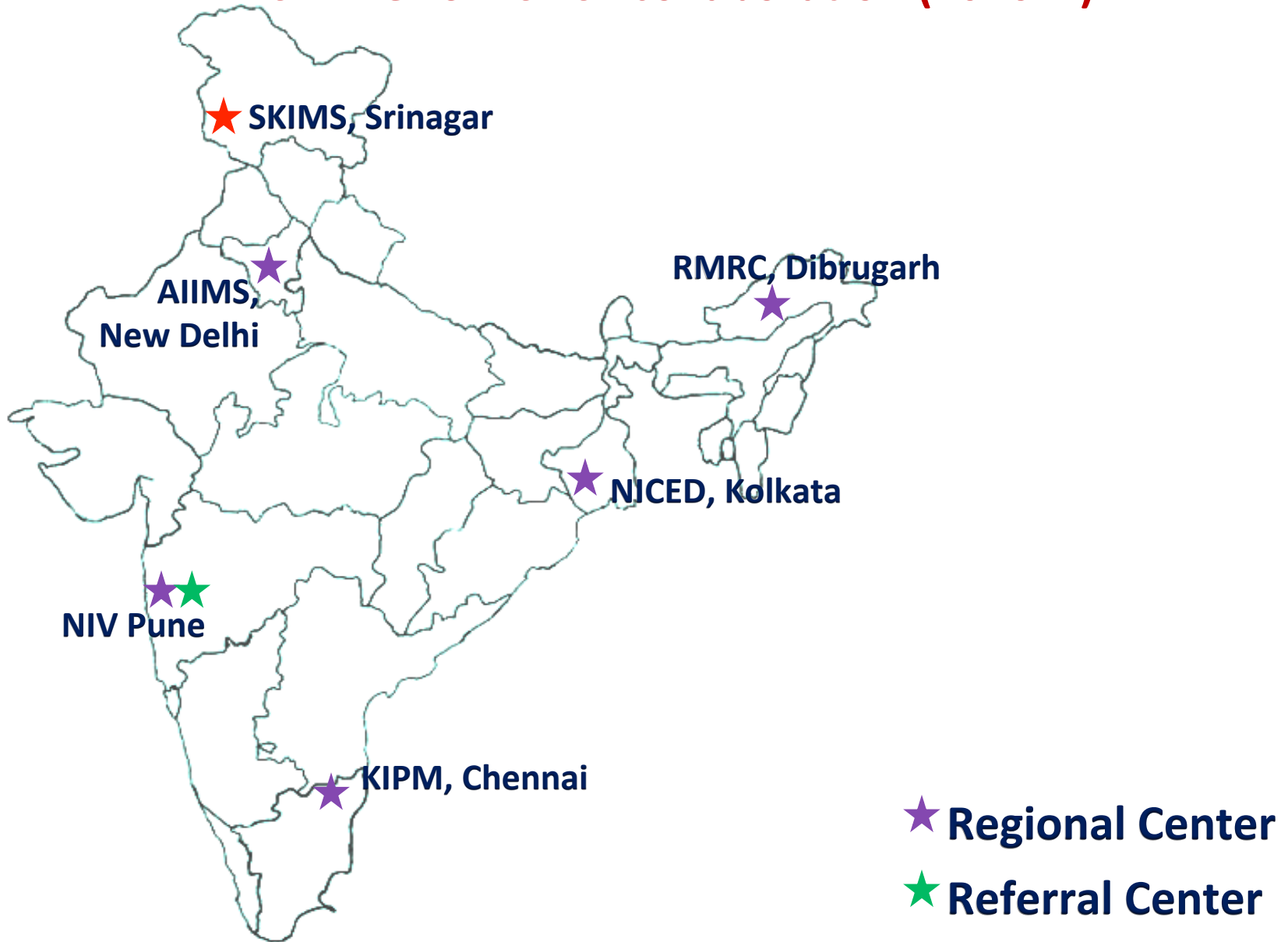
- Originally started as Avian Influenza (AI) labs in 2006 post AI outbreak in Nawapur. 12 regional labs
- Use syndromic case definition of ILI and SARI
- Weekly reporting of cases

DHR-VRDL network



DHR has initiated establishment of several Virus Research & Diagnostic Laboratories (VRDLs) across the country to provide diagnosis of viral diseases

ICMR-GHSA-CDC –collaboration (2016---



Objective of influenza surveillance (1)

- ✓ Describe **the seasonality** of influenza.
- ✓ Signal the **start and end** of the influenza season.
- ✓ Identify and monitor groups at **high risk of severe disease and mortality**.
- ✓ Establish baseline levels of activity for influenza and severe influenza-related disease with which to evaluate the impact and severity of each season and of future pandemic events.

Objective of influenza surveillance (2)

- ✓ Determine **influenza burden** to help decision-makers
- ✓ Identify **locally circulating virus types and subtypes**
- ✓ Assist in developing an understanding of the **relationship of virus strains to disease severity.**
- ✓ **Monitor antiviral sensitivity.**
- ✓ **Facilitate vaccine strain selection.**
- ✓ Provide candidate viruses for vaccine production.

Influenza surveillance network (Phase1)

Regional Centers

- North: Delhi
- North-East: Dibrugarh
- East: Kolkata
- South: Chennai
- West: Pune

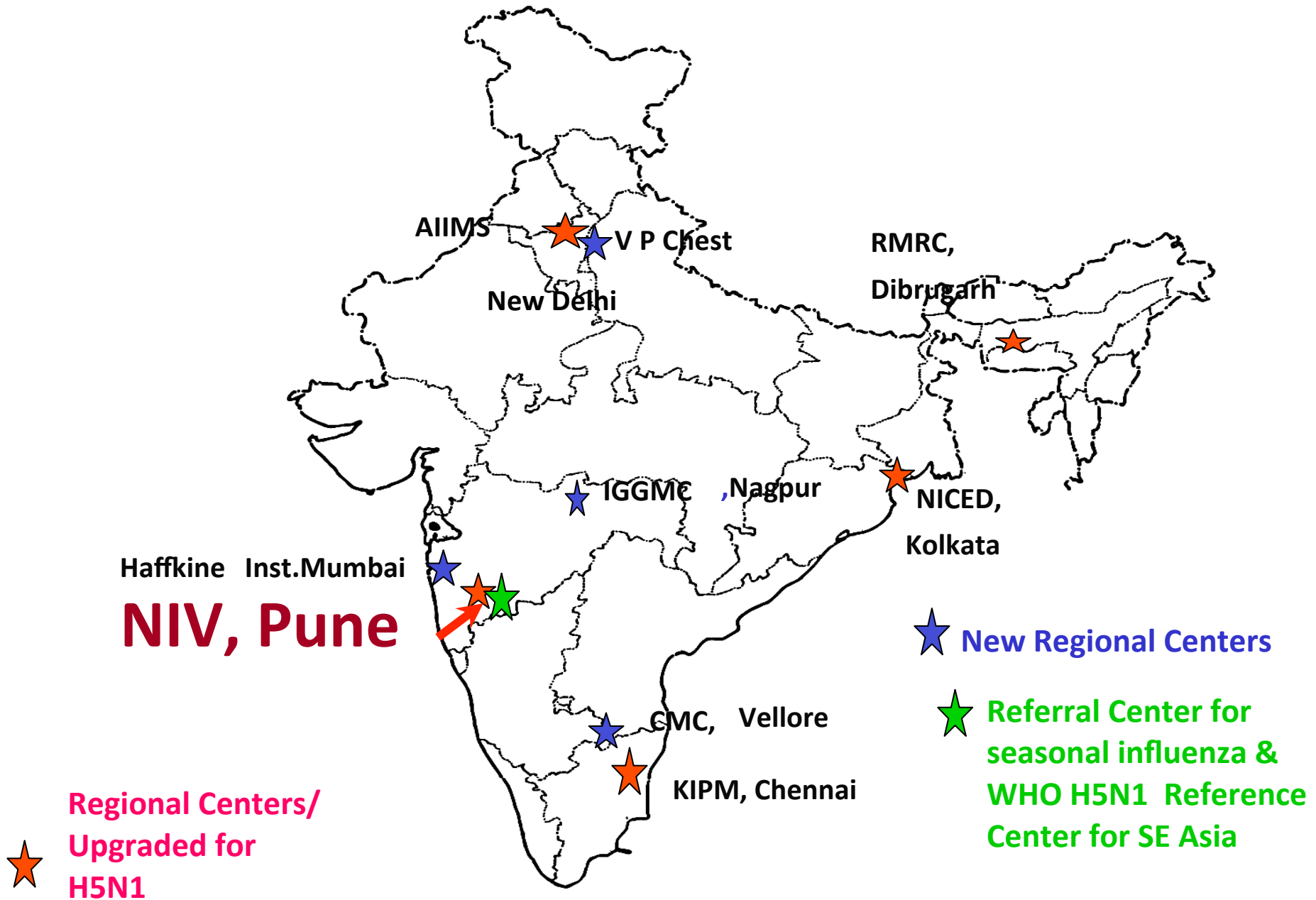
Referral Center

■ Pune



Started in 2003

Multi-site influenza surveillance network in India



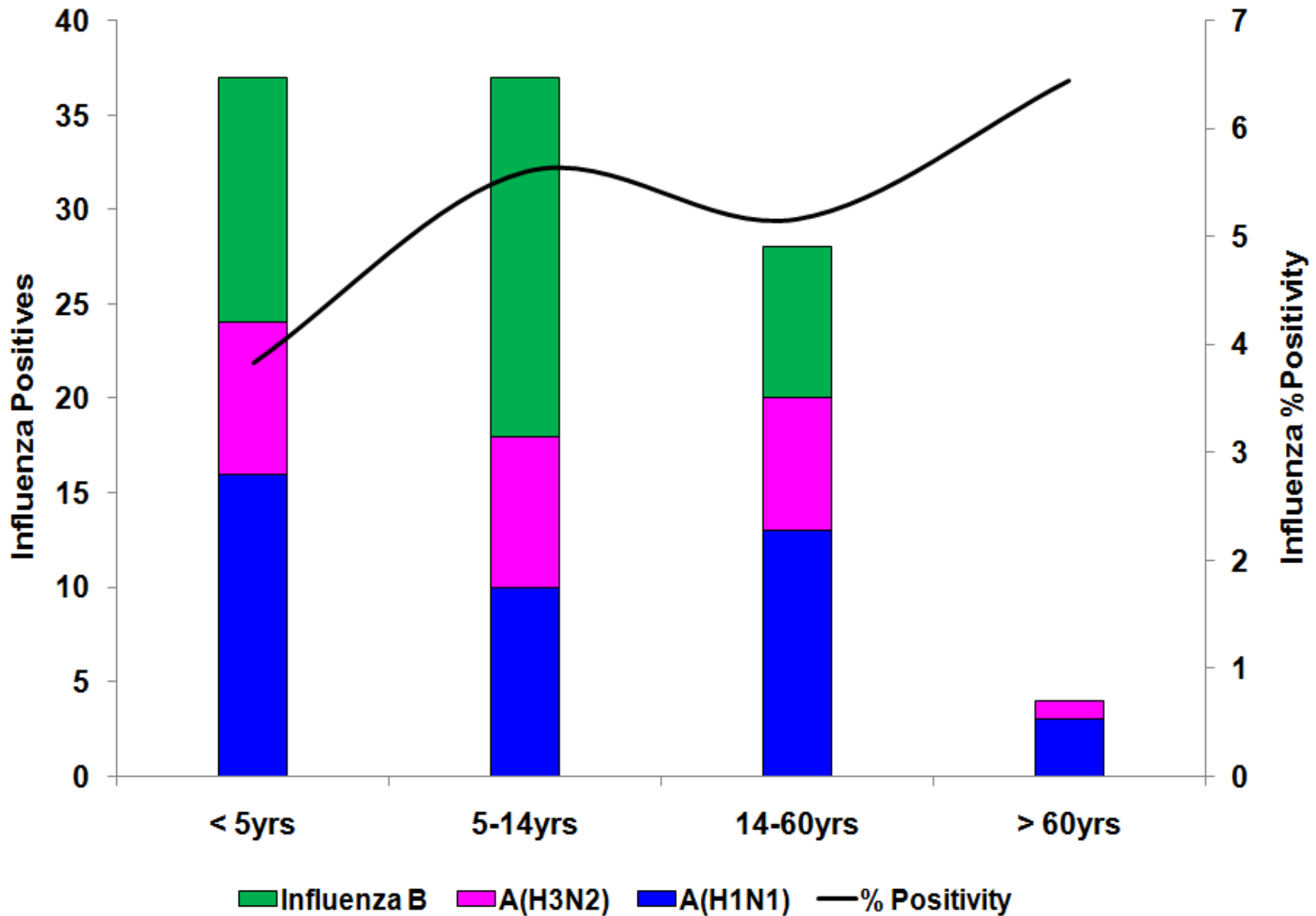
Influenza samples tested and Virus isolated (2004 to 2008)

Center	Specimen Tested	No. of Isolates	A(H3N2)	A(H1N1)	Type B
Total	13941	618 (4.4%)	185	172	261

Clinico-epidemiological characteristics

- Multivariate analysis showed that **chills /rigors, cough, fatigue, and ILI in family** had a significant correlation with influenza positivity among ILI cases.
- Overall, the **male-to-female ratio** of influenza positives: **1.5:1**
- There was **no statistically significant difference** in the influenza virus isolation rates among different age groups.
- Frequency of **type B influenza** was significantly higher among children (<15 years) than among adults.
- Such a difference was not observed for influenza A.

MSM Phase I- Age group wise Influenza Positivity



- **Our data indicated that influenza activity continued in India, with peak activity during the rainy season.**
- **Influenza is the causative agent in at least 5% acute respiratory infections.**
- **Influenza A(H1N1), A(H3N2) and type B co-circulated in the community.**
- **Genetic analysis showed: all circulating strains in India were similar to corresponding vaccine strains during 2004-08**
- **Although Avian Influenza established in Poultry; no evidence of human A (H5N1) infections**

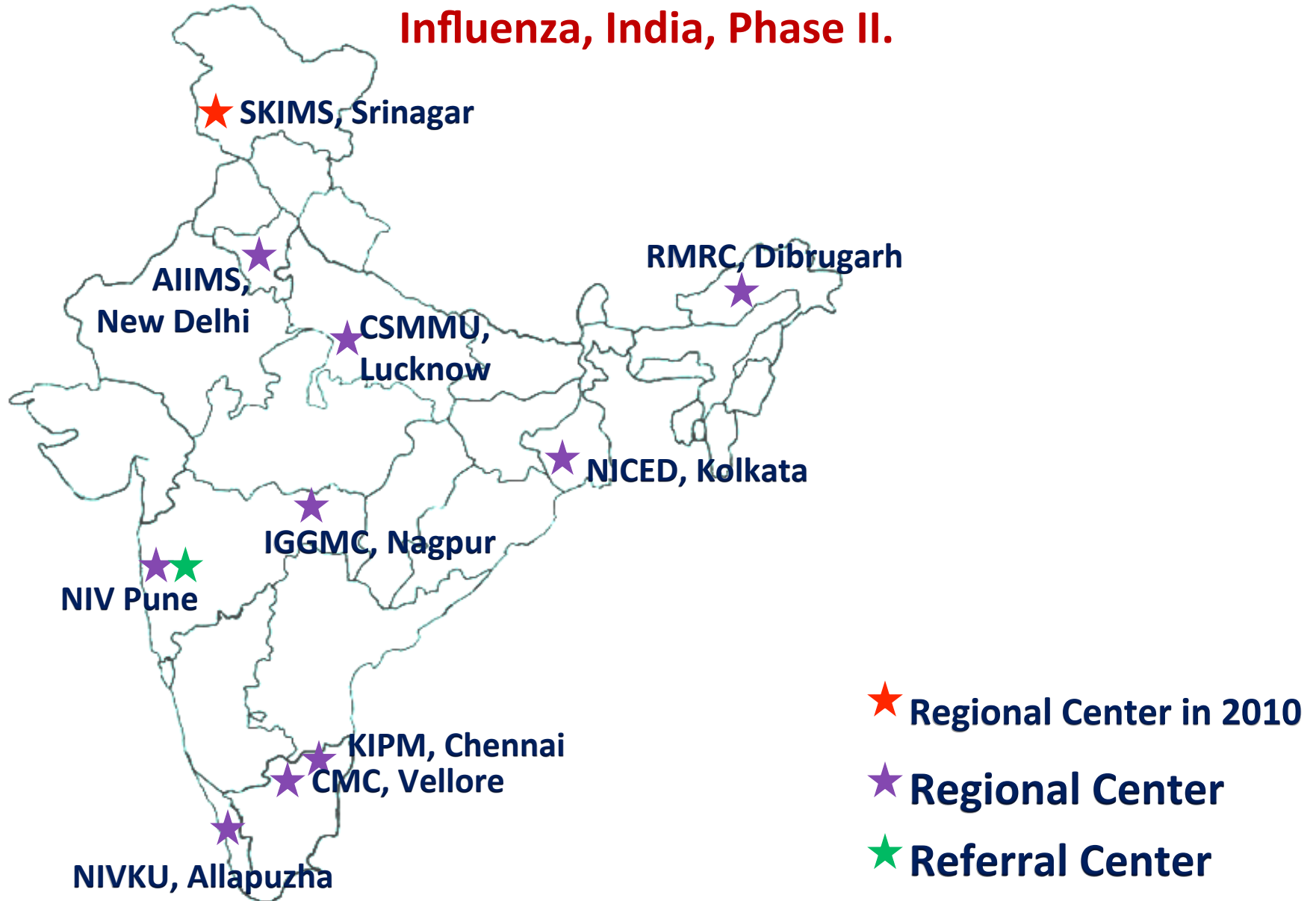
Multisite virological influenza surveillance in India: 2004–2008

Mandeep S. Chadha,^a Shobha Broor,^b Palani Gunasekaran,^c Varsha A. Potdar,^a Anand Krishnan,^b Mamta Chawla-Sarkar,^d Dipankar Biswas,^e Asha M. Abraham,^f Suresh V. Jalgaonkar,^g Harpreet Kau Alexander Klimov,ⁱ Renu B. Lal,ⁱ Ann Moen,ⁱ Lalit Kant,^h Akhilesh C. Mishra^a

^aNational Institute of Virology, Pune, India. ^bAll India Institute of Medical Sciences, New Delhi, India. ^cKing Institute of Preventive Medicine & Research, Chennai, India. ^dNational Institute of Cholera and Enteric Diseases, Kolkata, India. ^eRegional Medical Research Centre, Dibrugarh, In Christian Medical College, Vellore, India. ^fIndira Gandhi Government Medical College, Nagpur, India. ^hIndian Council of Medical Research, N Delhi, India. ⁱInfluenza Division, Centers for Disease Control and Prevention, Atlanta, GA, USA

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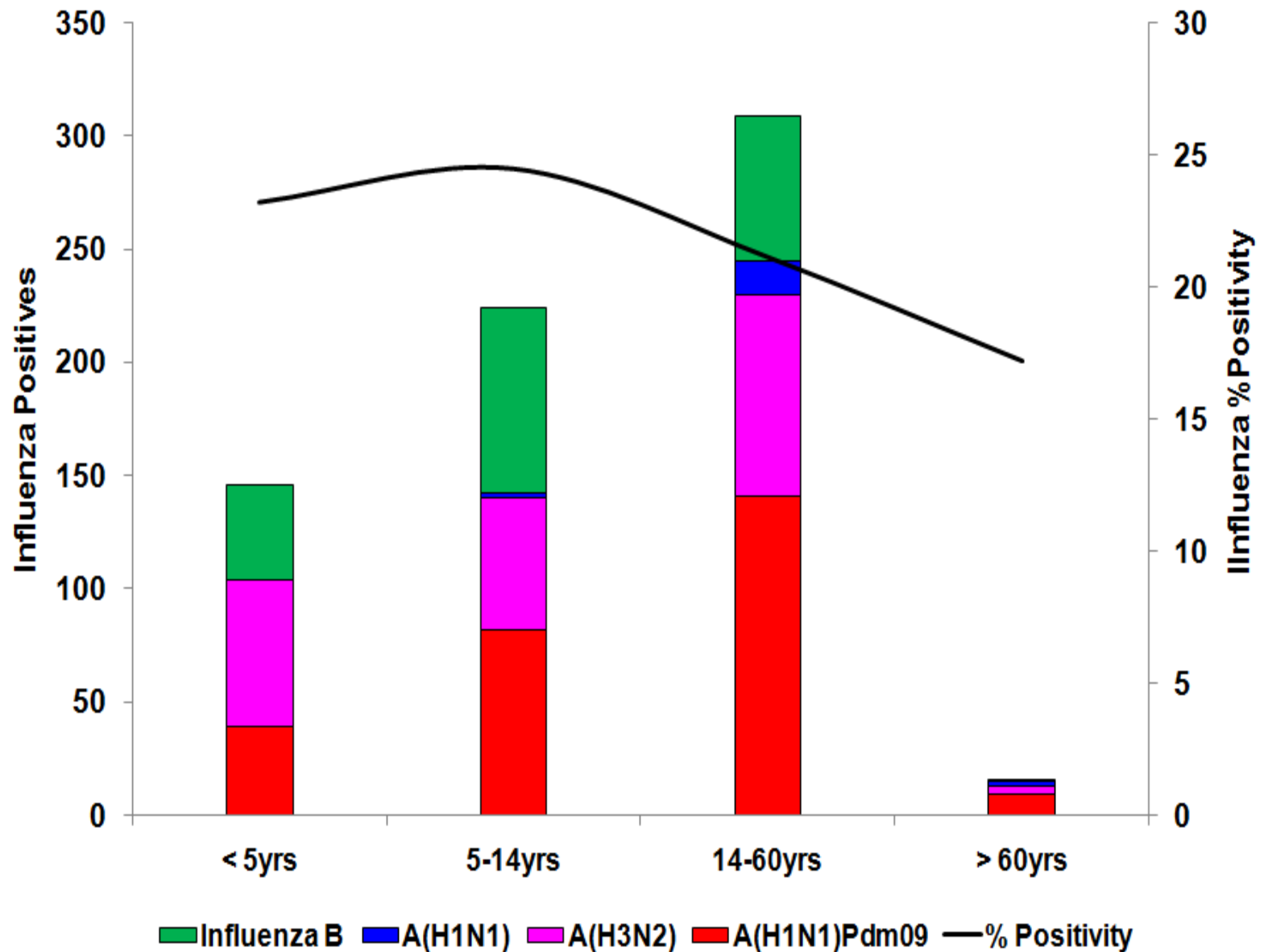
Multisite Epidemiological and Virological Monitoring of Human Influenza, India, Phase II.



Influenza Surveillance in India: May 2009- 2014

City	Total (influenza positivity)
Srinagar	791/4560 (17.34%)
Delhi	836/6093 (13.7%)
Dibrugarh	467/3064 (16.0%)
Lucknow	557/4453 (13%)
Kolkata	781/5794 (13.5%)
Nagpur	305/2868 (10.6%)
Pune	998/5996 (16.6%)
Chennai	589/6203 (9.4%)
Vellore	534/3032 (17.6%)
Alappuzha	510/4885 (10.4%)
Total	8560/46948 (18.2%)

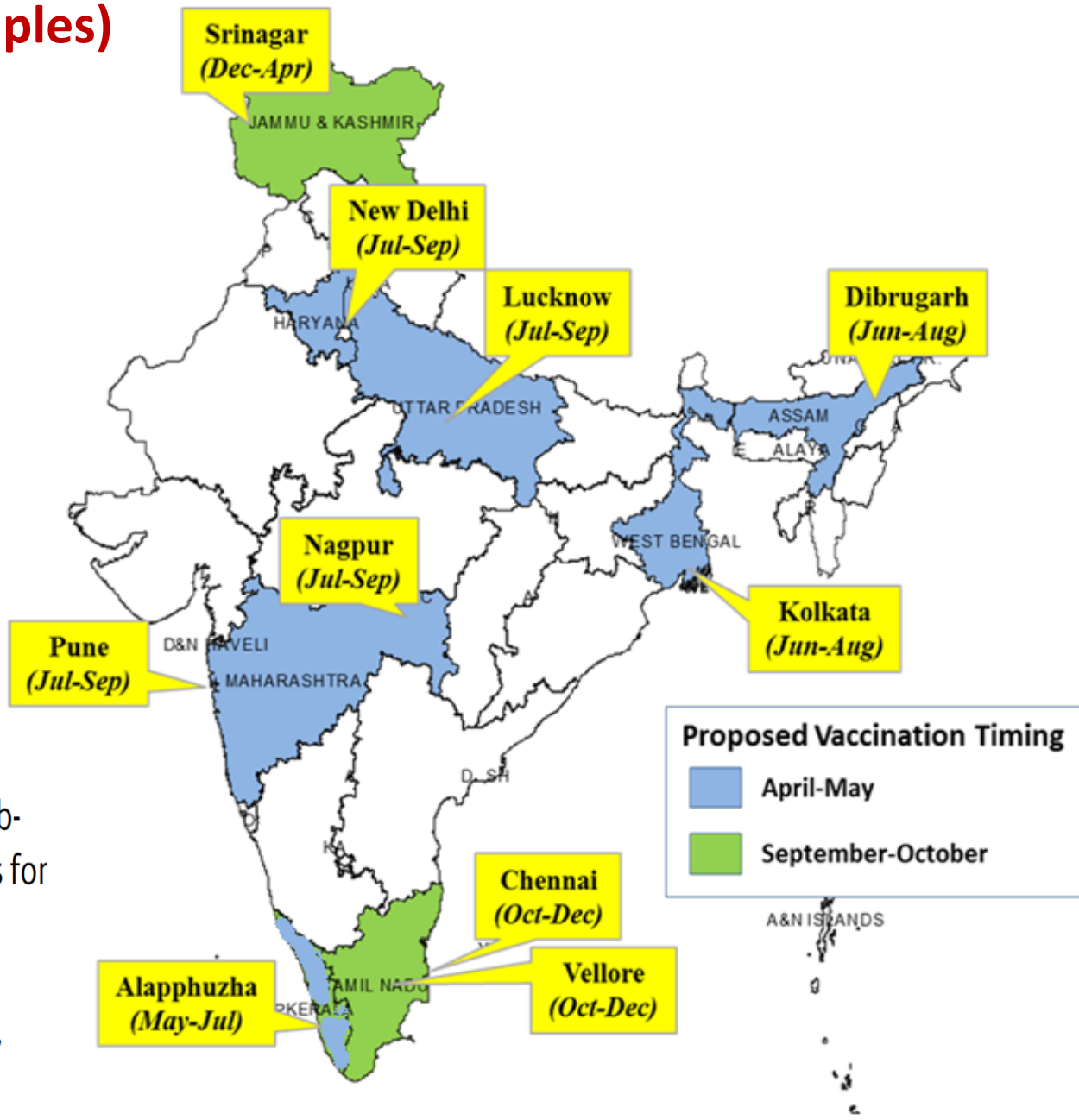
MSM Phase II- Age group wise Influenza Positivity



Peak circulation in different regions in India and vaccination timing (Based on > 43,000 samples)

Flags show peaks months of circulation.

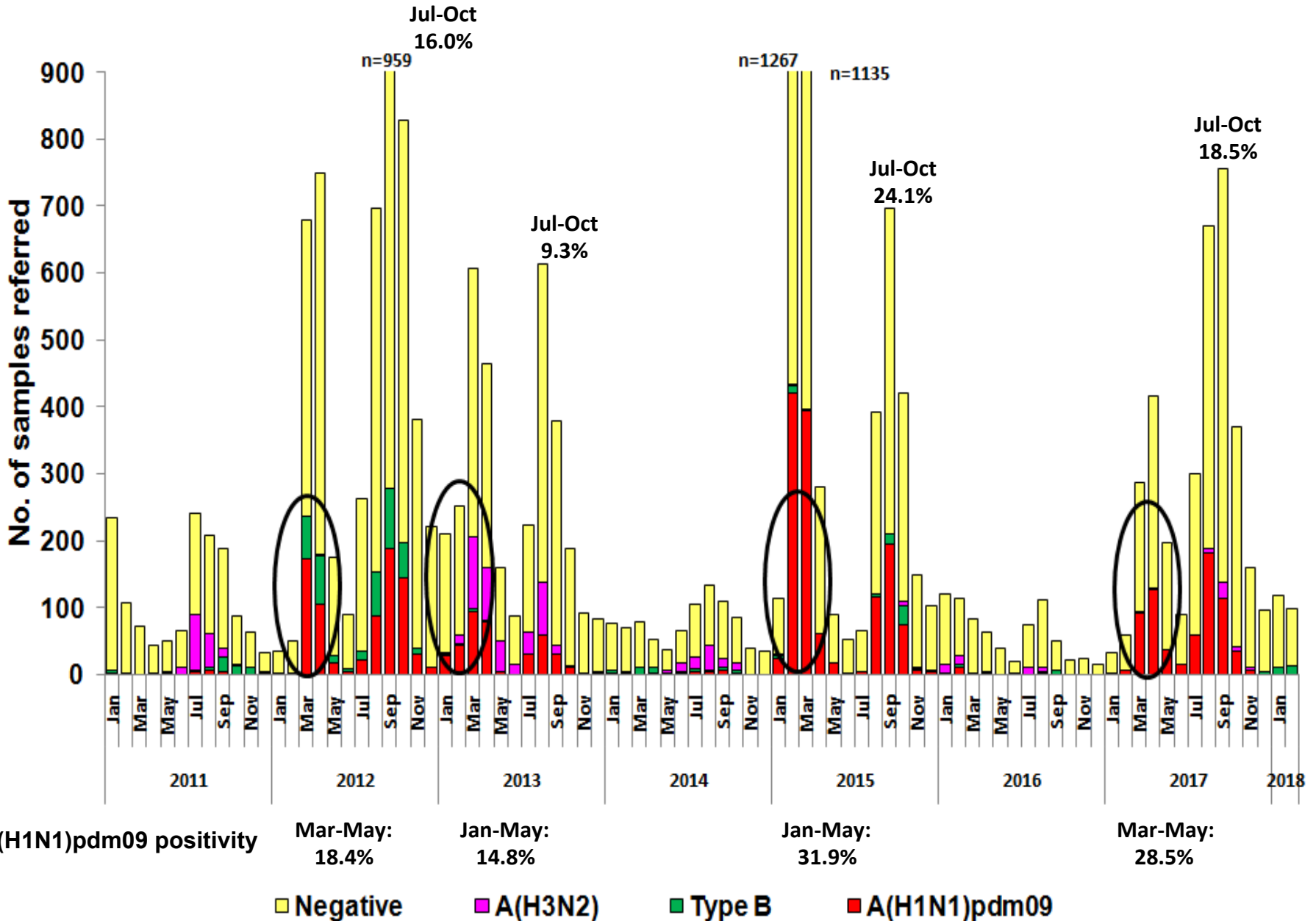
- April-May
- September-October



RESEARCH ARTICLE
 Dynamics of Influenza Seasonality at Sub-Regional Levels in India and Implications for Vaccination Timing

Mandeep S. Chadha^{1*}, Varsha A. Potdar¹, Siddhartha Saha², Parvaiz A. Koul³, Shobha Broor⁴, Lalit Dar⁴, Mamta Chawla-Sarkar⁵, Dipankar Biswas⁶, Palani Gunasekaran⁷, Asha Mary Abraham⁸, Sunanda Shrikhande⁹, Amita Jain¹⁰, Balakrishnan Anukumar¹¹, Renu B. Lal², Akhilesh C. Mishra¹

Referred hospitalized cases from January 2011- February 2018



Pandemic influenza severity

- Cases positive for pandemic H1N1 virus had significantly higher risk of hospitalization than those positive for seasonal influenza-A viruses (OR: 1.7).
- Case fatality ratio 0.86% for pandemic H1N1 was significantly higher than that of seasonal-A (0.13%)

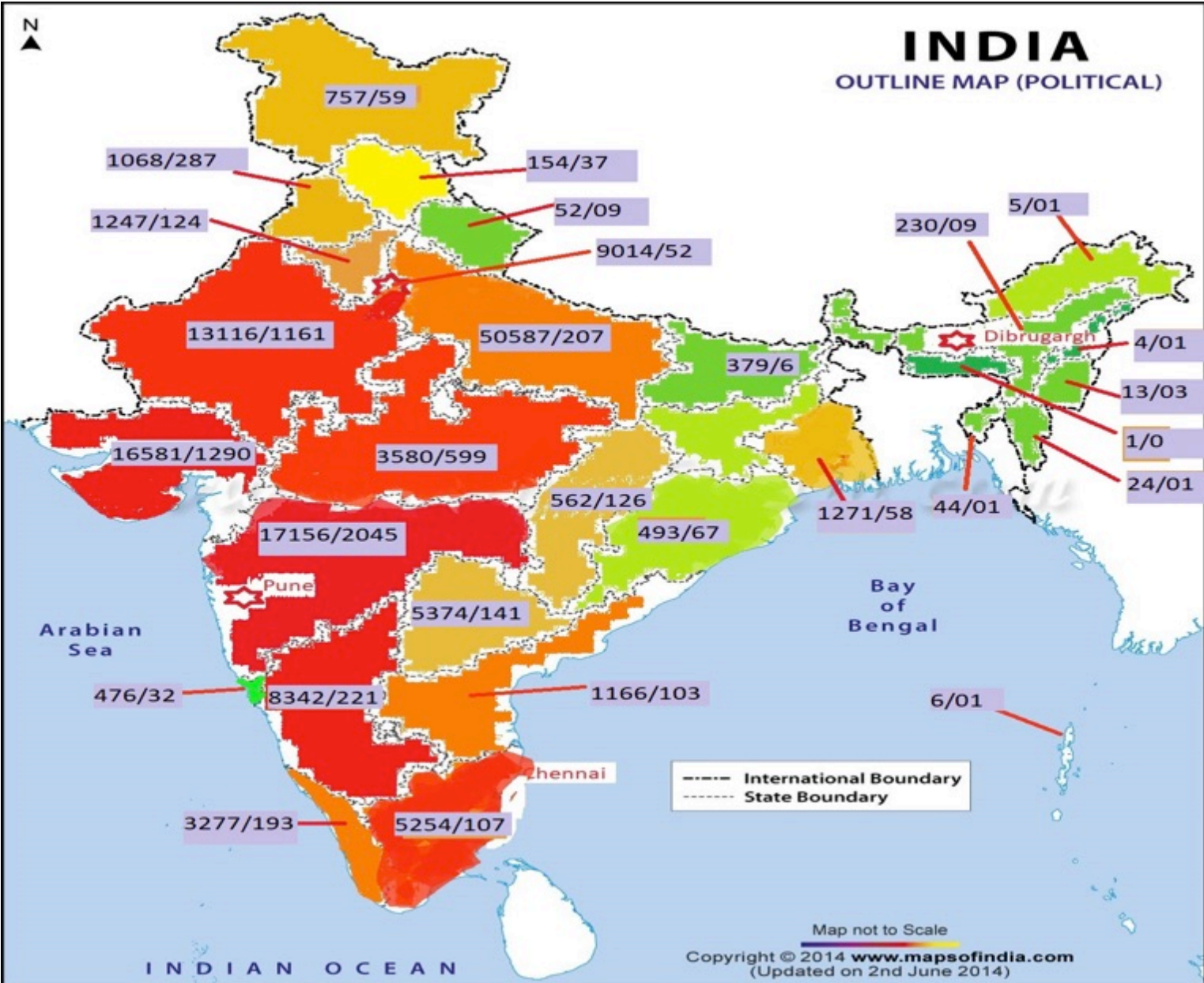
Pandemic Influenza (H1N1) 2009 Is Associated with Severe Disease in India

Akhilesh C. Mishra*, Mandeep S. Chadha, Manohar L. Choudhary, Varsha A. Potdar

Results: Prevalence of pandemic H1N1 as well as seasonal-A cases were high in Pune urban agglomeration during the study period. The cases positive for pandemic H1N1 virus had significantly higher risk of hospitalization than those positive for seasonal influenza-A viruses (OR: 1.7). Of 93 influenza related deaths, 57 and 8 deaths from Pune (urban) and 27 and 1 death from Pune (rural) were from pandemic H1N1 positive and seasonal-A positive cases respectively. The case fatality ratio 0.86% for pandemic H1N1 was significantly higher than that of seasonal-A (0.13%) and it was in category 3 of the pandemic severity index of CDC, USA. The data on the cumulative fatality of rural and urban Pune revealed that with time the epidemic is spreading to rural areas.

Conclusions: The severity of the H1N1 influenza pandemic is less than that reported for 'Spanish flu 1918' but higher than other pandemics of the 20th century. Thus, pandemic influenza should be considered as serious health threat and unprecedented global response seems justified.

Number of cases and death from 2011 to 2018



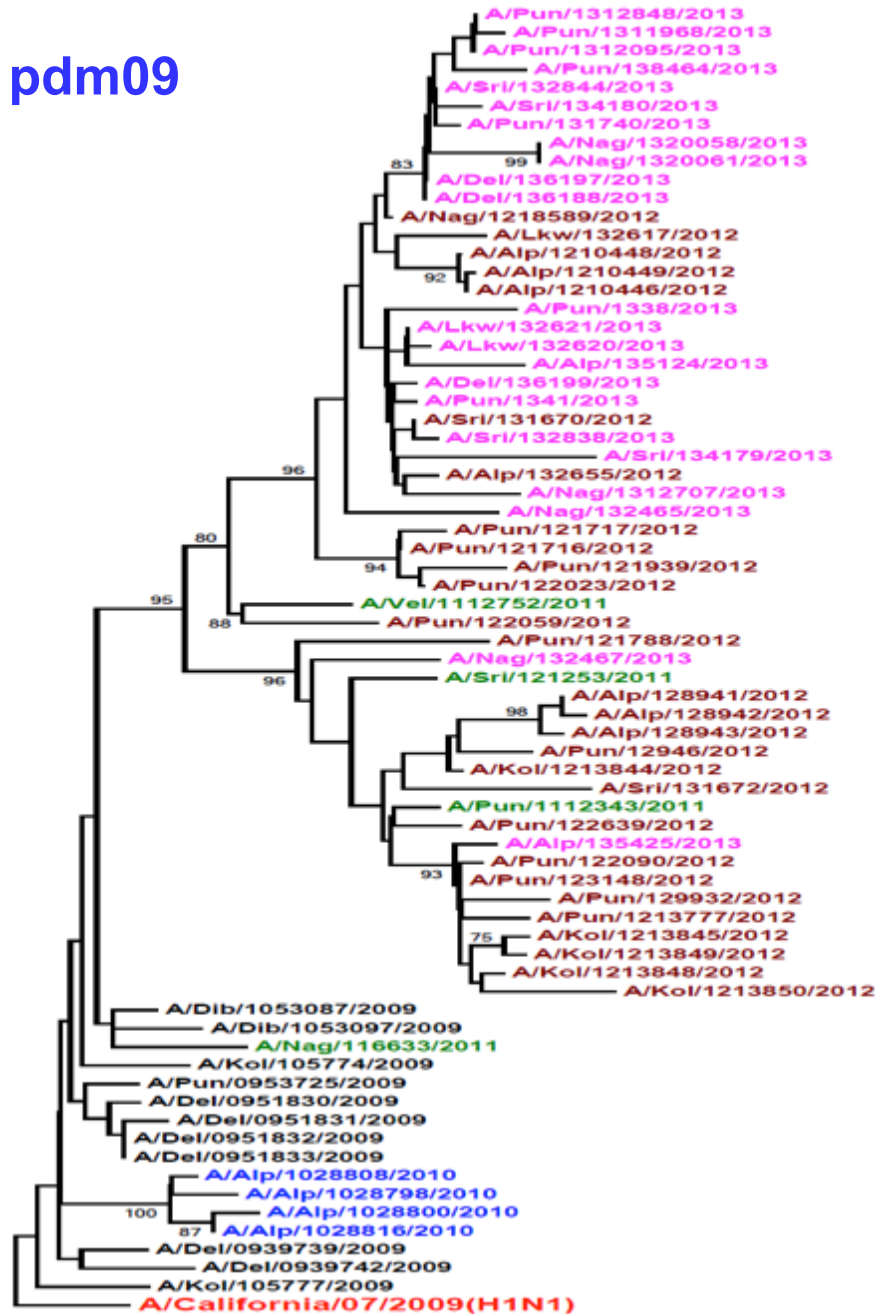
High Risk Groups Persons: Recommended for influenza vaccination

- Health Care workers
- Pregnant women.
- Persons with chronic illnesses : Chronic Obstructive Pulmonary Disease, Bronchial Asthma, Heart disease, Liver disease, Kidney disease, Blood disorders, Diabetes, Cancer, Obese & immunocompromised individuals.
- Children having chronic diseases
- Elderly individuals (≥ 65 years of age)
- Children between 6 months to 8 years of age.

Comparison of Indian Viruses & Vaccine strains

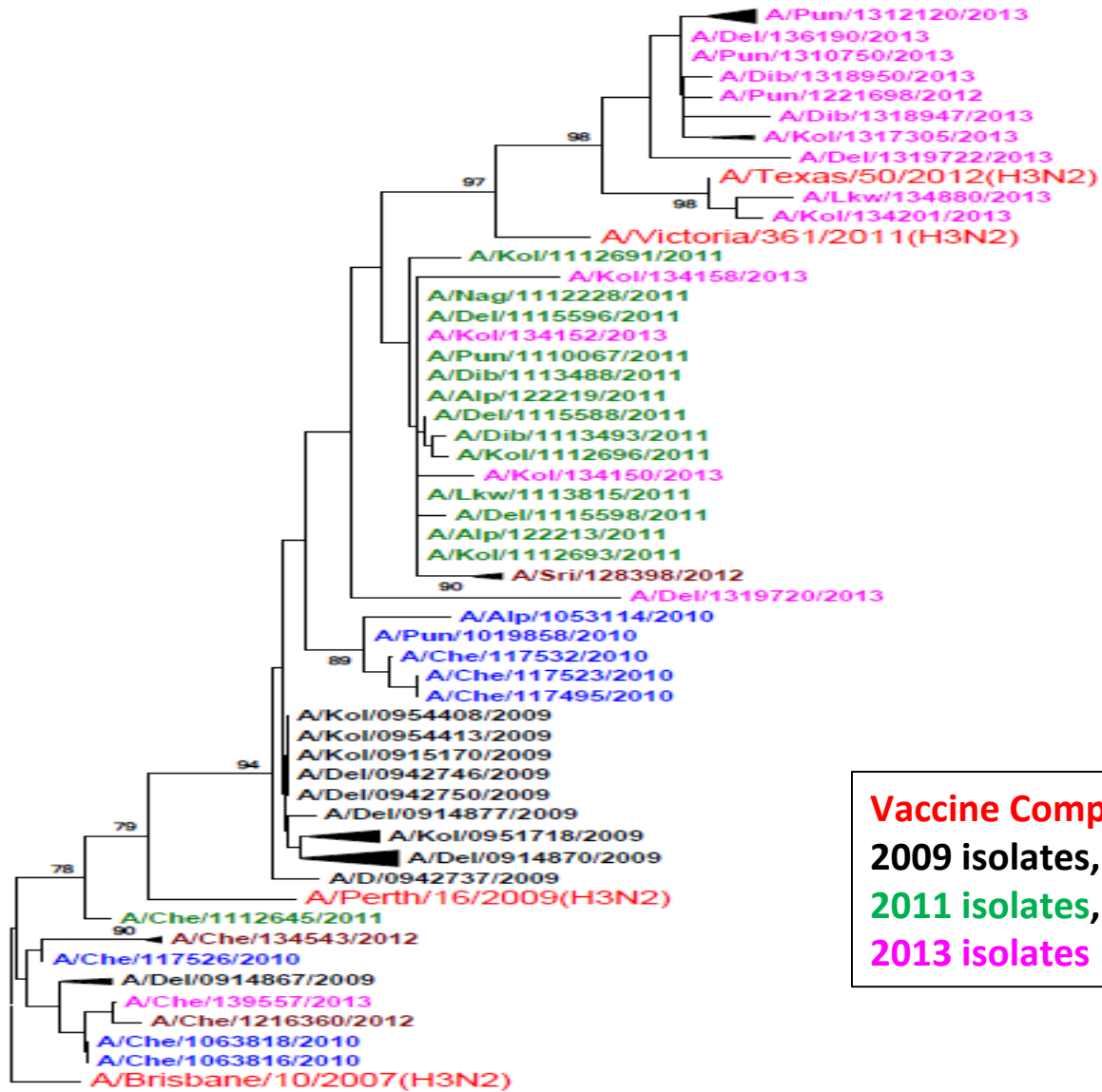
Phylogenetic analysis of HA gene of influenza

A/H1N1pdm09



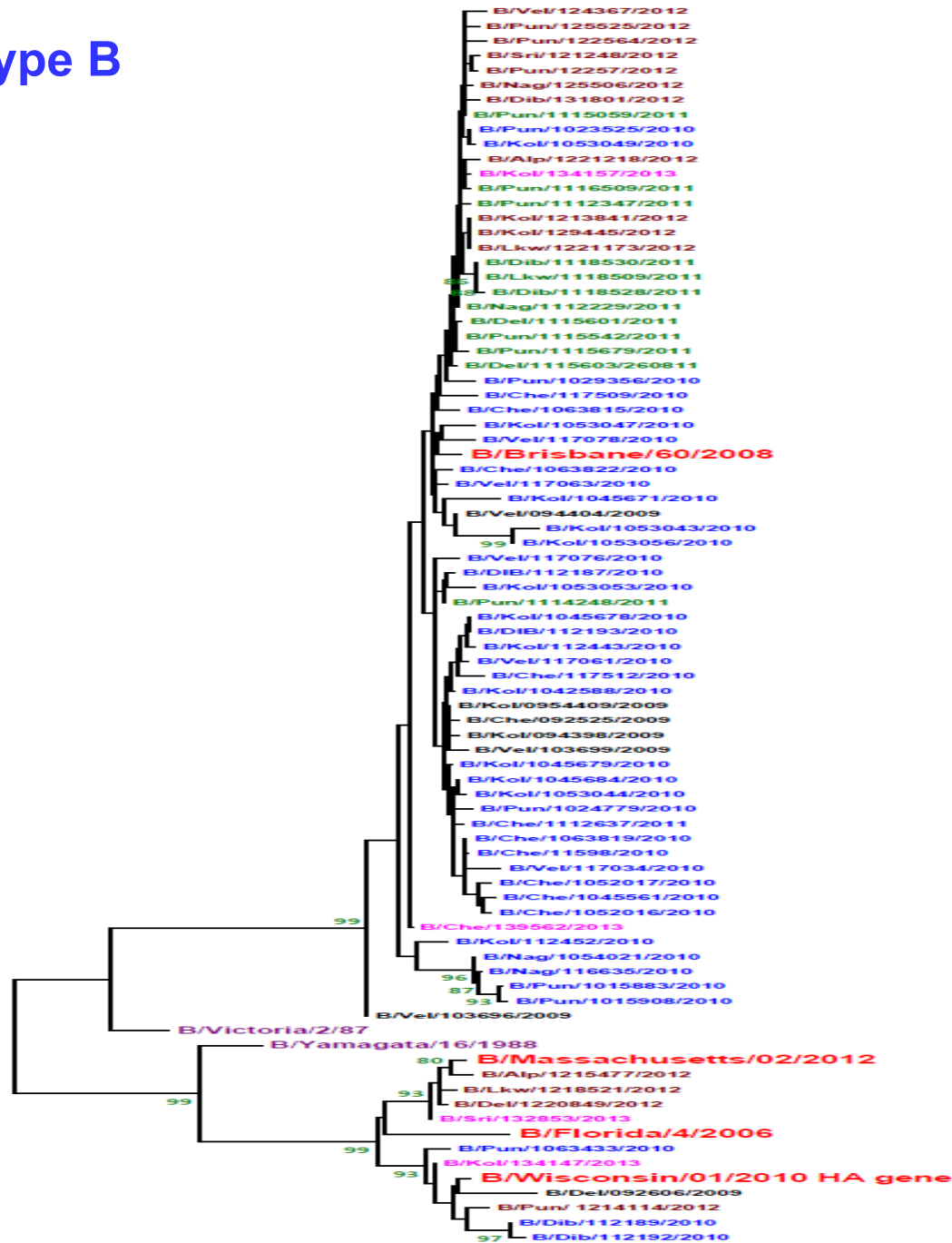
Vaccine Component
2009 isolates, 2010 isolates,
2011 isolates, 2012 isolates,
2013 isolates

A/H3N2



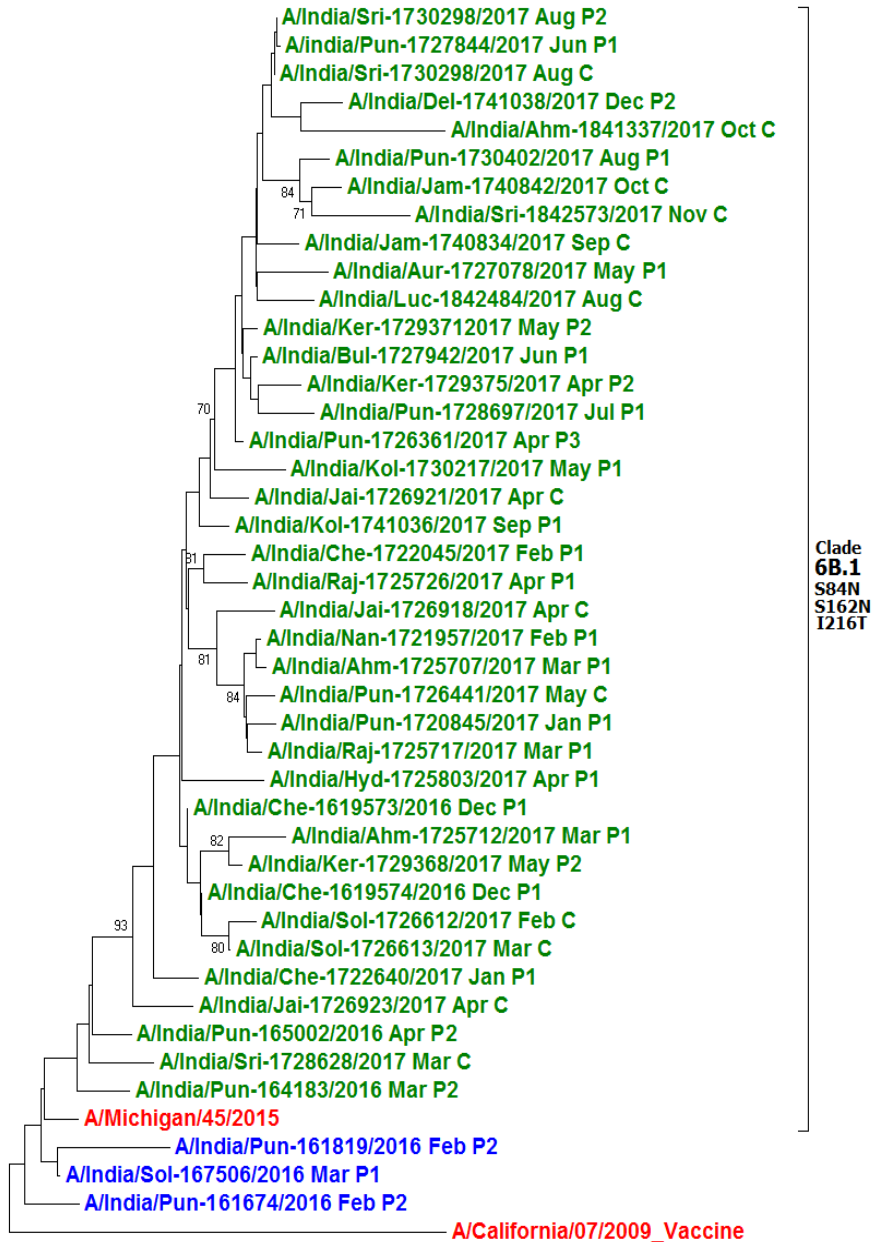
Vaccine Component
2009 isolates, 2010 isolates,
2011 isolates, 2012 isolates,
2013 isolates

Type B



Vaccine components
2009 isolates, 2010 isolates,
2011 isolates, 2012 isolates,
2013 isolates

H1pdm09 Hemagglutinin Neighbor-joining Phylogenetic Tree (n=80)

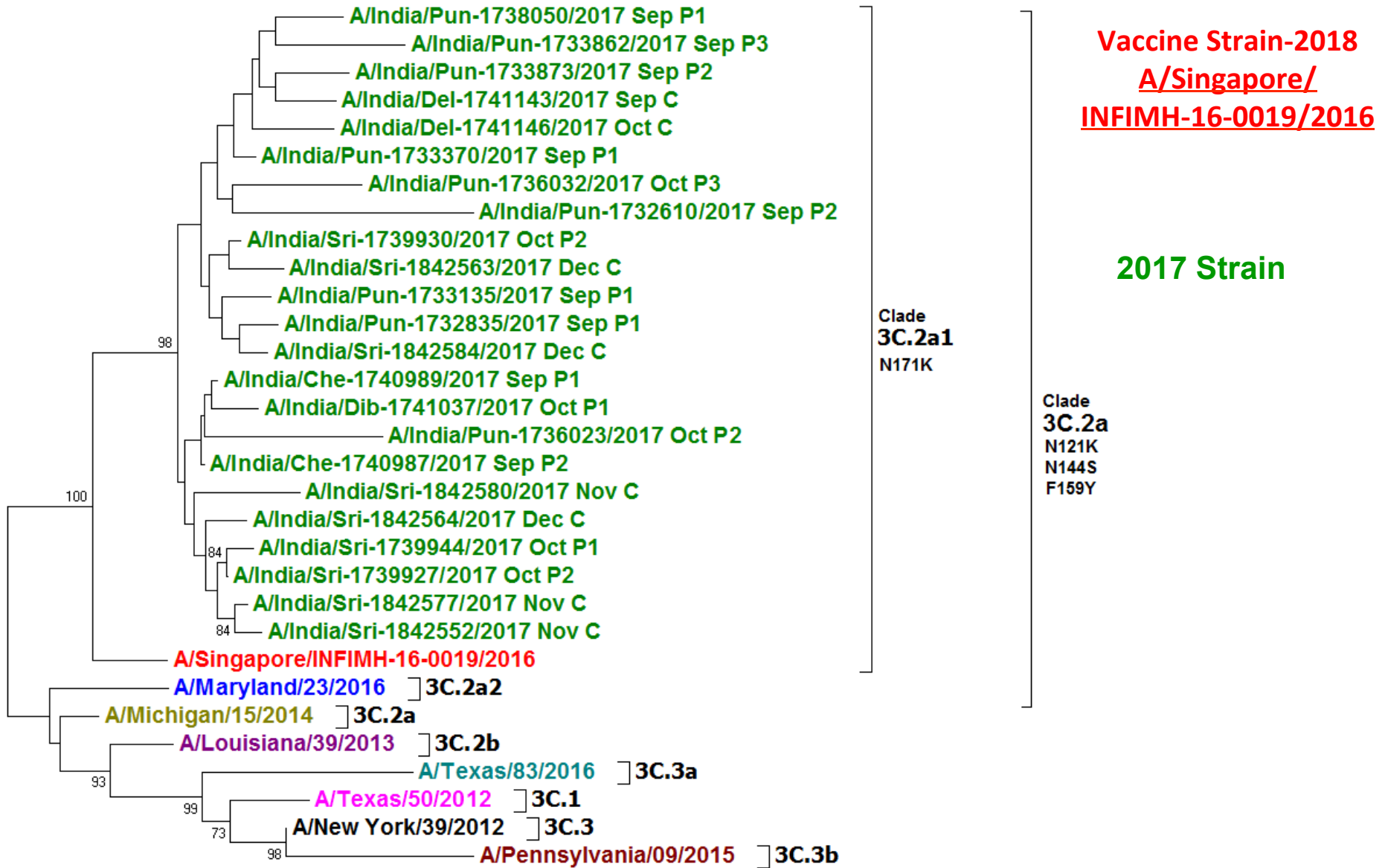


Vaccine strain for northern hemisphere 2017-18
A/Michigan/45/2015

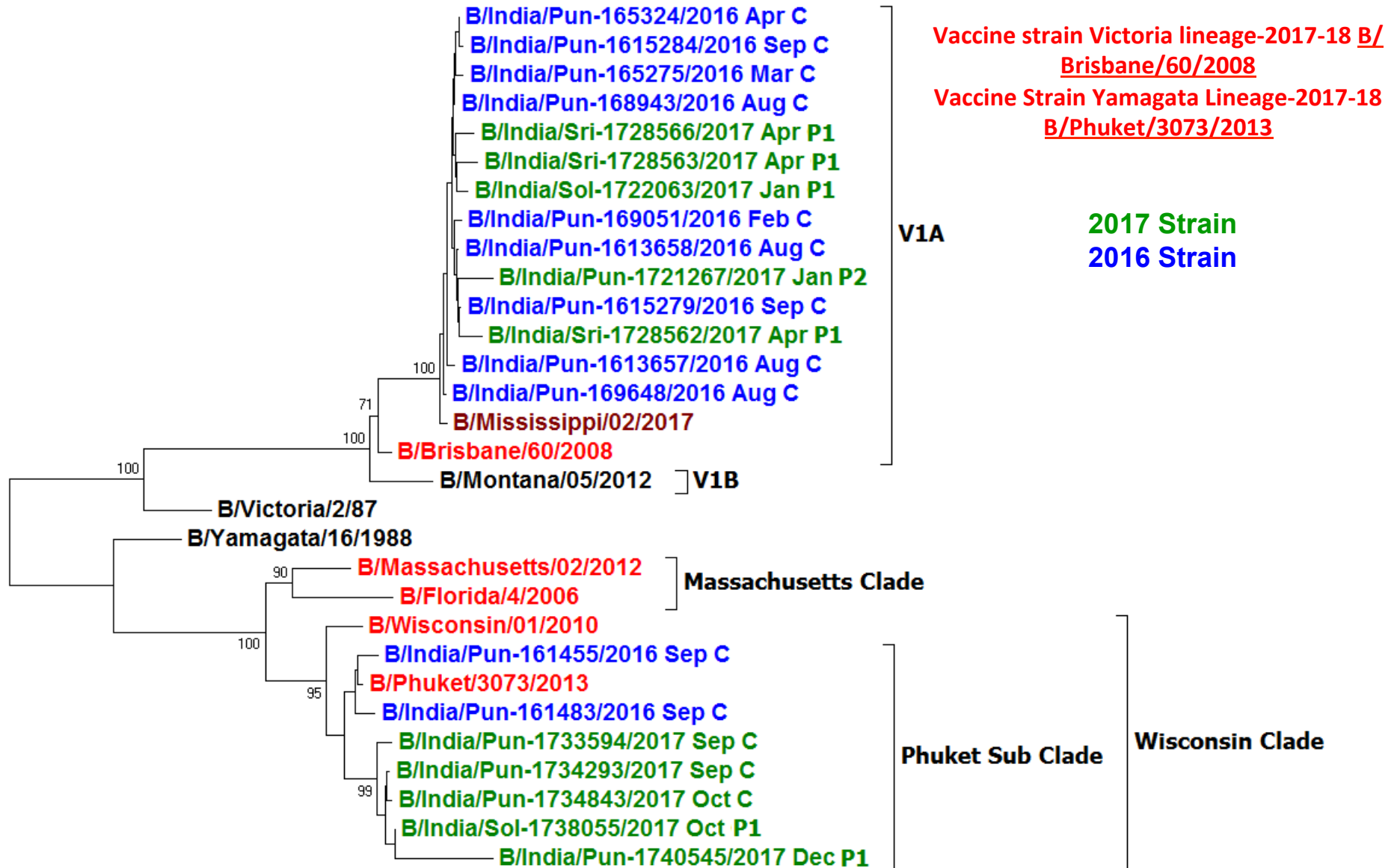
2017 Strain
 2016 Strain

- Pune-18
- Srinagar-12
- Chennai-11
- Jaipur-08
- Ahmedabad-07
- Lucknow-05
- Kolkata-05
- Kerala-04
- Jammu-03
- Solapur-03
- Delhi-02
- Hydrabad-02

H3 Hemagglutinin Neighbor-joining Phylogenetic Tree (n=23)



Influenza B Hemagglutinin Neighbor-joining Phylogenetic Tree (n=22)



Antiviral Susceptibility testing: Molecular methods (2012-2017)

Virus Subtype	No of Samples	Resistant
Allelic Discrimination for H274Y marker by real time RT PCR		
A(H1N1)pdm09 Referred & Surveillance	Clinical - 3497	12(H274Y)

A(H1N1)pdm09 samples tested by allelic discrimination RT-PCR for H274Y mutation to detect Oseltamivir resistance

Total Tested	Sensitive	Resistant
1012	1006	Maharashtra:4 Delhi: 2 Total: 6

Influenza isolates tested by NA1 phenotypic assay to detect Oseltamivir resistance

Influenza isolates	Total Tested	Sensitive	Resistant
H1N1pdm09	191	185	6
H3N2	45	45	0
Influenza B	19	19	0

Sharing of data and isolates

NIC, India has been sharing isolates with the CC at CDC, Atlanta.

Over 800 isolates have been submitted in the last 15 years.