

North Carolina State Laboratory of Public Health Influenza Plan

Test Methods

The North Carolina State Laboratory of Public Health (NCSLPH) routinely performs RT-PCR detection of influenza virus. Influenza surveillance data indicate that 2009 H1N1 is the predominant strain circulating in North Carolina. With the emergence of the 2009 H1N1 strain, the NCSLPH has suspended viral culture for the routine detection of influenza virus. Using the FDA-approved *CDC Human Influenza Real-time RT-PCR Detection and Characterization Panel*, the NCSLPH currently performs RT-PCR for detection of influenza virus (seasonal Influa, Influb, H1, H3, 2009 H1N1 and H5N1 as indicated). Viral culture for propagation and detection of other respiratory viruses is performed if the RT-PCR assay is negative for influenza viral RNA **AND** if the submitter requests additional testing on the submission form. Additionally, a select percentage of RT-PCR negative samples are placed into culture for surveillance of other respiratory viruses.

If there is strong reason to suspect a novel influenza infection [an epidemiological link to a known influenza novel virus such as H5N1 case or exposure to poultry potentially infected with H5N1], contact the Communicable Disease (CD) Branch Epidemiology staff immediately at 919-733-3419.

The NCSLPH works closely with the NC Communicable Disease Branch to develop guidance for sample submissions (<http://www.epi.state.nc.us/epi/gcdc/H1N1flu.html>). Laboratory surveillance will be based on the severity of illness (e.g., the Pandemic Severity Index) and on the interval of the pandemic that NC is experiencing. Guidelines for testing will be developed and distributed through Micronet@lists.ncmail.net, the NCSLPH webpage (<http://slph.ncpublichealth.com>), and the DPH influenza websites (www.flu.nc.gov).

The pandemic intervals (investigation, recognition, initiation, acceleration, peak, deceleration, and resolution) will determine testing strategies and testing algorithms at the NCSLPH. The highest test load is expected to occur during the recognition and initiation intervals when the novel virus demonstrates efficient human-to-human transmission. During the acceleration and subsequent peak intervals, laboratory testing is expected to decrease as more patients are being treated without laboratory confirmation. During the peak interval, the highest number of newly identified cases is expected and the NCSLPH will be testing for the purpose of surveillance of the pandemic strain. Once the peak for infection rate has been reached, cases will begin to decline and the state will enter into the deceleration interval followed by the resolution interval in which cases become sporadic and laboratory will continue testing for surveillance of the pandemic strain as well as other circulating influenza viruses.

When making decisions as to which diagnostic assays to perform and what emphasis to place on laboratory reports for use by clinicians, please review the guidance on rapid assays (http://www.cdc.gov/h1n1flu/guidance/rapid_testing.htm) stating that **“a negative rapid test result does not rule out influenza virus infection”**. Ensuring the clinicians and submitters are aware of the limitations of Rapid Influenza Diagnostic Tests when making clinical decisions can be very important to patient outcome.

Specimen Collection for Influenza

Note: The CDC package insert for RT-PCR requires samples to be stored at 2-8°C for no more than 72 hours between specimen collection and analysis. For this reason, ship specimens within 24 hours of collection to accommodate transit delays. All samples must be shipped with ice packs in insulated containers. If a shipment will be delayed because of holidays or weekends or distance/carrier considerations, freeze and hold specimens at -70°C, and ship on dry ice.

Respiratory Specimens

Each primary specimen container should be labeled with a unique ID # (date of birth, SSN, or CNDS) and the patient's first and last name, and the collection date.

Use only Dacron or rayon swabs with plastic or metal shafts. Calcium alginate swabs and cotton swabs with wooden shafts are **unacceptable**.

Nasopharyngeal Swab – Carefully swab the posterior nasopharyngeal area via the external nares with a dry sterile tipped swab. Break off the swab tip into a vial containing 2 ml of viral transport medium. Screw the cap on tightly.

Nasal Swab - Insert dry swab into nasal passage and allow it to absorb secretions. Place swabs in viral transport medium and break off at the neck of vial. Screw the cap on tightly.

Throat Swab – Vigorously rub the posterior wall of the pharynx with a dry, sterile, swab. The swab should not touch the tongue or buccal mucosa. Break off the swab tip into a vial of viral transport medium. Screw the cap on tightly.

Nasal Aspirate – Approximately 3-7 mls of sterile PBS is aspirated into a rubber bulb. The patient should be placed on their side in a supine position. Gently press one nostril closed with finger pressure. Use the point of the bulb to completely occlude the other side. The PBS is then squeezed into the nose and quickly aspirated. Secretions are then placed into a sterile vial. Screw the cap on tightly.

Lower Respiratory Tract Specimens- These specimens include bronchoalveolar lavage fluid (BAL), bronchial aspirates (BA), bronchial washes (BW), endotracheal aspirates (EA), endotracheal washes (EW), tracheal aspirates (TA), and lung tissue. The aspirates and washes should be placed into a sterile vial; lung tissue should be placed into viral transport medium. In both cases, ensure that the cap is screwed on tightly.

Transport medium is available from the NCSLPH Mailroom (919-733-7656). Upon receipt, place the transport media in refrigerator. Commercially available viral transport media can be used as well.

Blood components (for suspect H5N1 only)

Each primary specimen container should be labeled with a unique ID # (date of birth, SSN, or CNDS), the patient's first and last name, and the collection date. The NCSLPH will not conduct serologic tests. Blood components will be forwarded to CDC for testing.

Both acute and convalescent serum specimens should be collected for antibody testing. Collect convalescent serum specimens 2–4 weeks after the onset of illness. To collect serum for antibody testing:

- Collect 5 ml–10 ml of whole blood in a serum separator tube. Allow the blood to clot, centrifuge briefly, and collect all resulting sera in vials with external caps and internal O-ring seals. If there is no internal O-ring seal, then seal tightly with the available cap and secure with Parafilm®.
- The minimum amount of serum preferred for each test is 200 µl, which can easily be obtained from 5 ml of whole blood. A minimum of 1 ml of whole blood is needed for testing of pediatric patients. If possible, collect 1 ml in an EDTA tube and in a clotting tube. If only 1 ml can be obtained, use a clotting tube.

Required Submission Forms

Links to the forms are shown below. The patient's health care provider must complete the submission (requisition) forms.

The submission form for respiratory specimens can be found at <http://slph.ncpublichealth.com/Forms/DHHS-3431.pdf>.

In the case of suspected H5N1, the submission form for blood components can be found at <http://slph.ncpublichealth.com/Forms/DHHS-3445.pdf>. To forward the sample to CDC for serologic testing, the CDC 50.34 DASH form is required. This form can be found at http://www.cdc.gov/ncidod/dybid/westnile/resources/cdc_form5034.pdf

Please fill out all forms as completely as possible with the following information or the specimen may be considered UNSATISFACTORY for testing:

- **Symptom onset date**
- **First and Last name of patient and date of birth**
- **Date of collection**
- **Sample source**
- **Return address including telephone number and submitter's EIN number**
- **Epidemiologic risk factors including epi links, travel history, and vaccination history**

Finally, be sure to specify on forms DHHS-3431 and DHHS-3445 that influenza testing is requested and on the CDC 50.34 DASH form that H5N1 influenza testing is requested. It can be handwritten in "Other" category.

Shipping Instructions

Submission forms are available online at <http://slph.ncpublichealth.com/Forms/DHHS-3431.pdf>. Mailers and transport media may be ordered online at the NCSLPH website <http://slph.ncpublichealth.com/forms.asp#mailroom>. Mailers and transport media may be ordered by calling the NCSLPH Mailroom (919-733-7656 – **Sentinel Network Providers Only**). Upon receipt, open, place transport media in refrigerator and place ice packs in freezer.

Any suspect influenza specimen should be shipped as a UN3373 BIOLOGICAL SUBSTANCE, CATEGORY B. The shipper (hospital or clinic) – not the transport company – is responsible for the shipment until the package reaches the consignee (NCSLPH). Specimens can be shipped via FedEx, United States Postal Service (USPS), or the State Courier system. Package should be shipped by the fastest means possible. *Transit time of less than 24 hours after collection will optimize virus detection.***All samples must be shipped cold in insulated containers.****

Primary Packaging

The primary receptacle(s) must be leak-proof. Multiple primary receptacles must be wrapped individually to prevent breakage. When determining the volume of diagnostic specimens being shipped, include the viral transport media. Primary receptacle(s) must not contain more than 500 mL or 500 g. *The biological substance consists of the primary receptacle and its contents.*

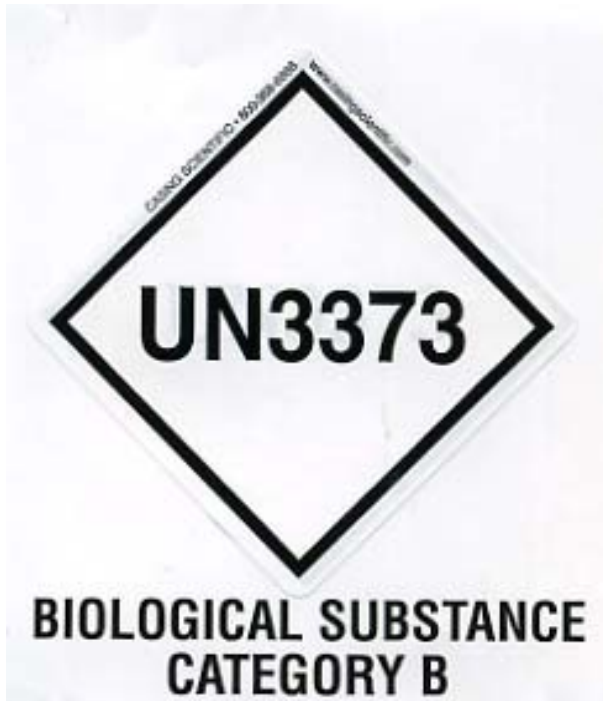
Secondary Packaging

- Use enough absorbent material to absorb the entire contents of all primary receptacles in case of leakage or damage. Secondary packaging must meet the IATA packaging requirements for biological substances, category B including 1.2 meter (3.9 feet) drop test procedure. (IATA packing Instruction 650)
- Secondary packaging must be leak-proof. Follow the packaging manufacturer or other authorized party's packing instructions included with the secondary packaging. Secondary packaging must be at least 100 mm (4 inches) in the smallest overall external dimension. Must be large enough for shipping documents, e.g. air waybill.

Outer Packaging

The outer packaging must not contain more than 4 L or 4 kg. Cold packs must be placed outside the secondary packaging.

- The cold packs must be leak-proof.
- Each package and the air waybill must be marked with the following label or exact wording:



- The name and telephone number of the responsible person must be marked on the package or provided on the waybill.
- An itemized list of contents must be enclosed between the secondary packaging and the outer packaging. This can be the requisition form (Appendix H-2). Place in a sealed plastic bag to protect from moisture. A Shipper's Declaration for Dangerous Goods is NOT required for Category B.

USPS or State Courier Shipping

If using the USPS or State Courier system, the viral culture kits from the NCSLPH may be used.

- Ship specimen(s) to the NCSLPH the same day collected. **DO NOT DELAY SHIPMENT OF SPECIMENS UNTIL ALL FOUR VIALS OF TRANSPORT MEDIA ARE USED.** Although this kit was designed for up to four specimens, the cost of the transport media is negligible and unused media can simply be discarded.
- Wrap the properly labeled (first and last name of patient with a unique identifier such as date of birth) inoculated transport medium (primary container) in an absorbent material, i.e. paper towel, and place into a leak proof secondary container (50 ml conical tubes).
- The empty plastic shipping tubes used to transport excess media should be used to maintain a tight pack for the specimens being submitted.
- Place secondary container(s) containing specimen(s) between the ice packs.
- Place completed forms in plastic bag and slide into space at narrow end of ice pack.

- Replace Styrofoam lid on the box, seal cardboard box, and attach return pre-addressed shipping label over existing label.

If extra boxes, and/or cold packs are needed, sentinel sites can call the NCSLPH mailroom at 919-733-7656 to place an order. All other submitters need to request boxes by ordering online at <http://slph.ncpublichealth.com/forms.asp#mailroom>.

FedEx Shipping

For more complete instructions for FedEx shipping, please see the following websites:

<http://www.fedex.com/us/services/options/dangerousgoods/regulatory.html>

http://images.fedex.com/us/services/pdf/PKG_Pointers_Specimens_2007.pdf?link=4

Please note FedEx requires someone to sign for package. Please contact the NCSLPH before sending a package that needs to be delivered at a time other than normal business hours. (Monday-Friday 8-4:30)

Shipping Address: NC State Laboratory of Public Health
306 N. Wilmington Street
Raleigh, NC 27601

NCSLPH Standard Operating Procedures

Notification

There is no need to notify NCSLPH personnel when submitting routine influenza specimens including 2009 H1N1. However, when specimens from suspected H5N1 influenza cases are submitted to NCSLPH, advance notification of the Laboratory Director is requested (919-733-7834) and the following internal staff will be notified: Assistant Laboratory Director, Virology/Serology Manager, Viral Culture/Rabies Supervisor, Bioterrorism and Emerging Pathogens Coordinator and Public Health Scientist.

Laboratory Handling

All samples requesting influenza testing will be processed using the RT-PCR assay. Specimens will only be placed into culture if the RT-PCR assay is negative AND if the submitter has requested additional testing by writing "culture if negative by PCR" on the submission form. Cell culture will be observed by light microscopy for the presence of CPE which indicates viral replication. If CPE is present, slides will be prepared for subsequent manipulation and fluorescent viewing with the appropriate monoclonal antibodies.

If the specimen is from a suspected case of H5N1 influenza, the primary specimen will be taken directly to the BSL-3 facility for nucleic acid isolation and subsequent RT-PCR for H5N1 detection. If H5N1 detection by RT-PCR is negative, RT-PCR for typing and subtyping will be performed.

Reporting results**For seasonal/H1N1 influenza specimens**

For RT-PCR results, allow 2-3 working days for sample preparation, RT-PCR testing, and reporting results.

- 1) If the RT-PCR is negative for the presence of influenza viral RNA (influenza viral RNA not detected by RT-PCR), the specimen is assumed negative for influenza and testing for other respiratory pathogens may be indicated. If no further testing has been requested, the sample will be finalized as “Virus NOT DETECTED”. A computer-generated report will be issued to the submitter via the mail.
- 2) If the RT-PCR is positive for the presence of influenza viral RNA, the specimen is assumed positive and no further testing is performed. The specimen is finalized as: seasonal Influenza A H1, Influenza A H3, Influenza B, or Influenza A/H1N1 pandemic DETECTED”. The submitter will be notified by phone and a computer-generated report will be sent out via the mail.

For culture and typing results, allow 5-7 working days for inoculation, viral propagation, fluorescent staining, and reporting results.

- 1) If no CPE is observed by day 7, the specimen will be finalized as: “Negative-no virus isolated.” A computer-generated report will be issued to the submitter via the mail.
- 2) If CPE is observed, slides will be made and the specimen will be finalized as: “Positive- isolate identified as _____.” The submitter will be called and a computer-generated report will be sent out via the mail.

*****All results are available online via the NCSLPH’s secure website at <http://slph.ncpublichealth.com>*****

For H5N1 influenza specimens

Due to the significant public health implications of a positive result, these samples will be processed as quickly as possible.

- 1) If the RT-PCR is negative for the presence of H5N1 influenza viral RNA (H5N1 influenza viral RNA not detected by RT-PCR), the specimen is assumed negative for H5N1 influenza and testing for other respiratory pathogens may be indicated. The specimen will be finalized as “H5N1 virus NOT DETECTED”. A computer-generated report will be issued to the submitter via the mail.
- 2) If the RT-PCR is positive for the presence of H5N1 influenza viral RNA (H5N1 influenza viral RNA detected by RT-PCR), the specimen is assumed positive and the specimen will be finalized as “H5N1 virus DETECTED”. The submitter will be notified by phone and a computer-generated report will be sent out via the mail. The primary specimen will be forwarded to CDC for further analysis.
- 3) If H5N1 influenza antibody is detected by serologic testing, CDC will notify the NCSLPH. In either situation, the CD Branch Epidemiology staff and the submitter will be notified with a call and a formal report will be sent via the mail.

*****All NCSLPH results are available online via the NCSLPH’s website at <http://slph.ncpublichealth.com>*****