Second Consultation on Influenza Surveillance in the United States
Steering Committee and Workgroup Reports
December 5-6, 2007
Atlanta, GA

Meeting Summary and Recommendations

On December 5-6, 2007 the Influenza Division, Centers for Disease Control and Prevention (CDC) and the Council of State and Territorial Epidemiologists (CSTE) convened a second expert consultation to discuss options developed over the past 12 months to improve surveillance for influenza in the United States. The meeting was attended by a variety of experts involved in influenza surveillance including epidemiologists and laboratorians from CDC, representatives from state and local health departments, and scientists working in academic settings. (For a list of participants, see Appendix 1) This report summarizes the discussion and lists the recommendations derived during the meeting.

Background

In June 2006, CSTE approved a position statement calling for an expert panel to evaluate and advise on influenza surveillance in the United States (Appendix 2). The statement was approved in the context of increased concerns about pandemic and avian influenza, recent high-profile vaccine shortages and severe influenza seasons, the occurrence of strains resistance to antiviral medications and growing concerns about the effectiveness of vaccination; these issues require more timely, complete and efficient influenza surveillance data. The position statement recognized that state, local and national surveillance systems and needs may not be perfectly aligned to meet these demands, and expressed an interest in finding a common approach to surveillance that might meet the needs of all partners.

CDC and CSTE responded by organizing the First Consultation on Influenza Surveillance in Atlanta, Georgia on November 2-3, 2006. The meeting goals included evaluation of the objectives, uses and value of the components of influenza surveillance at the national, state and local levels; identification and discussion of potential methods to improve surveillance systems; and outlining plans for a more robust, more efficient, and more useful national and local influenza surveillance system. (An Executive Summary of the November 2006 First Consultation on Influenza Surveillance, including recommendations and charges to each of the workgroups, can be found in Appendix 3.)

The discussions at this meeting and the discussions that occurred previously were explicitly focused on seasonal influenza, however, it was acknowledged that the discussions and plans were relevant to planning for surveillance during an influenza pandemic. It was also agreed that the framework for national surveillance should be built upon local surveillance efforts which, when combined, provide national level data.

The consultation developed harmonized goals for influenza surveillance. These goals included being able to detect the onset and duration of influenza virus activity and illness, describe the severity of influenza during the season, identify and characterize circulating viruses, determine who is affected by viral infection, determine the geographic spread of the virus, and guide community interventions. The group made eight recommendations to work toward improving influenza surveillance. Workgroups were established to establish how each recommendation would be addressed. Each workgroup included members of the Influenza Division at CDC and state and local epidemiologists and laboratorians. The Recommendations from the meeting included (see Appendix 3 for details):

1. Facilitate implementation of electronic death reporting as a means for improving reporting of pneumonia and influenza related deaths.
2. Develop methods for timely assessment of severe influenza and health care resource demands including developing standards and definitions for case reporting.
3. Develop methods for expanding laboratory networks within states, electronic laboratory reporting, and data feedback mechanism within states.
4. Develop flexible yet consistent systems for capturing outpatient ILI, specifically focused on expanded use of alternative electronic data sources.
5. Develop standardized definitions for influenza activity including a measure of intensity for the State and Territorial Epidemiologists' Report.
6. Promote standardized approaches to influenza surveillance among states by linking priority recommendations to sustainable funding through the Epidemiology and Laboratory Capacity program.
7. Formalize collaboration between federal, state and local public health authorities, with academic centers to develop protocols for rapid assessment studies, such as vaccine effectiveness and antiviral effectiveness evaluations during pandemic influenza.
8. CDC will work with CSTE members to plan the schedule and composition of the workgroups and timelines for their work

Five workgroups were established and met by teleconference during the following year to address the recommendations or to create a work plan towards the implementation of the recommendations. Workgroups included:

Laboratory (which focused on Recommendation 3),
Influenza-related hospitalization (Recommendation 2),
Mortality (Recommendation 1),
Outpatient Influenza-like illness (Recommendation 4), and
State and territorial issues (Recommendation 5).

A Steering Committee was also created (Recommendations 6, 7, 8) to facilitate the activities of the workgroups, promote standardized approaches to surveillance, and to collaborate on further steps and studies.

Workgroups met via telephone conferencing regularly throughout the next 12 months. During each teleconference meeting, workgroup members addressed the assignments based on the recommendations with a goal of delivering ideas, concepts, issues and

practical solutions at a follow-up meeting. The Second Consultation on Influenza Surveillance was held in Atlanta on December 5-6, 2007.

Second Consultation on Influenza Surveillance December 5-6, 2007
Meeting Objectives

The objectives of the meeting included:
1. To review recommendations of each workgroup
2. To develop a plan for modifications and/or enhancements to the current national influenza surveillance system
3. To develop the concept and plans for pilot projects to test modifications or enhancements in current surveillance systems or new surveillance systems

The general goal of both CDC-CSTE surveillance consultations was to guide federal and state public health officials responsible for influenza surveillance towards a more efficient and sustainable group of surveillance systems that would meet the goals of improved influenza surveillance established at the first consultation.

Workgroup Reports and Recommendations

1. Mortality Workgroup

A. Current situation: Currently, two influenza surveillance systems provide national level data on influenza-associated mortality.

122 Cities Mortality Reporting System (122 CMRS)
The 122 Cities Mortality Reporting System is the most timely and comprehensive source of influenza mortality data in the nation. The deaths captured in this system represent approximately 25% of all deaths in the United States and provide for a fairly timely determination of the relative impact of influenza from season to season. The 122 CMRS system has been in place for more than 50 years. However, because of the system's sampling frame, the data may not be entirely nationally representative. Additionally, this legacy system bypasses an important public health partner, the state health department, thus creating potential disconnects in the flow of information.

Influenza Associated Pediatric Mortality Surveillance System
As a result of the dramatic increase in influenza-associated pediatric mortality experienced during the 2003-04 influenza season, the Council of State and Territorial Epidemiologists voted to make influenza pediatric deaths a reportable condition beginning in the fall of 2004. The reporting of Influenza-related Pediatric Mortality takes place within the framework of the National Notifiable Disease Surveillance System, and as such, requires the participation of local and state health departments. The system was established to monitor and describe the incidence, distribution and basic epidemiologic characteristics of deaths among children with laboratory-confirmed influenza virus infection, and to rapidly provide information on influenza seasons which appear to be unusually severe for children. While this system only provides information on the impact

of influenza on children, most participants agreed that it is working reasonably well in most states.

B. Charge to the workgroup: The Mortality Workgroup was charged to determine if a more complete and representative system of reporting mortality could be implemented. Preliminary discussions suggested that the national movement towards electronic death reporting (EDR) would serve this charge. Recommendation #1 regarding implementation of electronic death reporting is the mandate to this workgroup. Currently, 15 (30%) states do not have electronic death reporting in place, however, four of these states have plans in place to develop such systems. EDR should provide a more timely picture of deaths attributed to influenza than what is available via non-electronic systems based on the rapid transmission of death reports electronically from locales where the deaths occur to a central repository (vital records at state health agency). However, while the workgroup was directed to focus on electronic death reporting (EDR), they also considered whether enhancements to the 122CMRS should be undertaken until all states have such a system in place.

The Mortality workgroup included experts from CDC (including the National Center for Health Statistics), state and local health officials, epidemiologists and vital records experts.

C. Recommendations from the Workgroup: Several recommendations were proposed:

1. Complete the web-enabled transformation of the 122 Cities Mortality Reporting System (122CMRS) with guaranteed open access to any jurisdiction that wishes to join.
2. Provide validated analytical tools for data analysis at the jurisdictional level.
3. For EDR states, a system will be developed to have a state-based Mortality Reporting System.
4. CDC will maintain 3 concurrent systems: 122 CMRS, 122 CMRS expanded system, and EDR system. Only the 122 CMRS data will be published until the other systems are validated.
5. Consideration should be given to replace 122 CMRS when EDR is mature.
6. Encourage state/cities which are part of the 122CMRS, who have EDR, to continue reporting until the system is replaced.
7. Develop a 2008 CSTE position statement encouraging states to develop and implement an EDR system in their states.

In addition, recommendations for “pilot projects” were proposed.

1. An assessment of current capacities in states without EDR,
2. An assessment of EDR systems to determine the feasibility of using these systems as models for mortality surveillance. This pilot project should be conducted in a small number of states with operating EDR systems. The states of New Hampshire, Utah, and Hawaii were highlighted as possible pilot sites, and
3. To provide all state influenza programs with an understanding of EDR. A webinar, or other training modality, should be conducted in the near future.

2. Hospitalization Workgroup

A. Current Situation: Currently, there is no national system for influenza-associated hospitalization surveillance.

Approximately seven states have some form of influenza hospitalization surveillance, and most of these ascertain influenza cases using influenza positive laboratory results. Two national programs, the Emerging Infections Program (EIP) and the National Vaccine Surveillance Network (NVSN) provide data on influenza-associated hospitalizations, but the coverage is limited to a small number of sites and therefore not necessarily representative enough to estimate the incidence of severe influenza- related morbidity on a national level.

The surveillance of influenza-associated hospitalizations can provide a valuable measure of a season's severity, identify groups at higher risk for severe outcome, and provide for the identification of viral strains associated with serious morbidity. It could be used to determine the age-specific rates of influenza-associated hospitalizations and monitor trends over time. Such a system could determine rates of serious influenza-associated complications among hospitalized individuals, describe clinical characteristics of hospitalized patients, identify factors associated with severe illness and identify novel virus strains.

Systems to monitor hospitalizations are, however, often resource intensive, passive by nature, and if based on admission diagnoses, may not reflect laboratory-confirmed influenza. Additionally, hospitalization due to influenza-related illnesses is not a reportable condition in most states and some state health agencies (perhaps as many as 15) do not have well-established relationships with the infection control professionals in their hospitals.

B. Charge to the Workgroup: The charge to the Hospitalization Workgroup is found in Recommendation #2 from the 2006 First Consultation on Influenza Surveillance. The Workgroup, composed of state and local public health officials, epidemiologists, and CDC staff, was directed to develop methods for timely assessment of severe influenza disease burden and health care resource demands, including developing standards and definitions for hospitalized case reporting. The Workgroup translated this charge into the following activities.

1. Improve measurement of influenza burden by implementing hospitalization reporting
2. CSTE should establish standards and definitions for hospitalized case reporting.
3. Determine methods for more timely assessment of burden and resource demands
4. Identify new partners and data sources of hospitalization data
5. Consider a CSTE position statement regarding hospitalization data at the 2008 annual meeting.

The Workgroup reviewed the current examples of hospitalization surveillance (noted above) and gleaned best practices from them.

C. Recommendations:

1. Establish a "laboratory-based surveillance" pilot project to conduct influenza-associated hospitalization surveillance. In this pilot project, cases would be identified through laboratory records of influenza-positive tests and cross-referenced with hospital admission information. This could identify laboratory-confirmed influenza-related hospitalizations from which a minimum data set of demographic information can be collected.

2. Establish an "electronic medical record-based surveillance" pilot project. In this pilot, cases would be ascertained from a variety of sources (positive laboratory findings, ICD-9 code for pneumonia or influenza, discharge or admission diagnosis of influenza) in persons who are participants in health maintenance organizations, or national/ regional health care systems with linked information systems.

3. Establish uniform case definitions and minimum required data elements for the pilot projects.

3. Laboratory Workgroup

Current situation: The current laboratory surveillance system for influenza can be best viewed as being comprised of two parts, the public health laboratory network and a network of clinical laboratories. The current network consists of approximately 140 laboratories and provides weekly reports of the number of samples tested for influenza virus and the number positive. These specimens, obtained during routine medical care, also provide data on the circulating virus and some limited demographic information on the patients tested.

Of the 140 labs in the network, approximately 75 are World Health Organization (WHO) Collaborating Laboratories and include laboratories from state health departments, academic centers, the Department of Defense, and large tertiary care hospitals (part 1). These labs are able to subtype influenza A viruses, report age data and send subsets of isolates to CDC for testing. The remainder of the laboratories are clinical laboratories (part 2), which participate in the National Respiratory and Enteric Virus Surveillance System (NREVSS). These are generally hospital clinical laboratories, test for other viruses in addition to influenza, and do not report age information.

The goals of laboratory-based surveillance include detection of when and where influenza viruses are circulating, identification and tracking circulating strains, and detecting emergence of novel influenza viruses. The strengths of the current laboratory-based surveillance system are that data is included from all states, large numbers of tests results are reported, training and some reagents are provided to labs, and that the network provides viruses for vaccine strain selection and seed virus production. System weaknesses include that the quantity of data is not always sufficient for state or sub-state level analysis, there is no data for some local areas, manual reporting, which is often used

is less timely and labor intensive, and virus shipping costs are largely absorbed by participating labs.

B. Charge to Workgroup: The charge to the Laboratory Workgroup was to develop methods for expanding laboratory networks within states, electronic laboratory reporting, and data feedback mechanisms within states (Recommendation #3, 2006 First Consultation on Influenza Surveillance).

C. Recommendations:

1. No changes need to be made to the public health laboratory network (part 1). The role of this network (WHO Collaborating Laboratories) is to provide more detailed and specific testing, including viral culture, subtyping, surveillance, and suspect/ unusual case investigation. The workgroup concluded that it currently works well, with the exception of decreasing funding, and recommends no changes for this part.
2. Clinical laboratory networks should focus on clinical laboratories within a state. Simple measures of influenza virus activity, such as the number of laboratory confirmed positive laboratory samples divided by the number of influenza tests conducted in a given time period (weekly) can provide helpful estimates of virus circulation and distribution within a state. Implementing such measures in a representative sample of laboratories throughout the state will immediately improve morbidity estimates within that jurisdiction. These data can then be combined to produce national views
3. Ensure that both systems operate with standard data sets to make compilation and analysis easier. Data collected should include patient-level variables, if possible. Protocols should be established so that all states can implement their systems in similar fashions. Some consideration to making laboratory confirmed influenza a nationally notifiable condition is warranted. The feasibility and implementation of this approach remain as challenges.
4. CDC should work with large, commercial laboratories that span several states or regions to evaluate use of these data in laboratory surveillance networks. Data from large, commercial laboratories present special challenges and opportunities.
5. Discuss solutions to funding as an obstacle to implement and expand laboratory surveillance systems. State and local public health laboratories face regularly diminishing resources which leads to decreasing capacity to conduct virologic surveillance. Stable funding for public health laboratories was viewed as critical to success.
6. Fund a small number of pilot studies to evaluate optimal methods to initiate laboratory surveillance in states. The Workgroup made the recommendation that a small series of states, with pilot funding, develop and evaluate systems that incorporate both state public health and clinical laboratories. Attention to methods and data sets that could be implemented in other states would be important.

4. Outpatient ILI Workgroup

A. Current situation: The ability to count and characterize the distribution of influenza-like illnesses (ILI) should provide the nation with a most sensitive picture of the impact

of influenza. The sheer number of ILI cases during peak influenza season is a great burden, not only on the health care delivery system, but also on any systematic effort to count and characterize the cases. The goals of ILI surveillance include monitoring community (i.e., outpatient) morbidity associated with seasonal influenza outbreaks at the local, state, & national levels with regard to: time course, relative severity, and geographic spread.

The US Sentinel Provider Surveillance Network, the first national syndromic surveillance system has been in place since 1997 as a collaborative effort between CDC and state and local health departments. With approximately 2500 outpatient sentinel providers, the US Influenza Sentinel Provider Surveillance Network generates robust data regarding influenza-like illnesses at the national and regional level and provides clinical specimens for virologic study. However, since there are fluctuations in reporting at the local level, the data at the state and local levels are not as robust. Concerns regarding the present system include lack of age group information in the collected denominator data, uncertainty about the universal use of the case definition, and the labor intensive nature of the work.

B. Charge to Workgroup: The charges to the ILI (Outpatient) Workgroup were to develop a flexible yet consistent system for capturing ILI, expand the use of electronic data sources, to evaluate/validate existing electronic health data, and to establish objectives & standards for collecting and reporting ILI data.

C. Recommendations:
The workgroup made a series of recommendations categorized into three major areas: general items, electronic data sources, and data display.

Recommendations related to general items included:

1. Change the name of the current national system to more accurately reflect the heterogeneous methods and data sources which currently contribute data and the intended future expansion in use of electronic data sources. “National influenza-like illness monitoring system” was proposed.
2. CDC should work with influenza surveillance coordinators to ensure data reported to CDC are available to state and local level public health officials in a timely and useful form.
3. States should ensure that the U.S. World Health Organization Collaborating Laboratories receive an adequate supply of clinical specimens for isolation of influenza virus.
4. CDC should continue to serve as the central repository for reporting of ILI data, whether from sentinel providers or electronic data sources, and should maintain the capacity to integrate, interpret, and report national and regional-level ILI data.

Recommendations related to electronic data sources:

5. Available outpatient and emergency department electronic data sources at the local, state, and national levels should be identified and evaluated for inclusion in ILI surveillance.
6. CDC should convene a working group of researchers and public health practitioners experienced with electronic ILI data validation to develop operational recommendations regarding the ICD-9 codes and chief complaint terms for routine use in public health electronic ILI surveillance.
7. Potential electronic ILI data sources should be validated at the national and state/local levels by systematic comparison to existing influenza surveillance data such as laboratory data (preferred), sentinel provider data, or influenza-related hospitalization data. State/local jurisdictions should inform CDC of their efforts and CDC should be available to provide technical assistance.
8. CDC should continue evaluating EARS (Early Aberration Reporting System, a web-based, syndromic surveillance system designed to monitor bioterrorism) methodology for the analysis and display of ILI data and should work with influenza surveillance coordinators to pilot utilization of EARS in state/local jurisdictions, and
9. CDC should develop and validate state or sub-state level geographic displays of ILI data.

State and Territorial Workgroup (National influenza map)

A. Current situation: Measures of influenza activity in states are provided to CDC by the state and territorial epidemiologists in each jurisdiction. CDC posts a weekly influenza activity map demonstrating geographic spread nationwide, per state activity level reports. The map is published regularly in CDC publications, including the Morbidity and Mortality Weekly Report. The map has been found useful in quickly conveying information on influenza circulation to a variety of audiences. Concerns about the accuracy and utility of the data depicted in the map have been raised by state and territorial epidemiologists.

B. Charge to the Workgroup: The charge to this Workgroup (Recommendation #5, First Consultation, November 2006) included addressing concerns about the State and Territorial Epidemiologist's Report component of national surveillance and the development of standardized definitions for influenza activity including a measure of intensity. As a result of this charge, the Workgroup focused on improvements to the national map depicting influenza morbidity and/or mortality.

C. Recommendations:
1. CDC/CSTE should define the information needs for the public, including health care providers, and develop clear health education and/or risk communications messages for appropriate audiences. The workgroup reported that the existing map primarily serves as a communications tool. Once the public needs are defined, then CDC/CSTE could refer to the appropriate data source (e.g., deaths, hospitalization, ILI, labs, other) for additional information. At the core of the discussion was the concern that the map is used by the media, general public and others to portray severity of illness in the nation, which is not accurate. Two actions to decrease misinterpretation of the map have been accomplished

already. They include providing the explicit clarification that "This map indicates geographic spread and does not measure the severity of influenza activity" and changing the visual depiction of state activity level; from contrasting bold color representation to "neutral" patterns.
2. CDC should evaluate existing data from state influenza coordinators (similar to the June 2006 survey), with attention to the data sources used in determining activity codes, and subsequently assess and characterize the variability in code determination by state epidemiologists. Additionally, an assessment of existing processes regarding electronic transmission of flu activity codes should be performed.
3. CDC and CSTE should examine the map's potential use during a pandemic with special attention to maintaining the existing map or modifying it to capture geographic spread (i.e., how scalable should/could the map be, and how frequent should the updates to the map occur in a pandemic).

General Discussion

In addition to the Workgroup discussions and the recommendations that were derived from them, a combined, final session was convened that produced some general observations and recommendations.

First, Position statements for consideration by the Council of State and Territorial Epidemiologists can be an effective vehicle for improvements in influenza surveillance to take place. Recommendations from the workgroups that could be addressed through CSTE Position Statements included:

* encouraging states to participate in the 122 CMRS expanded system, utilizing whatever means available to each state,
* encouraging the states explore the utility of sources of electronic influenza laboratory data, and
* recommending that CDC develop a hospital surveillance system for states that have such data to contribute to a national system.

As a result, members of CSTE who attended this Second Consultation on Influenza Surveillance agreed to work with CDC to develop a single, influenza-related position statement to be submitted for consideration at the June 2008 CSTE annual meeting (Appendix 3).

Second, it was recognized that many states can adequately conduct influenza surveillance utilizing a wide variety of methods. While concerns of comparability and uniformity were raised, the general consensus suggested that as long as a few guiding principles were followed, flexibility and feasibility were deemed more important at the state level. A menu of options should be provided to states rather than mandating methods. The guiding principles included: addressing each of the harmonized surveillance goals identified at the 2006 consultation; that the needs of the local/state/national health agencies for pandemic influenza surveillance should be considered; whatever system a state incorporates, it must have long term sustainability; and that the system should be a local system that builds up to a state system and consequently a national system.

Next steps

The work of the workgroups was completed with the presentation of recommendations to the steering committee. Decisions regarding the selection and timing of support to pilot projects will be made by the steering committee over the following 6 months. An influenza surveillance position statement will be written, submitted and discussed at the June 2008 CSTE annual meeting. Additionally, an influenza surveillance session at the CSTE meeting was proposed.

Update August 2008

- The Influenza Position Statement (Appendix 4), was presented to and approved by CSTE at the June 2008 meeting
    - CDC is developing a plan to address the recommendations in the position statement, namely, development of surveillance guidance and standards for influenza associated hospitalization surveillance, laboratory surveillance and electronic death reports. CDC is working toward the development of data procedures and standards for reporting and on mechanisms to receive and manage data transmitted from state health departments.
- A funding opportunity announcement was released by CSTE in April 2008 for state health departments to conduct influenza pilot projects in the areas of influenza associated hospitalization surveillance, electronic laboratory surveillance and transmit electronic death reports.
    - An objective review process was used for the selection of projects.
    - Five states received funding for the 3 surveillance activities described above and recipients are planning implementation of their pilot projects for the 2008-09 influenza season.

Appendix 1

Participants at the Second Consultation on Influenza Surveillance in the United States

Bernadette Albanese, El Paso County (CO) Department of Health
Ranal Ali, Duchess County (NY) Department of Health
Bob Anderson, CDC, NCHS
Beth Bell, CDC, NCIRD
Nana Bennett, Monroe County (NY) Department of Health
Lenee Blanton, CDC, Influenza Division
Joseph Bresee, CDC, Influenza Division
Eddy Bresnitz, NJ Department of Health
Alicia Budd, CDC, Influenza Division
Matt Cartter, CT Department of Health
Nancy Cox, CDC, Influenza Division
Christine Dao, CDC, Influenza Division
Rosaline Dhara, CDC, Influenza Division
Jeffrey Engel, NC Department of Health
Scott Epperson, CDC, Influenza Division
Paul Etkind, Nashua (NH) Department of Health
Lyn Finelli, CDC, Influenza Division
Anthony Fiore, CDC, Influenza Division
Kathleen Gensheimer, ME Department of Health
Ken Gershman, CO Department of Health
Carol Glaser, CA Public Health Laboratory
Julie Goplin, ND Department of Health
Tom Haupt, WI Department of Health
Laurie Kamimoto, CDC Influenza Division
Tao Kwan-Gett, Seattle-King County (WA) Health Department
Jennifer Lemmings, CSTE
Jan Markowitz, NAPHSIS
Lisa McHugh, NJ Department of Health
Jose Montero, NH Department of Health
Don Olson, NYC Department of Health
Bob Rolfs, UT Department of Health
Sandy Roush, CDC, NCIRD
Anne Schuchat, CDC, NCIRD
Michael Shaw, CDC, Influenza Division
David Shay,CDC, Influenza Division
Vivek Shinde, CDC, Influenza Division
Peter Shult, WI Public Health Laboratory
Leslie Sokolow, CDC, Influenza Division
Patricia Somsel, MI Public Health Laboratory
Christina Tan, NJ Department of Health
William Thompson, CDC, Influenza Division
Jerry Tokars, CDC DEPR
Melinda Wharton, CDC, NCIRD
Lisa Wyman, UT Department of Health

Bao-Ping Zhu, MO Department of Health Dennis M. Perrotta, facilitator

Appendix 2

06-ID-04
Committee: Infectious Diseases

Title: Assessment of Influenza Surveillance in the United States
Statement of the Problem:
Influenza is a major public health issue in the United States, causing an estimated 200,000 hospitalizations (1) and 36,000 deaths each year in the United States (2). Substantial public health resources are committed to prevention of influenza and influenza-associated morbidity and mortality, primarily through influenza vaccination, but also including promotion of respiratory hygiene and use of antiviral medications. During the past several years, influenza has received heightened attention because of:

- Increased pediatric mortality during the 2003-4 influenza season (3);
- Early onset of influenza season and vaccine mismatch in 2003-2004 (4);
- Vaccine shortages and/or distribution delays during four of the past six seasons (5,6);
- Widespread resistance of influenza A (H3N2) to adamantane-type antiviral medications detected during 2005-2006 season (7); and
- Increased concerns regarding pandemic influenza.

Information from public health surveillance is needed to assess the public health burden of influenza, inform policy makers and the public, promote vaccination, evaluate vaccination strategies, guide vaccine development (antigenic characterization of circulating influenza viruses), detect changes in influenza viruses including detection of novel viruses with pandemic potential, and to guide public health interventions to limit morbidity and mortality.
The emergence of avian influenza A (H5N1) as a widespread epizootic disease capable of causing severe human disease has increased both the importance of seasonal influenza surveillance and public interest in both seasonal and pandemic influenza. Surveillance systems for seasonal influenza should serve as a foundation for pandemic surveillance. Although seasonal surveillance systems will almost certainly need to be enhanced during a pandemic, current influenza surveillance systems should be evaluated for their readiness to serve as the foundation for pandemic surveillance.
Currently, United States influenza surveillance includes these components (8):
1. World Health Organization (WHO) and National Respiratory and Enteric Virus Surveillance System (NREVSS) Collaborating Laboratories.
2. U.S. Influenza Sentinel Providers Surveillance Network.
3. 122 Cities Mortality Reporting System.
4. State and Territorial Epidemiologists Reports.
5. Influenza-associated pediatric mortality.
6. Emerging Infections Program (EIP) - laboratory-confirmed influenza related hospitalizations in persons less than 18 years of age.
7. New Vaccine Surveillance Network (NVSN) -- laboratory-confirmed influenza hospitalization rates for children less than 5 years old.
In addition, other methods are being used in some states, including:

- Influenza-associated hospitalizations (9)
- Syndromic surveillance using emergency department chief complaints (respiratory, systemic/febrile illness), hospitalizations for pneumonia, and over-the-counter sales of medicines. (10-12)

Although the current influenza surveillance system has provided useful information, several factors suggest that a formal assessment of influenza surveillance is needed. These include:
1) Currently, the approaches to and resources dedicated to influenza surveillance vary markedly from state to state.
2) Some components of influenza surveillance work well at the national and international level, but provide little useful information at state and local levels (e.g., influenza mortality, pediatric influenza hospitalizations). Heightened interest in influenza has increased the need for information at state and local levels. In addition, it is unlikely that current surveillance methods would be sustainable or satisfy information needs at state and local levels during an influenza pandemic.
3) The current classification system used in the State and Territorial Epidemiologist Reports is problematic in several ways. First, it continues to be very challenging to implement in a standardized manner across states. Secondly, it is potentially confusing to media and policymakers. Although it is often interpreted by media and policymakers as a linear scale describing the seriousness of the seasonal epidemic (i.e., from a mild to a severe flu season) that scale is actually communicating at least two dimensions of severity. That is, it is used to communicate both how disease occurrence is distributed across geographical areas and the intensity of transmission. For example, a state might have detected influenza transmission at a relatively low level across the state. This might well be appropriately described as “widespread”, yet using that descriptor especially early in the season is likely to be interpreted as indicating a severe influenza season.
4) CDC has urged or required through grant requirements that states conduct influenza-like Illness (ILI) surveillance year round, but there is little scientific information about the predictive value of either individual ILI reports or an increase of ILI report frequency during non-seasonal influenza time periods. If the intent is to detect a pandemic of influenza, it is highly unlikely that ILI surveillance can meet this need or would be sustainable during a pandemic.
5) The role of syndromic surveillance methods for .tracking influenza and in particular the potential redundancy between ILI surveillance and chief complaint surveillance deserves attention.
6) Collection of viral isolates is becoming increasingly difficult as practitioners increasingly rely on rapid influenza tests that provide them with real-time clinical information but don’t provide a source of information on the types of viruses that are circulating.
7) Consideration should be given to integrating seasonal and pandemic influenza surveillance with local, state, and federal surveillance computer systems and surveillance system standards (e.g., NEDSS, PHIN, and the PHIN Preparedness Functional Requirements). Plans should be made to assure that surveillance applications are prepared to manage surveillance data during a pandemic.

Statement of the desired action(s) to be taken:

CSTE recommends that CDC convene an expert panel to conduct an assessment and issue recommendations regarding surveillance for influenza in the United States.

a) That panel should include representatives of local, state, and federal public health agencies and individuals with expertise in influenza, public health surveillance, pandemic preparedness, virology and laboratory testing, immunizations, vaccine development, hospital infection control (i.e., infection control practitioners, hospital epidemiologists), medical and public health informatics, and risk communications.

b) This assessment should consider the objectives, uses and value of the components of influenza surveillance at national, state, and local levels for both seasonal epidemics of influenza

and during an influenza pandemic. The interaction of U.S. surveillance with global needs should also be considered.

c) The panel should issue recommendations for influenza surveillance in the United States that balance local, state, and national needs with available resources.

d) Recommendations should include setting priorities for improvement or change; listing of the resources needed to accomplish any recommended changes; addressing surveillance needs for seasonal influenza and assessing the ability of the surveillance system to serve as a basis for surveillance during an influenza pandemic.

e) Recommendations for research and evaluation to guide future surveillance system development should be included.

e) Given the high priority and attention currently being given to pandemic preparedness, this process should be conducted to produce a final report and recommendations by the end of 2006.

Public Health Impact:

Influenza is a major public health issue causing substantial disease and death during seasonal epidemics and with the potential for pandemics of historic magnitude. Many assessments of the public health system have emphasized the essential role of surveillance in guiding an effective public health response and the need for strong local, state, and federal cooperation and coordination (13). As stated in Institute of Medicine report, *Emerging Infections: Microbial Threats to Health in the United States* "The importance of surveillance to the detection and control of emerging microbial threats cannot be overemphasized " (14).

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Coordination:
Agency for Response:
(1) Julie Gerberding, MD, MPH
Director
Centers for Disease Control and Prevention
1600 Clifton Road, NE, MS D-14
Atlanta, Georgia 30333
404-639-7000
jyg2@cdc.gov
Agencies for Information:
(1) Paul E. Harris, MD, MBA
Executive Director, Association of State and Territorial Health Officers
1275 K Street NW, Suite 800
Washington, DC 20005
(202) 371-9090
Ghardy@astho.org
(2) Scott Becker
Executive Director
Association of Public Health Laboratories
2025 M Street NW, #550
Washington, DC 20036-3320
(202) 822-5227
Sbecker@aphl.org
(3) Patrick Libbey
Executive Director
National Association of City and County Health Officers
1100 17th Street 2nd floor
Washington, D.C. 20036
202-783-5550
plibbey@naccho.org
(4) Rex Archer, MD, MPH
President, National Association of County and City Health Officials
Director of Health
Kansas City Health Department
2400 Troost Avenue, Suite 4000
Kansas City, MO 64108
(816) 513-6252
rex_archer@kcmo.org
(5) Bruce Gellin, M.D., M.P.H.
Director, National Vaccine Program Office
U.S. Department of Health & Human Services
200 Independence Avenue, S.W.
Washington, D.C. 20201
(202) 690-5566

BGellin@OSOPHS.DHHS.GOV

Submitting Author:
(1) Robert T Rolfs, MD, MPH
State Epidemiologist
Bureau of Epidemiology, Utah Department of Health
PO Box 142104 (For overnight mail only, use: 288 North 1460 West)
Salt Lake City, Utah 84114-2104
801-538-6191
rrolfs@utah.gov

Co-Author:
(1) Ken Gershman, MD, MPH
Chief, Communicable Disease Epidemiology
Colorado Department of Public Health
4300 Cherry Creek Drive South
Denver, Colorado 80246
(303) 692-2657
ken.gershman@state.co.us

Appendix 3

Executive Summary of November 2-3, 2006 Consultation on Influenza Surveillance in the United States

Consultation on Influenza Surveillance in the United States
November 2-3, 2006
Atlanta, GA
Meeting Summary and Recommendations

On November 2-3, 2006 the Influenza Division, Centers for Disease Control and Prevention (CDC) and the Council of State and Territorial Epidemiologists (CSTE) convened an expert consultation to evaluate and to explore options to improve surveillance for influenza in the United States. The meeting was attended by epidemiologists and laboratory experts from CDC, state and local health departments, and academic centers. This report summarizes the main areas of discussion, outlines recommendations from the meeting, and lists steps towards addressing these recommendations. The consultation catalyzed the process of evaluation of influenza surveillance systems, and serves as an initial step towards the ultimate goal of achieving long-term improvements. As a result, this summary will be followed by quarterly reports of progress towards this goal.

Background and rationale for the meeting

Influenza remains a cause of substantial annual morbidity and mortality and, is the leading cause of death in the United States from vaccine-preventable diseases. The Centers for Disease Control and Prevention estimated that between 1990 and 1999 an average of more than 200,000 persons were hospitalized and 36,000 persons died of influenza-associated illnesses each year in the U.S. Because of the disease burden, and associated economic burden, vaccines against influenza have been used for decades as the principal prevention strategy. Influenza surveillance data have been somewhat effective in guiding these immunization programs and policy.

Recently, several issues have led to interest among national, state and local public health officials to reassess the goals, structure and utility of influenza surveillance systems in the United States. High-profile vaccine shortages, severe influenza seasons, concerns about the effectiveness of vaccination, and the increasing concerns of pandemic influenza caused by the continued spread of avian influenza have served to increased interest and awareness of influenza among a wide variety of segments of society. Pandemic influenza planning efforts are likely to require surveillance data that are more timely and complete than those provided by current surveillance systems. The increasing availability of electronic health data has raised suggestions that these alternatives to existing manual methods of collecting influenza surveillance data be investigated Finally, recognition that local, state and national surveillance needs may not be aligned has increased interest in finding a common approach to surveillance that might satisfy partners at each level. As a result, in June 2006, CSTE approved a position statement calling for an expert panel to evaluate and advise on influenza surveillance. Specifically, the statement recommended that the objectives, uses and value of surveillance system components be assessed and that recommendations for changes to improve surveillance systems be derived that would balance federal, state and local needs.

The statement called for a report of the panel's findings by the end of 2006. This report is in response to this statement.

Meeting Goals

The expressed goals of the meeting were to 1) evaluate the objectives, uses, and value of the components of influenza surveillance at the national, state, and local levels; 2) identify and discuss potential methods to improve existing surveillance systems; and 3) outline plans for a more robust, more efficient, and more useful national, state and local surveillance system for influenza.

To achieve these goals, the meeting was arranged into sessions that were intended to establish consensus on the goals of surveillance, to evaluate the ability of current surveillance systems to meet these goals at the national, state, and local levels, and to derive a plan to address areas where the current systems are unable to meet the goals.

Meeting Summary

Harmonizing influenza surveillance goals

The first session of the meeting was intended to review the goals of surveillance from the perspectives of both national and state stakeholders. Following short presentations that reviewed current CDC and state goals, differences were discussed, and a consensus group of major goals were developed. These harmonized goals were defined as goals of surveillance that were common between state and federal public health agencies. These harmonized goals formed the foundation for the rest of the meeting's discussions.

The Harmonized Influenza Surveillance Goals are:

- To detect the onset of influenza and the duration of influenza activity in a geographic area
- To measure and describe the severity of influenza during a season
- To determine the populations affected (especially to determine risk groups for severe outcomes)
- To identify prevalent virus types, subtypes and novel subtypes that might signal a pandemic
- To determine the geographic distribution of influenza during the season
- To provide information to communicate to key partners, such as
    - Policy Makers
    - Emergency response officials
    - Public and media
    - Clinical decision makers
- To provide data to guide interventions in a variety of arenas, including
    - Policy
    - Clinical
    - Individual
    - Public health control measures (outbreak detection – including Institutions)
- To support research related to critical questions

In the discussion regarding goals of the variety of partners in the meeting, important themes emerged. One was that the needs of state and federal officials were sometimes different. An example of this was CDC's strong need to use surveillance to establish and follow trends in disease burden (i.e. rates of outcomes) that would be used to inform vaccine policy. While this was recognized as a critical need for federal public health officials, these issues need not necessarily be a focus for state or local systems because vaccine policy is made on a national level. Equally striking, however, were the commonalities between perspectives. All partners recognized the primacy of using surveillance to know when and where influenza activity was occurring, as this information directly informed response and communications at all levels.

A second theme was that the goals of seasonal and pandemic influenza surveillance are generally similar, even though timeliness and completeness of data may be different. As a result, the group decided that developing surveillance systems that could serve both seasonal and pandemic needs are superior to establishing separate surveillance systems to meet each of these needs.

Finally, the group agreed that, generally, if the state and local needs regarding surveillance were met, national needs would also be satisfied. While there were some key exceptions to this, such as the need to continue specific projects, such as Emerging Infections Program surveillance, to provide data for federal decisions, this conclusion led to a common agreement that national systems that were the sum of state-based systems would, in general, be most efficient and simple, and should be sought where possible

II. Review of existing surveillance systems

CDC's National Influenza Surveillance Systems were reviewed and written materials were provided that contained detailed reports of each system's data collection, reporting elements, and strengths and weaknesses. Following this, the potential uses of BioSense data for influenza surveillance were reviewed. Each of the systems was then measured against the harmonized goals, and their strengths and weaknesses to meet these goals were listed. Several conclusions emerged from this discussion. First, while national systems generally met the needs of CDC, the data from the systems were often not robust enough (i.e. too few data points in each state) or timely enough to meet the states' primary need to determine quickly the onset and geographic spread of influenza in their state. Similarly, systems like the Emerging Infections Program sites that were well-suited to provide information on a season's severity at the national level, were not necessarily useful to states, because they collected data within limited geographic areas. Secondly, systems that might provide representative and timely enough data to be used by states, notably Sentinel Provider Network, were generally more labor-intensive and inefficient, and, therefore, were difficult to sustain in some states. Finally, it was noted that many of the systems were equally valuable and capable to meet one or more of the goals, which raised questions about efficiency and opportunities to reduce duplication. For instance, monitoring the timing of influenza activity is possible using both laboratory and disease surveillance systems.

A summary of an assessment of state health department influenza surveillance activities was presented and provided valuable data on the states' views of the national surveillance systems and on other influenza surveillance activities undertaken at the state level.

Finally, a group of state-based surveillance systems were reviewed, with the intent that these be viewed as potential options to fill gaps identified in the discussion to follow. Examples presented included obtaining outpatient influenza-like illness (ILI) data from electronic health maintenance organizations (HMO) records and from emergency department syndromic surveillance systems, reporting of electronic death certificate data, making influenza-associated hospitalizations reportable, and establishing sentinel clinical laboratory surveillance.

III. Improving Surveillance

During the second day, participants were divided into small discussion groups, each of which addressed a common set of questions. The groups were charged with identifying modifications to surveillance that would improve the systems' abilities to meet the harmonized surveillance goals as the local, state, and national levels and formulating a plan for how these improvements might be achieved. The groups were asked to consider the needs for seasonal and pandemic surveillance. Participants were brought back together for presentation of the groups' findings to the entire group of meeting participants. The recommendations of the group are provided below.

IV. Findings and recommendations of the panel

Several themes emerged from the meeting and reflect the consensus of the participants.

- The existing national surveillance system does not fully meet the needs of the state and local health departments. It was acknowledged that national systems have evolved to address the needs from the federal perspective primarily. Notably, national systems do not always provide sufficient data for areas within states that allow local and state officials to make decisions based on the data. As a result, a variety of state and local surveillance systems have been initiated that fill these gaps. While these systems have served to address the unmet needs of states, they do not necessarily contribute to the national picture because of differing surveillance and data collection methods.
- The relatively large number of state and federal systems to monitor influenza is likely inefficient. To address the dual needs of simplicity and efficiency, and to maximize sustainability of influenza surveillance the fewest number of systems needed to address local, state and federal needs should be sought. The group concluded that a national system that is based on the sum of comparable state and local systems would be most efficient.
- Because of the relative labor-intensive nature of current influenza-like illness surveillance interest was expressed in the increased use of electronic data sources to augment and potentially replace current systems that use manual reporting methods. In addition, the use of electronic data takes advantage of increased national interest in using electronic data sources for public health surveillance (e.g., BioSense) and the increased use of these types of data in local and state health departments as a product of bioterrorism initiatives. The participants also recognized the potential opportunity to use electronic data sources to track hospitalizations and deaths, and to standardize collection of data between states.
- Some systems that are used by federal public health officials to make policy and recommendations but do not provide useful data at a local or state level should be continued. These include laboratory surveillance to monitor vaccine match and

antiviral resistance, and the use of population-based platforms for special research studies, including vaccine effectiveness assessments.

- Pandemic influenza surveillance should be based on routine seasonal surveillance as much as possible. While the needs, in terms of timeliness of information, during a pandemic may be different, the goals are substantially the same between seasonal and pandemic influenza. The recommendations derived from the meeting related to building better surveillance systems to monitor for both seasonal and pandemic influenza.
- The group recognized the value of ongoing dialogue between all public health partners in solving issues as they arise and in deriving improved surveillance systems. The group agreed that this consensus meeting was a start of a long-term collaboration towards enhancing surveillance and cooperation among partners.

Recommendations

The main recommendations from the meeting are as follows:

Recommendation #1: Facilitate implementation of electronic death reporting as a means for improving reporting of pneumonia and influenza related deaths.

Recommendation #2: Develop methods for timely assessment of severe influenza disease and health care resource demands including developing standards and definitions for case reporting.

Recommendation #3: Develop methods for expanding laboratory networks within states, electronic laboratory reporting, and data feedback mechanism within states.

Recommendation #4: Develop flexible yet consistent systems for capturing outpatient ILI, specifically focused on expanded use of alternative electronic data sources. Local and state health departments and CDC should make it a priority to evaluate existing electronic health data to enhance influenza surveillance where appropriate. Objectives and standards for collecting and reporting different aspects of influenza infection using these data types should be established and, the validity of potential data sources needs to be evaluated.

Recommendation #5: Develop standardized definitions for influenza activity including a measure of intensity for the State and Territorial Epidemiologists' Report.

Recommendation #6: Promote standardized approaches to influenza surveillance among states by linking priority recommendations to sustainable funding through the Epidemiology and Laboratory Capacity program.

Recommendation #7: Formalize collaboration between federal, state and local public health authorities, with academic centers to develop protocols for rapid assessment studies, such as vaccine effectiveness and antiviral effectiveness evaluations during pandemic influenza.

Recommendation #8: CDC will work with CSTE members to plan the schedule and composition of the workgroups and timelines for their work

Action Items

The action items identified from the meeting are listed below. Work has already begun on these items.

Action Item #1: Form an Influenza-Associated Mortality Surveillance Workgroup that includes participation from CSTE, NACHO, CDC (including NCHS), and NAPHSIS to focus on electronic death reporting and short-term mortality surveillance enhancements that may be necessary until all states have a functioning electronic death reporting system.

Action Item #2: Form an Influenza-associated Hospitalization Surveillance Workgroup that includes participation from CSTE, NACCHO, AHA, APIC, and CDC. This group should focus on methods for timely assessment of severe influenza disease burden and health care resource demands including developing standards and definitions for hospitalized case reporting.

Action Item #3: Form an Influenza Laboratory Surveillance Workgroup that includes participation from APHL, CSTE, NACCHO, CDC, and commercial laboratories that will address methods for expanding laboratory networks within states, electronic laboratory reporting, and data feedback mechanisms within states.

Action Item #4: Form an Outpatient ILI Surveillance Workgroup that includes participation from CSTE, NACCHO, CDC, APIC, and MCOs/HMOs to focus on enhancing current methods to collect ILI and exploring the use of electronic data sources, including BioSense data.

Action Item #5: Form a Working Group that includes participation from CDC and CSTE to address concerns about the State and Territorial Epidemiologist's Report component of national surveillance.

Action Item #6: A small group CDC staff and CSTE members (CDC-CSTE Influenza Surveillance Steering Committee) will be formed to oversee and coordinate the work described above. This group will convene the Workgroups, monitor their progress, facilitate the implementation of the recommendations and actions, and work to implement Recommendations 6, 7 and 8.

Appendix 4

CSTE Position Statement on Influenza Surveillance in the United States
2008 Annual Meeting
08-ID-10

Title: Influenza Surveillance in the United States

Statement of the Problem:

Influenza is a major public health issue in the United States, causing an estimated 200,000 hospitalizations (1) and 36,000 deaths each year in the United States (2). Substantial public health resources are committed to prevention of influenza and influenza-associated morbidity and mortality, primarily through influenza vaccination, but also including promotion of respiratory hygiene and use of antiviral medications. During the past several years, influenza has received heightened attention because of:

- Increased pediatric mortality during the 2003-4 influenza season (3);
- Widespread resistance of influenza A (H3N2) to adamantanes detected during the 2005-2006 season (7); and resistance to Oseltamivir detected in H1N1 isolates during the 2007-08 influenza season;
- Increased concerns raised during pandemic influenza planning efforts at the local, state and national level with respect to varying surveillance needs at all levels of government.

Information from public health surveillance is needed to assess the public health burden of seasonal influenza, inform policy makers and the public, promote vaccination efforts, evaluate vaccination strategies, vaccine strain selection, detect changes in influenza viruses including detection of novel viruses with pandemic potential, and to guide public health interventions to limit morbidity and mortality.

The emergence of avian influenza A (H5N1) as a widespread epizootic disease capable of causing severe human disease has increased both the importance of seasonal influenza surveillance and public interest in both seasonal and pandemic influenza. Surveillance systems for seasonal influenza should serve as a foundation for pandemic surveillance. Currently, United States influenza surveillance includes several components (8):

1. World Health Organization (WHO) and National Respiratory and Enteric Virus Surveillance System (NREVSS) Collaborating Laboratories.
2. U.S. Influenza Sentinel Providers Surveillance Network.
3. 122 Cities Mortality Reporting System.
4. State and Territorial Epidemiologists Reports.
5. Influenza-associated pediatric mortality.
6. Emerging Infections Program (EIP) - laboratory-confirmed influenza related hospitalizations
7. New Vaccine Surveillance Network (NVSN) -- laboratory-confirmed influenza hospitalization in children less than 5 years old and outpatients 0 – 12 years old.

In addition, other methods are being used in some states, including:

- Influenza-associated hospitalizations (9); syndromic surveillance using emergency department chief complaints (respiratory, systemic/febrile illness); hospitalizations for pneumonia; and over-the-counter sales of medicines. (10-12)

Although the current influenza surveillance system has provided useful information, in 2006, CSTE passed a position statement urging CDC to convene an expert panel to conduct an evaluation of influenza surveillance in the United States. It was requested that such a panel would:
a) include representatives of local, state, and federal public health agencies and individuals with expertise in influenza, public health surveillance, pandemic preparedness, virology and laboratory testing, immunizations, vaccine development, hospital infection control (i.e., infection control practitioners, hospital epidemiologists), medical and public health informatics, and risk communications.
b) consider the objectives, uses and value of the components of influenza surveillance at national, state, and local levels for both seasonal epidemics of influenza and during an influenza pandemic. The interaction of U.S. surveillance with global needs should also be considered.
c) issue recommendations for influenza surveillance in the United States that balance local, state, and national needs with available resources.
d) issue recommendations that would setting priorities for improvement or change; listing of the resources needed to accomplish any recommended changes; addressing surveillance needs for seasonal influenza and assessing the ability of the surveillance system to serve as a basis for surveillance during an influenza pandemic.
e) issue recommendations for research and evaluation to guide future surveillance system development should be included.

In response to this position statement, CDC's Influenza Division convened an expert consultation in November 2006 to initiate the process. The main recommendations of the meeting were:
Facilitate implementation of electronic death reporting as a means for improving reporting of pneumonia and influenza related deaths.
Develop methods for timely assessment of severe influenza disease and health care resource demands including developing standards and definitions for case reporting.
Develop methods for expanding laboratory networks within states, electronic laboratory reporting, and data feedback mechanism within states.
Develop flexible yet consistent systems for capturing outpatient ILI, specifically focused on expanded use of alternative electronic data sources.
Develop standardized definitions for influenza activity including a measure of intensity for the State and Territorial Epidemiologists' Report.

Following the meeting workgroups were established that met throughout 2007 to determine how to implement the recommendations. These groups reported their recommendations to the larger expert consultation panel during a second meeting convened in December 2007.
The expert consultation panel acknowledged that several factors impact influenza surveillance strategies. These include:
1) Currently, the approaches to and resources dedicated to influenza surveillance vary markedly from state to state.
2) Some components of influenza surveillance work well at the national and international level, but provide little useful information at state and local levels (e.g., influenza mortality, pediatric influenza hospitalizations). Heightened interest in influenza has increased the need for information at state and local levels. In addition, it is unlikely that current surveillance methods would be sustainable or satisfy information needs at state and

local levels during an influenza pandemic.
3) The current classification system used in the State and Territorial Epidemiologist Reports is problematic in several ways. First, it continues to be very challenging to implement in a standardized manner across states. Secondly, it is potentially confusing to media and policymakers, as it may be interpreted to both describe the seriousness of the seasonal epidemic (i.e., from a mild to a severe flu season) the distribution of cases across different geographical areas...
4) The role of syndromic surveillance methods for .tracking influenza and in particular the potential redundancy between ILI surveillance and chief complaint surveillance deserves attention.
5) Collection of viral isolates is becoming increasingly difficult as practitioners increasingly rely on rapid influenza tests that provide them with real-time clinical information but don't provide a source of information on the types of viruses that are circulating.
6) Consideration should be given to integrating seasonal and pandemic influenza surveillance with local, state, and federal surveillance computer systems and surveillance system standards (e.g., NEDSS, PHIN, and the PHIN Preparedness Functional Requirements). Plans should be made to assure that surveillance applications are prepared to manage surveillance data during a pandemic.

The 2007 expert consultation concluded that CDC and CSTE need to have a national surveillance system that moves surveillance toward a unified system versus a piecemeal approach to disease reporting activities. The recommendations of the 2007 consultation are stated in the "Statement of desired actions to be taken" below:

Statement of the desired action(s) to be taken:
1. CDC should publish formal influenza surveillance guidelines derived from the recommendations made in the two CSTE/CDC Consultations (in the form of R&R or other).
2. CDC should work with states to foster development of standardized surveillance systems for influenza associated hospitalization, and influenza associated electronic death reporting. Those states with current, or in the process of developing systems, should work with CDC to develop standards for data format and transmission.
3. CDC should establish a mechanism to accept data in a standardized format for those states able to send influenza associated hospitalization data, influenza mortality data, and laboratory data. This mechanism should include the ability to accept data according to PHIN standards for those states able to transfer it according to those standards.
4. The Influenza Division should provide adequate funding for states to enhance surveillance activities and resources should be provided to the Influenza Division by CDC to fund influenza surveillance activities.

Public Health Impact:
Influenza is a major public health issue causing substantial disease and death during seasonal epidemics and with the potential for pandemics of historic magnitude. As stated in Institute of Medicine report, *Emerging Infections: Microbial Threats to Health in the United States* "The importance of surveillance to the detection and control of emerging microbial threats cannot be overemphasized " (14). What is needed is a national approach to influenza surveillance that can move this nation from a piecemeal to a more unified and standardized system of disease surveillance.

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Coordination:

Agency for Response:

(1) Julie Gerberding, MD, MPH
Director
Centers for Disease Control and Prevention
1600 Clifton Road, NE, MS D-14
Atlanta, Georgia 30333
404-639-7000
jyg2@cdc.gov

Agencies for Information:

(1) Paul E. Jarris, MD, MBA
Executive Director, Association of State and Territorial Health Officers
1275 K Street NW, Suite 800
Washington, DC 20005
(202) 371-9090
pjarris@astho.org

(2) Scott Becker
Executive Director
Association of Public Health Laboratories
2025 M Street NW, #550
Washington, DC 20036-3320
(202) 822-5227
Sbecker@aphl.org

(3) Patrick Libbey
Executive Director
National Association of City and County Health Officers
1100 17th Street 2nd floor
Washington, D.C. 20036
202-783-5550
plibbey@naccho.org

(4) Rex Archer, MD, MPH
President, National Association of County and City Health Officials
Director of Health
Kansas City Health Department
2400 Troost Avenue, Suite 4000
Kansas City, MO 64108
(816) 513-6252
rex_archer@kcmo.org

(5) Bruce Gellin, MD, MPH
Director, National Vaccine Program Office
U.S. Department of Health & Human Services
200 Independence Avenue, S.W.
Washington, D.C. 20201
(202) 690-5566
BGellin@OSOPHS.DHHS.GOV

Submitting Author:
Kathleen F. Gensheimer, MD, MPH
State Epidemiologist
Maine CDC, Maine Dept. of Health and Human Services
State House #11, Key Plaza
Augusta, Maine 04333
207 287 5183
Kathleen.F.Gensheimer@Maine.gov

Lyn Finelli, DrPH, MS
Influenza Division
Centers for Disease Control and Prevention
1600 Clifton Road, NE, MS A-32
Atlanta, Georgia 30333
404-639-2554

Co-Authors:
(1) Ken Gershman, MD, MPH
Chief, Communicable Disease Epidemiology
Colorado Department of Public Health
4300 Cherry Creek Drive South
Denver, Colorado 80246
(303) 692-2657
ken.gershman@state.co.us

30

(2)Robert Rolfs, MD, MPH
Utah Dept of Health
801-538-6191
rrolfs@utah.gov