India

Capital: *New Delhi*
Infant Mortality Rate: *44.6/1,000 live births*
Population: *1,220,800,359 (July 2013 est.)*

Overview

CDC has supported capacity-building for surveillance since 2004, leading to improved characterization of circulating influenza viruses and capacity to rapidly detect novel viruses, including avian influenza viruses. CDC-supported laboratory training and preparedness workshops have strengthened India's response measures against seasonal, avian, and pandemic influenza. CDC also collaborates with Indian partner organizations on research to quantify influenza burden in India, evaluate the effectiveness of influenza vaccines in young children at increased risk for severe respiratory illness, and identify optimal timing for influenza vaccination in India to inform the development of national influenza vaccination policy.

Highlights

- Continued surveillance for A(H1N1)pdm09 viruses and genetic characterization of re-emerging H3N2.
- Conducted pre-monsoon influenza vaccination of children in Northern India for the first time, as longitudinal data on seasonality of influenza viruses persuaded the Drug Controller General of India (FDA equivalent) to permit importation of Southern Hemisphere (SH) vaccine for spring time vaccination.
- Contributed data for global pandemic influenza-related mortality estimates and global estimates for respiratory hospitalizations.
- Generated crucial data on respiratory morbidity among children and elderly in addition to providing platforms for new research projects.

Surveillance

Indian Council of Medical Research conducts sentinel surveillance at 10 surveillance sites throughout India which are generating crucial epidemiological and virological data. The National Influenza Center (NIC) at Pune has been sending timely isolates to CDC for antigenic analysis and has contributed cumulative weekly influenza surveillance data to the WHO FluNet website. Surveillance efforts have documented that influenza seasonality varied across India with peak influenza activity occurring during January–March in the northern most tip of the country and during the rainy season (August–October) in the rest of the country. Previously, India was only using Northern Hemisphere influenza vaccine, but these findings have led to importation of Southern Hemisphere vaccine for pre-monsoon vaccination of children in India.

Surveillance Activities

- Processed 12,687 samples during the year; 2,095 tested positive for influenza, of which 684(33%) were A (H1N1)pdm09, 951(45%) were A (H3N2), and 460(22%) were B viruses.
- Detected a resurgence of influenza A (H1N1)pdm09 during the winters of 2012–13 following a period of minimal circulation in 2011–12 winters, causing serious illness and fatalities.
- Participated in the Influenza Disease Burden in India study and established influenza-like illness (ILI) and febrile acute respiratory infection (FARI) case definitions that include measured or reported fever to provide an optimal balance between sensitivity and specificity for the identification of patients hospitalized with influenza.

Laboratory

Indian surveillance network members have trained extensively with CDC-Atlanta scientists on typing, sub-typing, PCR, real-time PCR, and reverse genetics techniques. The Indian network of surveillance sites now has ten sites equipped with RT-PCR to detect seasonal influenza viruses, including A (H1N1)pdm09. Four of these laboratories are also equipped to handle avian influenza.

Genetic characterization of viruses is carried out mostly at the NIC. All India Institute of Medical Sciences (AIIMS) has developed capacity to carry out virus neutralization assays and testing for cell-mediated immunity (CMI) and nutritional factors as part of a vaccine study.

Another virology laboratory became functional for influenza testing in Delhi; it provides support for testing thousands of samples collected under various HHS/CDC-supported influenza studies. CDC-developed technologies for individual respiratory virus detection as well as multi-pathogen detection using Taqman Low Density Array (TLDA) have been transferred to AIIMS. Laboratory studies of molecular mechanisms of influenza A and host cell interactions conducted with the International Centre for Genetic Engineering and Biotechnology (ICGEB) are leading to identification of unique host cell factors that may be manipulated by influenza A viruses.

Laboratory Activities

- Observed genetic characterization of circulating strain A(H1N1)pdm09 from India belonging to clade 7 with minimal changes in recent isolates.
- Generated a comprehensive database with full length HA and NA sequences for influenza A (H3) and influenza B viruses – data analysis is underway.
- Reviewed the real-time RT-PCR process for influenza testing at the newly operational laboratory at the International Clinical Epidemiology Network (INCLEN) Trust and helped fine-tune some of the quality aspects of testing.

Preparedness

HHS/CDC activities have focused on supporting pandemic influenza preparedness programs and helping advance the field of influenza research (seasonal, pandemic and avian) in India. Many of the preparedness activities related to increased awareness and response to minimize the risk of spread of human infections and disease were carried out with Ministry of Health and Family Affairs (National Center for Disease Control and the Indian Council of Medical Research) and WHO partners prior to 2009. These efforts contributed to India's ability to respond to the 2009 H1N1 pandemic. CDC continues to provide technical and laboratory support for ongoing surveillance activities.

Current activities are focused on influenza vaccination strategies, and increasing awareness and acceptance of influenza vaccine among health care providers. Support from the U.S. Biomedical Advanced Research and Development Authority (BARDA) has led to increased influenza manufacturing capacity. Studies are being planned to look at the efficacy of indigenously produced live attenuated influenza vaccine (LAIV) in India.

Preparedness Activities

- Received license to import SH vaccine for vaccination prior to influenza peak due to evidence-based data on influenza seasonality.
- Reported very low acceptance rates from initial surveys in a tertiary care hospital, due primarily to limited knowledge about influenza vaccines. Discussions are underway to provide Influenza vaccinations to all health care providers within the federal government.
- Led production of LAIV monovalent pandemic H1N1 vaccine at the Serum Institute of India, Pune, and now in the process of producing trivalent LAIV.

Training

Consultations and Presentations

- Seasonal, Avian and Pandemic Influenza Control and Prevention Strategies; Identification of Gaps and Way Forward. Chaired by the Secretary-Department of Biotechnology and Co-chaired by Secretary-Department of Health Research, India: New Delhi (June 2013).
- Meeting of National Experts in the field of Influenza Surveillance-consultation for mortality estimate for influenza related deaths in India: New Delhi (May 2013).
- Influenza Burden Analysis Meeting: New Delhi (May 2013).

Trainings and Workshops:

- Hands on laboratory training on TLDA technology at INCLEN Trust Laboratories, New Delhi.

Publications

Broor S, Sullender WS, Fowler K, Gupta V, Widdowson M-A, Krishnan A, Lal RB. Demographic Shift of Influenza A(H1N1pdm09 during and after Pandemic, Rural India. Emerg. Infect. Dis. 18:1472–1475, 2012.

Broor S, Krishnan A, Roy DS, Dhakad S, Kaushik S, Mir MA, Singh Y, Moen A, Chadha M, Mishra AC, Lal RB. Dynamic patterns of circulating seasonal and pandemic 2009A (H1N1) influenza viruses from 2007–2010 in and around Delhi, India. PLoS One. 7:e29129, 2012.

Hirve S, Chadha M, Lafond K, Dawood F, Lele P, Sambhudas S, Deoshatwar A, Juvekar S, Lal RB, Mishra AC. Performance of case definitions used for influenza surveillance among hospitalized patients in a rural area of India. Bull World Health Organ; 90:804–812, 2012.