

Part B. SURVEILLANCE

NC Department of Health and Human Services, Division of Public Health

A. Introduction

The NC Division of Public Health (NC DPH) conducts routine influenza surveillance annually from October through May. The Communicable Disease Branch (CDB) (formerly General Communicable Disease Control Branch) oversees and coordinates the influenza surveillance activities. NC participates in many of the activities of influenza surveillance outlined by the Centers for Disease Control and Prevention (CDC). They include virologic surveillance by the NC State Laboratory of Public Health (SLPH), surveillance of influenza-like illness (ILI) by sentinel providers and the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT), influenza activity level in NC as reported by the State Epidemiologist, and the 122-Cities pneumonia and influenza mortality system, of which Charlotte, NC is one of the reporting cities.

Influenza surveillance in NC also includes the investigation of outbreaks of influenza, case investigations of severe illness and deaths in children associated with influenza, and enhanced surveillance for novel influenza viruses in certain situations (e.g. travelers, refugees, and poultry workers who meet specific epidemiologic criteria). NC added novel influenza virus infections in humans to the list of reportable conditions in 2006.

In 11 of the largest hospital systems in NC, ILI surveillance is augmented by hospital-based public health epidemiologists (PHEs). PHEs perform active surveillance for hospital admissions for ILI and investigate clusters of ILI with special attention to those involving increased severity or unusual populations. PHEs also assist with case investigations of hospitalized patients who have unusual clinical syndromes or severe morbidity associated with influenza.

The NC DPH has also developed an algorithm for detection and management of suspect cases of avian influenza H5N1 in outpatient settings. This algorithm is available as an interactive .pdf file at the NCDPH website (www.ncpublichealth.com); hard copies have been distributed to local health departments and health care providers across the state through a variety of mechanisms, including Medicaid bulletins, state medical society websites, and distribution at meetings.

In the event of an influenza pandemic, routine surveillance systems will need to be rapidly adapted to respond to the challenges of increased influenza cases. In the early phases of a pandemic, surveillance systems will need to have the sensitivity to detect early human cases of novel virus in the state. In the later phases, surveillance systems will need to assimilate large amounts of data to determine age-specific attack rates, morbidity, and mortality.

Syndromic surveillance for ILI is being conducted in nearly all hospital emergency departments (EDs) across the state. ED data is collected and analyzed for ILI trends with the NC Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT). NCDPH monitors ED data for specific syndromes, such as ILI, on a daily basis. Laboratory data from the NC State College of Veterinary Medicine and data from a wildlife refuge are also downloaded in the NC DETECT system daily. NCDPH will rely heavily on NC DETECT to monitor ILI in hospital emergency departments across the state.

Synthesis of these systems and information to provide useful human health intelligence upon which to base critical decisions will be the challenge especially during a pandemic event. NC's approach is to develop a scaleable plan related to the CDC Pandemic Intervals.

Planning Assumptions:

- It is impossible to predict an accurate impact. Using the 1918 pandemic as a model with a 35% attack rate, the result in North Carolina could be:
 - 1.6 million doctor visits
 - 290,000 hospitalizations
 - 65,300 deaths
- The World Health Organization and CDC will coordinate surveillance at the national and international level.
- Routine influenza surveillance systems will be overwhelmed during the later phases of the pandemic
- Influenza Surveillance systems will need to be flexible to accommodate the pertinent epidemiology of the identified virus(es).

B. Interpandemic period (no corresponding CDC Pandemic Interval)

NC DPH will:

1. Maintain routine influenza surveillance, which is conducted from October to May each year. Current influenza surveillance is coordinated through the Communicable Disease Branch, Influenza Surveillance Coordinator, weekly reports are developed and disseminated and include
 - a. **Disease-based surveillance** conducted by a voluntary network of sentinel providers as part of the CDC Influenza-Like Illness Network (ILINet; formerly known as the Sentinel Provider Network or SPN). These providers also submit nasopharyngeal specimens from a sample of patients with ILI to the State Laboratory for Public Health for testing to identify prevailing strains.
 - b. **Syndromic Surveillance** utilizing Emergency Department visits from 111 hospitals in NC and the analysis of chief complaints, triage notes, and vital signs as they relate to ILI through the NC Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT). This system monitors ED data for specific syndromes such as ILI on a daily basis. Laboratory data from the NC State College of Veterinary Medicine and data from the Piedmont Wildlife Refuge, Carolina Poison Control, and Emergency Medical Services (Pre-hospital Medical Information System) is also downloaded into the system daily.
 - c. **122-Cities Pneumonia and Influenza Mortality Reporting** (Charlotte, NC)
 - d. **Reporting of Outbreaks** in long-term care facilities, schools, and other settings of public health importance.
 - e. **Investigations of deaths and severe illness in children less than 18 years of age.** NC conducts active surveillance for influenza-associated deaths and cases of encephalopathy in children less than 18 years of age. Pediatric deaths are on the list of immediately reportable conditions in NC.

2. In 11 of the largest hospital systems, ILI surveillance is augmented **by hospital-based public health epidemiologists (PHEs)**. Some of responsibilities of the PHEs include:
 - a. Performing active surveillance for hospital admissions for ILI and investigating unusual clusters of ILI with special attention to travel history and occupational status.
 - b. Conducting case investigation on hospitalized patients who have unusual clinical syndromes or severe morbidity associated with influenza
 - c. Assisting local health departments with investigation of pediatric deaths associated with influenza.
 - d. Weekly reporting of influenza testing (DFA and/or rapid) results to the Influenza Surveillance Coordinator and Local Health Departments.
 - e. The 10 hospital systems participating in the PHE program are:
 - i. Cape Fear Valley Medical Center: Fayetteville
 - ii. Carolinas Medical Centers: Charlotte,(Mercy, Pineville, University)
 - iii. Duke University Medical Center: Durham
 - iv. Mission Hospitals: Asheville
 - v. Moses Cone Healthcare System: Greensboro
 - vi. New Hanover Regional Health Network: Wilmington
 - vii. Wake Forest University Baptist Hospital: Winston-Salem
 - viii. Pitt County Memorial Hospitals: Greenville
 - ix. University of North Carolina Hospitals: Chapel Hill
 - x. Wake Med Hospitals: Raleigh, Cary
3. Coordinate with NC Department of Agriculture and Consumer Services and the respective industries that currently perform **testing for influenza in poultry and swine**. Testing of poultry for influenza viruses is performed on a routine basis as well as upon request
 - a. Testing for AIV is performed at the request of the grower or company veterinarian
 - b. Testing for AIV is performed on all poultry with respiratory disease
 - c. A respiratory sample of all broilers is tested for AIV within 10 days of processing
4. Testing for influenza in swine herds is done at the request of the farmer or company veterinarian

Upon recognition of unusual patterns of disease with high morbidity or mortality, the Pandemic Influenza Surveillance Coordinator, the Influenza Surveillance Coordinator and the State Epidemiologist will make recommendations regarding further testing, infection control provisions and will coordinate with the CDC regarding elevation to Investigation Interval.

Communication of a single case or outbreak of Avian Influenza in poultry with the potential to infect humans (H5, H7 and H9) occurs directly from the State Veterinarian (Department of Agriculture) to the State Epidemiologist. Active surveillance of any poultry worker with avian influenza will be coordinated through the Communicable Disease Branch. This is in accordance with the NC Highly Pathogenic Avian Influenza Response Plan. A report of avian influenza in a poultry worker would trigger an upgrade in the influenza interval phase in NC and would be reported immediately to the CDC.

Identification of a single human case or outbreak of swine influenza would be reported immediately to the CDC.

C. “Investigation” Interval

(Sporadic cases of novel influenza occurring)

Trigger:

- Identification of animal case of influenza A subtypes with potential implications for human health within the state. Actions:
 - Assess human exposures and risks of infection
 - Monitor for human disease
 - Increase communication between Department of Agriculture and the CDB regarding the presence of avian and swine influenza in NC
 - Establish clear reporting mechanisms for daily exchange of information between the two agencies

Action

- Local health departments and DPH will conduct active surveillance in poultry and swine workers if a novel virus is identified in poultry and swine (Appendix B-1)

Trigger:

- Identification of human case of potential novel influenza A infection

Actions:

If case is within the state:

- Assess case contacts to determine human to human transmission and risk factors for infection
- Share information with animal and human health officials and other stakeholders, including reporting of cases according to the Nationally Notifiable Diseases Surveillance System and sharing virus samples
- Expand virologic and disease-based surveillance to year-round surveillance.
 - Recommend viral testing and case investigation for ILI outside of typical influenza season.
 - Instructions would include methods of testing, methods on requesting testing, shipment and handling of samples, etc. (Section H, Appendix H-2, H-3) This would be communicated to laboratories and providers through professional newsletters, the NC Health Alert Network and at educational events Submit specimens to SLPH for viral testing on cases of ILI which occur outside of peak of ILI activity
 - Enhance surveillance among travelers or those relocated from geographic areas in which novel viruses have been isolated (Appendix B-1 and B-2)

If case is outside the state:

- Continue surveillance measures listed for interpandemic period.

Additional surveillance measures during investigation interval will include:

- Continue surveillance methods for influenza
 - Virologic surveillance

- o Disease-based surveillance
- o Outbreak investigations
- o Case investigations of pediatric deaths and encephalopathy associated with influenza
- o ILI surveillance in hospital EDs (NC DETECT) and admissions (PHEs)
- The CDB Pandemic Flu Surveillance Coordinator regularly monitors bulletins from CDC and WHO regarding virologic, epidemiologic and clinical findings associated with new variants isolated within or outside the US
- The CDB Pandemic Flu Surveillance Coordinator regularly monitors basis updates from the World Animal Health Organization (OIE) on outbreaks of novel viruses in animals.
- Monitor ILI in military personnel at the military bases through BioSense and directly through the local health departments and base public health officials.

D. “Recognition” Interval

(Clusters of novel influenza cases identified and confirmation of sustained and efficient human-to-human transmission)

Triggers:

- Confirmation of human cases of novel influenza A and demonstration of efficient and sustained human-to-human transmission.
- Two or more laboratory-confirmed pandemic cases that are not epidemiologically linked to any previous case

Actions:

If within the state:

- Continue/initiate actions described for “Investigation Interval”
- Implement case-based investigation and containment
- Confirm all suspect cases at public health laboratory
- Report cases according to Nationally Notifiable Diseases Surveillance System
- Conduct enhanced novel influenza A surveillance
- Activate an Incident Management Team and evaluate need for full activation of the Public Health Coordination Center, This will establish a clear chain of accountability, meet staffing requirements for an extended period and establish communications/coordination plans with partner responding agencies.
 - o The CDB Pan Flu Surveillance Coordinator and the SLPH will report to Operations
 - o Coordination of DPH with Department of Agriculture and NCEM will occur through the Liaison Officer
- Contact the State Emergency Response Team to assess if the State EOC will be activated beyond routine operations
- Activate all current surveillance methods for influenza if outside of the regular influenza season
 - o Virologic surveillance
 - o Disease-based surveillance
 - o Outbreak investigations

- Case investigations of pediatric deaths and encephalopathy associated with influenza
 - ILI surveillance in hospital EDs (NC DETECT) and admissions (PHEs)
- Establish contact with the major military installations in NC to coordinate active surveillance in military personnel returning from areas where novel virus has been isolated or confirmed in humans
- The CDB Pan Flu Surveillance Coordinator will continue to monitor updates from CDC, WHO and OIE frequently in order to maintain a high level of situational awareness
- The CDB Pan Flu Surveillance Coordinator with the assistance of the Flu Surveillance Coordinator will produce at minimum weekly reports on flu activity in NC and updates to the status of the pandemic. This list will be distributed to all public health and responder partners.
- Activate a recruitment program to increase the numbers and activities of sentinel providers if required, or take other measures needed to enhance sentinel surveillance.
- In the absence of a NC electronic death record system, activate a sentinel mortality register for surveillance of influenza and pneumonia deaths
 - If activated, the NC State Mortuary Operations and Recovery Team will have the capacity to generate electronic records of people who are deceased and can supplement a sentinel surveillance system (the SMORT is currently being developed as a resource in NC)
- Monitor school absenteeism due to ILI through reports from Local Health Departments or through statewide data if available from the NC Department of Public Instruction.

If outside the state:

- Continue/initiate actions described for "Investigation Interval"
- Conduct enhanced novel influenza A surveillance.
- Implement appropriate screening of travelers and other border health strategies, as directed by CDC
- Perform active surveillance for ILI in travelers returning to NC from areas where novel influenza virus infection have been confirmed in humans (see Attachment B2)

If a novel virus is identified in a North Carolina resident, it will be reported directly to the local health department. Local health departments will notify the CDB on call Epidemiologist. This is in accordance with the procedures in place for all immediately reportable conditions.

- The Communicable Disease Branch will work with local health department personnel to conduct the epidemiologic investigation to determine possible sources of exposure and identify contacts
- Isolation of the individual and quarantine of the contacts will be conducted by the local health director
- CDC will be notified by the State Epidemiologist

- Local health departments will maintain records of all known isolated and quarantined individuals and provide a regular report to the Pan Flu Surveillance Coordinator.

E. “Initiation” Interval

(First human cases of pandemic influenza virus in the US; if pandemic strain first emerges in US, “Recognition” and “Initiation” intervals are the same)

Trigger:

- Laboratory-confirmed case of defined pandemic influenza detected within the US

Actions:

DPH will:

- Continued enhanced surveillance for detecting additional or potential cases of the epidemic strain to determine when community mitigation interventions will be implemented.
- Continue all surveillance methods for influenza if outside of the regular influenza season
 - Virologic surveillance
 - Disease-based surveillance
 - Outbreak investigations
 - Case investigations of pediatric deaths and encephalopathy associated with influenza
 - ILI surveillance in hospital EDs (NC DETECT) and admissions (PHEs)
- Initiate collection of additional surveillance data as needed to meet state or federal surveillance needs. Such additional data may include some or all of the following:
 - In conjunction with CDC, local health department and other partners, design studies to Document outbreaks of influenza in different population groups
 - Determine age-specific attack rates, morbidity and mortality
 - Describe unusual clinical syndromes, risk factors and treatment
 - Describe factors associated with fatal cases
- The CDB Pan Flu Surveillance Coordinator will report to CDC as requested the numbers of cases and other required information
- The CDB Pan Flu Surveillance Coordinator will continue to monitor updates from CDC, WHO and OIE frequently in order to maintain a high level of situational awareness
- The CDB Pan Flu Surveillance Coordinator with the assistance of the Flu Surveillance Coordinator will produce at minimum weekly reports on flu activity in NC and updates to the status of the pandemic. This list will be distributed to all public health and responder partners.
- In conjunction with CDC, CDB and the Immunization Branch will conduct efficacy studies for available vaccine
- CDB will implement tools to study the effectiveness of control methods and community containment measures.
- CDB with the OCME will conduct mortality surveillance for influenza and pneumonia deaths Continue/initiate actions described for “Recognition Interval”
- Prepare for investigation and response

- Continue enhanced surveillance for novel influenza A

F. “Acceleration” Interval

(Public health officials recognize that containment efforts have not succeeded and onward transmission is occurring)

Trigger:

- Increasing numbers of cases which exceed resources to provide case-based control measures.

Actions:

- Elevate the activation level the Public Health Coordination Center to effectively manage DPH resources over the extended period of a pandemic
- Communicate with the State Emergency Response Team regarding needed support
- Dispatch representatives, provide technical assistance and deliver reports as requested to the State EOC.
- Transition surveillance from individual case confirmation to mortality and syndromic disease monitoring
- Monitor ILI in hospitals through the NC DETECT and PHEs and communicate with OEMS regarding data obtained through the State Medical Asset Resource Tracking Tool (SMARTT) System. (SMARTT is the NC web-based reporting system that collects information on hospital, long term care facilities and other medical facilities resources including numbers and types of beds, medications, durable equipment (ventilators), etc.) Specific queries will be made based on pandemic needs.
- Monitor through the Sentinel Provider Network the number of cases being seen in outpatient settings even if only gross numbers can be obtained.
- Laboratory surveillance will be conducted as follows:
 - Once circulation of pandemic influenza is documented in NC, routine or diagnostic testing will continue to be conducted in order to monitor hospitalizations and mortality associated with novel influenza infection. Testing at the SLPH will be conducted after joint consultation with CDB, SLPH and the medical provider to:
 - Monitor relative proportions of pandemic and seasonal strains in circulation
 - Monitor for mutations in circulating strains, including presence of mutations conferring antiviral resistance
- The CDB Pan Flu Surveillance Coordinator will report to CDC as requested the numbers of cases and other required information in the frequency requested
- Monitor effectiveness of community mitigation activities including school dismissal, large group participation, etc
- Monitor vaccination coverage levels, antiviral use, and adverse events

- Investigate possible pandemic influenza in a person receiving antiviral medications (after consultation with CDB epidemiologists)_to confirm treatment failure or determine resistance
- Confirm pandemic influenza in a person who had received vaccine(after consultation with CDB epidemiologists) to confirm vaccine failure
- Assist in the determination of illness if highly unusual circumstances arise
- Continue/initiate actions described for “Initiation Interval”

G. “Peak/Established Transmission” Interval
(Extensive transmission in the community)

Triggers:

- Percentage of visits due to ILI reported by ILINet providers exceeds peak value averaged over the past three seasons or percentage of ED visits due to ILI reported through NC DETECT exceeds peak value averaged over the past three seasons **AND**
- “Widespread” influenza activity is reported by the State Epidemiologist using CDC surveillance criteria and >20% of specimens from patients with influenza-like illness submitted to the state public health laboratory are positive for the pandemic strain during a seven day period
- Health care system surge capacity has been exceeded

Actions:

- Continue/initiate actions described for “Acceleration Interval”
- Laboratory confirmation of only a sample of cases as required for virologic surveillance
- Implement surveillance primarily for mortality and syndromic disease

H. “Deceleration” Interval
(Rates of pandemic influenza declining)

After the first pandemic wave, surveillance methods will return to a level utilized during early phases (decelerate) but may re-accelerate into a second wave. Surveillance will be directed at determining the onset of subsequent waves and to determine the efficacy of containment measures such as vaccine, antiviral medications, school dismissal and canceling large gatherings.

Triggers:

- Percentage of visits due to ILI reported by ILINet providers falls below peak value averaged over the past three seasons and percentage of ED visits due to ILI reported through NC DETECT falls below peak value averaged over the past three seasons
- <10% of specimens from patients with influenza-like illness submitted to the state public health laboratory are positive for the pandemic strain for at least two consecutive weeks

- “Regional”, “local”, or “sporadic” influenza activity is reported by the State Epidemiologist using CDC surveillance criteria
- Health care system utilization is below surge capacity

Actions:

- Continue/initiate actions described for “Peak/Established Transmission Interval”
- Transition surveillance from syndromic to case-based monitoring and confirmation

I. “Resolution” Interval

(Pandemic cases occurring only sporadically)

Triggers:

- Laboratory-confirmed pandemic influenza cases are occurring sporadically
- Health care system utilization is approaching pre-pandemic levels

Actions:

- Return to routine surveillance activities to verify resolution of epidemic wave
- Continue/initiate actions described for “Deceleration Interval”
- Resume enhanced virologic surveillance to detect emergence of increased transmission.
- Prepare for possible second wave
 - Review and analyze epidemiologic data obtained during the pandemic
 - Age-specific mortality, morbidity and attack rates
 - Vaccine efficacy
 - Antiviral medication efficacy
 - Community containment measures