Enhancing Influenza Surveillance: From the Global to the Local Perspective

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Presentation Outline

- Purpose and uses of surveillance
- International influenza surveillance
- An HHS Initiative: Enhancing influenza surveillance in Asia
- Surveillance in the United States: a template for surveillance systems elsewhere?
Objectives of Influenza Surveillance

- Determine **which** influenza viruses are circulating; **where** are they circulating; **when** are they circulating
- Determine **intensity and impact** of influenza activity
- Detect **unusual** events
  - Infection by unusual viruses with pandemic potential
  - Unusual syndromes caused by influenza viruses
  - Unusually large/severe outbreaks of influenza
Practical Uses of Influenza Surveillance Data

- Vaccine strain selection
- Treatment decisions
- Public health resource allocation
- Influenza prevention and control policy
- Pandemic planning
- General Information: public and media
Surveillance System Attributes

--CDC’s “Updated Guidelines for Evaluating Public Health Surveillance Systems”

- **Simplicity**: structure/use, only collect data that will be used
- **Flexibility**: adapt changing informational/operational needs
- **Representativeness**: geographics/demographics, disease spectrum
- **Timeliness**: data collection, analysis, and use
- **Stability**: reliably collect, manage, and report data
- **Data quality**: completeness, validity
- **Acceptability**: willingness to participate/voluntary
- **Sensitivity**: detect outbreaks, monitor changes over time
- **Predictive value positive**: activity detected by system reflect true elevations
Importance of Global Influenza Surveillance

- Monitor circulating influenza viruses to determine new antigenic variants worldwide to update the vaccine annually.
- Serve as the “early warning system” for novel influenza viruses.
- Understand the impact of influenza on populations to guide policy and resource decisions.
History

- 1947 WHO Global influenza system initiated
  - Global network of National Influenza Centers established
  - First WHO Collaborating Center in UK
- Used as an example of international collaboration and cooperation
WHO's Influenza Program

National Influenza Centers
(~ 110 Laboratories in 80 Countries)
- Isolate influenza viruses
- Identify viruses and send to International Collaborating Center(s)
- Collect epidemiologic information

International Collaborating Centers
(Atlanta, London, Melbourne, Tokyo)
- Analyze influenza viruses received
- Provide data for annual vaccine recommendations
- Prepare and distribute candidate vaccine strains

World Health Organization
(Geneva)
- Collect information for the Weekly Epidemiological Record and WWW for distribution
- Make annual vaccine recommendations

Vaccine Producers
Geographic Distribution of NICs and CCs

Countries containing at least 1 WHO influenza laboratory

- WHO Collaborating Centers - Atlanta, London, Melbourne, and Tokyo
- Countries containing at least 1 WHO influenza laboratory
Current Status of WHO System

- 175,000 isolates/yr (600 to 1200 M cases)
- WHO CCs receive 6,500 – 8,000 samples/yr.
- WHO CCs and NICs sequence HA of 1,000 samples/yr; complete genomes now sequenced (e.g., members of GIP sequenced complete genomes of 20 H5N1 viruses in few weeks; plan for many more total genomes to be sequenced)
- Molecular correlates of antigenic change
- >290 M doses of influenza vaccine w/wide
Model of the influenza A H3 HA structure
U.S. Contributions to WHO Global Influenza Surveillance

- U.S. surveillance data reported weekly through WHO’s FluNet (integrate data from variety of sources including DoD information)
- Contribute data for vaccine strain selection; analysis of antigenic, genetic and pathogenic properties of viruses
- Produce/distribute WHO kits for strain identification to NICs and domestic labs
- Conduct international training (group and individual bench training)
- Assist with outbreak investigations (U.S. and abroad)
- Develop U.S. recommendations for vaccines and antivirals (through ACIP)
H5N1 Infections of Humans, Asia 2004

- **Largest human outbreak of H5N1**
  - Associated with widespread H5N1 poultry outbreaks
  - Cases distributed over a wide geographic area
  - Confirmed H5N1 cases are an underestimate of all human H5N1 cases
  - Very high case fatality (68%) and severe disease

- **Transmission via direct contact with poultry (avian-to-human transmission of H5N1 viruses)**
  - Inefficient: Millions of humans likely exposed to sick or dead poultry - no evidence for large numbers of human cases

- **No evidence for efficient human-to-human transmission of H5N1 viruses**
Identification of Gaps in Information

- **Large gaps** in critical information in H5 affected countries
  - What routine surveillance is in place? None!
  - How are people becoming infected?
    - What types of exposures result in infection/severe illness?
  - What are the characteristics of the viruses causing outbreaks in different countries?
    - Antigenic, genetic, antiviral susceptibility, virulence in animal models (Note: limited access to viruses from Cambodia, Laos, China and other countries; disconnect between human and veterinary health officials)
The HHS response: An Initiative to Enhance Influenza Surveillance in Asia

- Bilateral funding ($1.5 M) for countries with WHO National Influenza Centers to build country surveillance networks (CDC Program Announcement)
- Funding for WHO HQ and WHO’s WPRO for pandemic preparedness planning, country assessments, training (biosafety), personnel, purchase of supplies and equipment, etc. (>1.25 M though Cooperative Agreements with WHO Regional Offices and HQ)
- Funding for CDC’s IEIP in Thailand and for NAMRU 2 in Jakarta, each of which will work with respective National Influenza Centers and MoH
- Funding for staff to coordinate WHO’s Animal Influenza Network and to facilitate communications and interactions between public health and veterinary agencies (e.g., USDA, FAO, OIE)
- Funding for shipment of influenza isolates and other specimens to WHO CCs (current costs = $600 - $1,000 per shipment)
What Do We Expect to Achieve?

- A significant increase in geographic reach of WHO’s Global Influenza Surveillance Program.
- Earlier access to critical virus isolates from Asia, both from humans and from birds during outbreaks of avian influenza.
- Establishment of NICs in countries not participating in WHO’s Global Program.
- Increased numbers of shipments and of influenza isolates from Asia for analysis by Collaborating Centers; used for vaccine development and determination of antiviral susceptibility.
- Vaccine candidate reference strains produced in advance for viruses with pandemic potential.
A Little Help Can go a Long Way
U.S. Influenza Surveillance: A Template for Country Surveillance

- Virologic surveillance
  - Preliminary data reported
  - Proportion of influenza virus type/subtypes
  - Antigenic characterization - vaccine match
- Indirect measures or “tracking systems” are used to monitor impact
  - % ILI from sentinel providers
  - % P&I mortality
  - Estimates of overall influenza activity by state
- Determine periods of “excess” ILI or death
- Ongoing effort to improve epi/lab capacity in U.S.
U.S. Influenza Surveillance

Sentinel Providers
State and Territorial Epidemiologists
Vital Statistics Registrars
Health Departments
Laboratories
Public Health Officials
Physicians
Public
Media
Other
Virologic Surveillance in the U.S.

- ~120 participating laboratories
- Specimens collected during routine patient care
- Specimens collected year around in many states
- Weekly reports
  - # specimens tested (127,316 tested in 2003-04 season)
  - # positive for influenza: type, subtype, age (24,612 positive specimens in 2003-04 season; approximately 1000 analyzed by CDC for 2003-04 season)
Influenza-like Illness Surveillance in the U.S.

- 1,932 physicians/clinics enrolled for the 2003-04 season; over 8 M patient visits
- Weekly reports
  - Total # of patient visits
  - # visits for influenza-like illness (ILI) by age group
    - ILI = fever ≥ 100 F (38 C) and cough or sore throat, in absence of a known cause
- Submit specimens for culture
Influenza-like Illness
Reported by Sentinel Providers

Week
% of Visits for ILI

% ILI 2003-04
%ILI 1999-2000*
%ILI 2002-03
national baseline
State Epidemiologist’s Report

- Assessment of overall influenza activity at state level
  - None, sporadic, local, regional, widespread
  - Incorporates virus circulation & illness
  - Only system reporting state-level data
- Allows local interpretation of surveillance data
122 Cities Mortality Reporting System

- Purpose: timely assessment of P&I-related mortality; certificates received within 8 days of death; reported to CDC within another 7 days.
- Weekly reports from vital statistics offices in 122 US cities.
  - Total # of death certificates filed
  - # with pneumonia or influenza listed
- ~ 1/3 of US deaths
Pneumonia and Influenza Mortality for 122 U.S. Cities

% of All Deaths Due to P&I

Epidemic Threshold

Seasonal Baseline

Weeks
Challenges for Surveillance

- Standardization of data over time and across states/provinces and countries
- Filling gaps in surveillance (Asia, Latin America, the Middle East, and Africa)
- How much data is enough?
- Detecting animal to human transmissions
- Integration of animal and human surveillance
- Transparency! (Share information, viruses, reagents, funding, and expertise)
- Increased demand for public information
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- WHO Headquarters in Geneva
- Many colleagues from NIHE, NIVR, NCDV and other institutions in Vietnam
- Many colleagues in Thailand (IEIP Site and MoH)
Enhancing Influenza Surveillance:
We’re on a Roll