Section VII: Influenza Outbreaks

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Outbreaks Overview

Respiratory illness clusters are challenging to investigate because infectious respiratory diseases are sometimes difficult to distinguish from non-infectious causes of respiratory symptoms. Local testing capacity is also limited for many respiratory pathogens. Another challenge is just deciding what is and is not an outbreak. It is important to determine if the reported number of cases is greater than the expected number of cases for a location for a particular time of year. An investigator must also determine if cases are related (by contact, relationship, physical location or pathogen) to each other. Some outbreaks require more investigative work than others depending on how many people are or could be impacted, the health status of the potentially exposed population, the severity of the illness, how widespread the outbreak is or how quickly the outbreak is spreading. At a minimum, all reported outbreaks should be documented and basic control measures should be provided or reviewed. See page VII.3 for indicators of when more intensive investigations should be performed.

Every epidemiologist develops his or her own style of investigating outbreaks. Experience is crucial to honing good investigative intuition. This section is meant to help new outbreak investigators get started as well as to serve as a basic reference for more experienced investigators.

Why Conduct an Outbreak Investigation? *(1)*

1. To determine the likely sources of exposure and mechanisms of transmission in order to eliminate them and prevent new exposures

2. To determine risk factors for illness in order to mitigate those risks in the specific setting/location

3. To identify the cause of the outbreak to help guide treatment and care for the remaining cases that have not fully recovered

4. To document what occurred before and during the outbreak to decrease the time it takes to control or to prevent future outbreaks

Which Outbreaks Should Be Investigated? (*2*)

According to the Centers for Disease Control and Prevention (CDC) website, when deciding how to respond to a respiratory disease outbreak, public health agencies must take into consideration many factors such as the availability of resources and competing agency priorities. While each agency needs to determine the level of public health response appropriate for each outbreak, several characteristics of respiratory outbreaks typically warrant further investigation of the outbreak and an urgent response. The characteristics below should not be viewed as a comprehensive or definitive list, but should serve as a general guide to determine which outbreaks merit further investigation.

- Outbreaks of unknown etiology

- Outbreaks associated with severe disease outcomes, such as death or hospitalization

- Outbreaks for which identification of the causative agent or potential dual infections is needed, determined *a priori*

- Outbreaks which may be useful to answer epidemiologic, laboratory or infection control questions

- Outbreaks of possible vaccine-preventable diseases

- Outbreaks associated with institutional settings or with a likely (controllable) environmental source

- Clusters of respiratory infection potentially caused by a bioterrorism agent

- Outbreaks among a vulnerable population

- Outbreaks which have generated excessive public anxiety

- Outbreaks which are either very large or rapidly progressing

The list above, which is taken directly from the CDC website, can be used for any infectious respiratory disease outbreak. In addition to the above list, DSHS has defined what respiratory clusters and outbreaks health departments should investigate and those outbreaks for which summary reports are requested. See page VII.4 for operational definitions on outbreaks requiring summary reports.

What is an Outbreak?

An outbreak is a localized increase in a disease, symptom or syndrome that clearly exceeds the expected level. For rare diseases (e.g., measles, anthrax), a single case may be considered an outbreak. Several public health, medical and regulatory agencies and organizations provide definitions of what constitutes an outbreak.

The Centers for Medicaid and Medicare Services (CMS) defines an outbreak in healthcare facilities as "the occurrence of more cases of a particular infection than is normally expected, the occurrence of an unusual organism, or the occurrence of unusual antibiotic resistance patterns." CMS further elaborates on what constitutes an outbreak by describing the following scenarios as outbreak indicators (*3*):
- one case of an infection that is highly communicable
- trends that are 10 percent higher than the historical rate of infection for the facility that may reflect an outbreak or seasonal variation and therefore warrant further investigation
- occurrence of three or more cases of the same infection over a specified length of time on the same unit or other defined area

The American Medical Directors Association expands on the three or more cases indicator by specifying that three or more cases must occur within the same 24 hour period (*4*).

Some states, like Arizona, utilize some of CDC's former definitions for respiratory outbreaks. Arizona guidance defines an acute febrile respiratory illness (AFRI) or influenza-like illness (ILI) outbreak differently in different settings (*5*):
- Hospitals or medical facilities: An outbreak of AFRI or ILI in an acute-care hospital is one or more *health care facility-associated* case(s) of confirmed influenza in patient(s), OR three or more *health care facility-associated* cases of AFRI or ILI among health care workers and patients of a facility on the same unit within 72 hours.
- Assisted living facility: An outbreak of AFRI or ILI in an assisted living home (10 or fewer residents) is three or more cases occurring within 72 hours, OR a sudden increase of cases over the normal background rate. In assisted living centers (11 or more residents), an outbreak is three or more cases of AFRI or ILI occurring within 72 hours in residents who are in close proximity to each other (e.g., in the same area of the facility), OR a sudden increase of cases over the normal background rate. **One case of confirmed influenza by any testing method along with other cases of respiratory infection in an assisted living facility resident is also an outbreak**.
- Long-term care facility (LTCF): An outbreak of AFRI or ILI in a long-term care facility is three or more cases occurring within 72 hours in residents who are in close proximity to each other (e.g., in the same area of the facility), OR a sudden increase of cases over the normal background rate. **One case of confirmed influenza by any testing method along with other cases of respiratory infection in a long-term care facility resident is also an outbreak**.

The latter part of Arizona's outbreak definition for assisted living facilities and LTCFs is the same as CDC's current outbreak definition for long-term care facilities (*6*).

The Infectious Diseases Society of America recommends facilities implement facility wide influenza outbreak control measures when two or more people have ILI and one person tests positive for influenza (*7*).

All medical or long-term care facilities should be aware of definitions used by their regulatory agencies and adhere to those standards for notifying their regulators. Schools should also be aware of reporting requirements as established by the Texas Education Association. Any suspected outbreak reported to a regulatory agency should also be reported to the local health department. Any facility or entity with a concern about increases of specific infectious disease occurrences should contact their local or regional health department.

Health departments in Texas can use the following operational definitions for deciding which cluster or outbreak investigations should have a completed Respiratory Disease Outbreak Summary Form faxed to DSHS:

In hospital or clinic settings:
- A sudden increase of cases over the normal background rate
- Three or more healthcare-associated infections of AFRI or ILI among patients or healthcare workers on the same unit within 72 hours
- One or more healthcare-associated infections of confirmed influenza

In long-term care settings:
- A sudden increase of cases over the normal background rate
- Three or more cases of AFRI or ILI among residents or healthcare workers who are in close proximity with each other (e.g., same area of the facility) within 72 hours
- Two or more cases of AFRI or ILI among residents when there is at least one confirmed influenza case in the facility

In school or child care settings:
- A sudden increase of cases or absenteeism over the normal background rate
- Five or more cases of AFRI or ILI in one week among students or staff in an epidemiologically linked group (e.g., single class, sports team or after school group)

In other settings:
- A sudden increase of cases over the normal background rate
- Five or more cases of AFRI or ILI within one week in people in the same area of the building or work group

Selected terms in the operational outbreak definitions:
- Healthcare-associated infection (HAI) of influenza: Onset of new respiratory symptoms and positive influenza test was > 3 days after admission to hospital
- Acute febrile respiratory illness (AFRI): An illness characterized with onset in the past 4 days of fever and at least one of the following: cough, sore throat, rhinorrhea or nasal congestion
- Influenza-like illness (ILI): An illness characterized with a fever greater than or equal to 100°F plus a cough and/or a sore throat in the absence of a known cause other than influenza

Outline of an Outbreak Response

No two outbreak investigations are the same. The course of the outbreak investigation depends on multiple factors including the pathogen, the setting of the outbreak, the number of people involved, the demographics of the people involved, the geographic spread and the severity of the illness. Interest in the outbreak by the facilities involved, the health departments involved, the media and community leaders also influences outbreak investigations. Outbreak investigators must be flexible and able to expand or limit the investigation as needed based on the information that is learned over the course of the investigation. The following outline describes some of the key processes and decisions that occur in outbreak investigations.

1. Receive Initial Report
   - Collect basic information on the situation being reported. See page VII.8.
   - Provide basic respiratory control measures and/or review control measures the entity has already implemented. See page VII.21.

2. Assess Situation
   - Determine if the situation requires additional follow-up.
     - Affirmative answers to the following questions indicate additional follow-up is warranted:
       - Is the outbreak ongoing?
       - Will health department involvement help stop the outbreak?
       - Will health department involvement help the facility to prevent future outbreaks?
       - See pages VII.3 and 4 for additional outbreak characteristics meriting further investigation.
     - Consult with fellow epidemiologists and supervisor if uncertain.
   - Determine who will fill the lead investigator role.

3. Conduct Outbreak Investigation
   - Notify appropriate partners of the outbreak investigation initiation.
     - Include background on the outbreak and expectations for assistance that may be requested.
       - Alert internal chain of command and public affairs.
       - Alert appropriate DSHS regional office(s).
   - Develop and maintain case definitions, a line list and an epidemic curve (epi curve). See pages VII.10 - VII.19.
   - Confirm the existence of an outbreak through historical review of similar cases, case investigation and laboratory testing. See page VII.20.
   - Review and/or recommend diagnostic testing; assist with coordination of specimen collection or submission as necessary. See page VII.20.
     - Arrange for 5 to 10 specimens to be tested for influenza even if rapid influenza testing has already been done.
   - Identify risk factors using appropriate epidemiologic tools and investigation/study designs:
     - Review case medical records

- o Interview cases and (potentially) controls
- o Map locations of cases in the facility/community
- o Observe or review infection control practices
- Implement and adapt control measures as necessary. See page VII.21.

4. Expand Investigation (as needed)
   - Consider utilizing an incident command system (ICS) structure to ensure that the roles of individuals and assisting agencies are clearly defined.
   - Surge internally as needed
     - o Identify staff who can assist with data entry, interviewing and other tasks as necessary.
   - Surge externally as needed
     - o Activate MOUs/MOAs with other health departments.
     - o Utilize volunteers and/or student groups.
     - o Request assistance from DSHS regional office
       - ▪ DSHS epidemiologists can act as subject matter experts for consultation with investigation plans and operations.
       - ▪ DSHS epidemiologists can also provide surge capacity for investigation operations.
       - ▪ DSHS can provide logistical support for laboratory testing, control measure recommendations and acquisition and distribution of chemoprophylaxis and vaccines.
       - ▪ DSHS regional epidemiologists can request assistance from DSHS EAIDB epidemiologists.
     - o CDC Epi-Aid teams are valuable resources for conducting in-depth studies associated with the investigation. CDC Epi-Aid teams can only be requested by the state epidemiologist. Contact DSHS EAIDB to start the CDC Epi-Aid request process.
   - Note for cross-jurisdictional investigations:
     - o DSHS regional epidemiologist should facilitate the coordination of investigations involving multiple counties within a single region.
     - o DSHS EAIDB epidemiologists should facilitate the coordination of investigations crossing multiple regions or states.

5. Communicate Findings and Document Investigation
   - Share findings and final recommendations in writing with the facility.
   - Provide a final update to internal and external partners.
   - Draft a written report summarizing the investigation.
     - o Consider sharing the experience with the public health community through presentations at conferences, publishing in public health newsletters, publishing in peer reviewed journals and/or Epi-X reports.
   - Conduct an after action report on the investigation and use the results to improve future investigation responses.
   - Submit the outbreak summary report to DSHS. A Respiratory Disease Outbreak Summary Form is available on the DSHS website.

Basic Information to Collect

When a call is received regarding a potential outbreak, it is important to collect as much information as possible. The information collected during the initial report will help describe the situation and determine what resources are needed to respond. The following list has basic information that should be collected for any outbreak.

On the reporter
- Name of caller
- Caller's title/position
- Caller's phone number

On the setting/facility
- Type of cluster/outbreak setting (e.g., private party/celebration/event, nursing home, jail)
- If applicable, date of event
- Name of setting
- Address of setting
- Setting/facility contact person
- Phone number of setting/facility contact person
- Total number of people in the setting
- If applicable, total number of staff

On potential cases
- Number of people ill
- If applicable, number of staff ill
- Description of symptoms seen
- Number of people hospitalized
- Number of people deceased
- Date of first onset of illness
- Date of most recent onset of illness
- What medical evaluation has been done?
- What diagnostic testing has been performed? Results?

On control measures
- What control measures have already been implemented?
- Have efforts been made to separate people who are ill from those who are not?

Additional information to consider requesting
- For private events/parties/celebrations
    - Name and contact information of attendees
- For facilities
    - Line list of cases to include names, onset dates, symptoms, room number(s) and any other information you feel may help determine risk
    - Map of the facility
    - Calendar of events

Example data from two different outbreak settings:

Question	Wedding Scenario	Nursing Home Scenario
Name of caller:	Mrs. Smith	Mrs. Jackson
Caller's title/position:	Mother of the Bride	Guardian of a resident
Caller's phone number:	512-458-1234	512-458-5678
Type of cluster/outbreak setting (private party/celebration/event, nursing home, jail, etc.):	Private celebration - wedding	Nursing home
If applicable, date of event:	01/01/10	n/a
Name of setting:	Mrs. Smith's House	Long Life Nursing Home
Address of setting:	123 Somestreet, Austin, TX	123 Anotherstreet, Austin, TX
Setting/facility contact person:	Bride is Mrs. Taylor	Mr. Davids – Director
Phone number of setting/facility contact person:	Same as caller	512-458-1289
Total number of people in the setting:	100	100
If applicable, total number of staff:	n/a	20
Number of people ill:	Maybe 30	30
If applicable, number of staff ill:	n/a	1
Description of symptoms seen:	Sore throat, fever	Sore throat, fever, some pneumonia
Number of people hospitalized:	0	3
Number of people deceased:	0	0
Date of first onset of illness:	01/02/10	02/13/10
Date of most recent onset of illness:	01/05/10	02/25/10
What medical evaluation has been done?	Unknown	3 were hospitalized, waiting for diagnosis
What testing has been done? Results?	n/a	Bacterial cultures on 3 hospitalized are pending. 5 people were rapid influenza test negative
What control measures have already been implemented?	n/a	Hand hygiene training. Made hand sanitizer available to most residents
Have efforts been made to separate people who are ill from those who are not?	n/a	Yes
Comments	Guests started calling mother of the bride saying they were ill and wanted to know if others are ill too. Willing to provide guest list to us. No food served.	Caller said everyone ill at nursing home. Spoke with director and got more info. They will send us a line list.

Case Definitions

In order to accurately count how many cases of an illness have occurred, it is necessary to clearly define what constitutes a case. In public health, there are two main uses for case definitions: 1) surveillance of notifiable conditions for reporting purposes and 2) outbreak investigations.

Case definitions are different from a doctor's diagnosis. A diagnosis is a process of determining what is affecting an individual's health status and guides what treatment options will be employed. There is room for some subjective consideration by the individual physician for determining the most likely cause of illness. Case definitions for public health surveillance specify what criteria must be met in order to count a person as a case. Surveillance case definitions are not meant to be diagnostic. Case definitions tend to have strict criteria to ensure that there is less variation in what is counted as a case.

Case definitions have four parts:
- Clinical criteria – symptoms and/or laboratory results
- Person – who can be a case
- Place – the outbreak location, where the person was exposed or where the person resides
- Time – when onset or exposure occurred

Surveillance case definitions for reporting individual cases of a notifiable condition describe clinically compatible symptoms and what laboratory testing is required. The person and place portions are understood as residents of the appropriate health jurisdiction. The time portion is implied to be the current reporting year. Case definitions for notifiable conditions are standardized within each state. Case definitions for notifiable conditions in Texas can be found in the Epi Case Criteria Guide located at http://www.dshs.texas.gov/idcu/ under the disease reporting link. The case definitions used in Texas are based upon but not always identical to the case definitions used by the CDC.

Case definitions for outbreaks are determined by the lead outbreak investigator. If the outbreak crosses multiple health jurisdictions, then all of the involved health jurisdictions should agree upon a case definition. Outbreak case definitions need to be very clear and should explicitly state the person, place and time parts of the case definition. The clinical criteria portion of the case definition may be identical, more restrictive or less restrictive than the clinical criteria in a case definition for a notifiable condition. A clear outbreak definition helps to distinguish between cases associated with the outbreak and coincidental cases that may occur sporadically in the same county/city/community but are unrelated to the outbreak.

What works well for clinical criteria may vary depending on the setting. For example, using 100ºF as an indicator of fever in a nursing home resident may not be a good indicator of fever resulting from an infectious disease process. Frail, elderly individuals often have lower baseline temperatures than healthy, younger individuals. Thus, frail nursing home residents infected with influenza may have a fever (higher than normal temperature) that does not exceed 100 ºF (*8*). Patients of any age with severe neurologic or neurodevelopmental conditions may also only have "subtle deviations from their baseline medical status and be unable to communicate symptoms effectively" (*9*). It may be more reliable to define fever in a nursing home outbreak (or any

setting with frail, elderly or immunocompromised individuals) as a temperature two or more degrees above the patient/resident's baseline temperature.

Example surveillance case definition (from the Epi Case Criteria Guide):

Legionellosis: Legionellosis is associated with two clinically and epidemiologically distinct illnesses: Legionnaires disease, which is characterized by fever, myalgia, cough, clinical or radiological pneumonia, and Pontiac fever, a milder illness without pneumonia.

Confirmed: A clinically compatible case that meets at least one of the confirmatory laboratory criteria

Confirmatory laboratory criteria:
- Isolation of any *Legionella* organism from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid, or
- Detection of *Legionella pneumophila* serogroup 1 antigen in urine using validated reagents, or
- Demonstration of seroconversion by a fourfold or greater rise in specific serum antibody titer between paired acute and convalescent phase serum specimens to *Legionella pneumophila*

Example outbreak case definitions:

Case definition in outbreak 1: A resident or employee of nursing home X with onset of diarrhea and nausea (or vomiting) since June 23, 2011.

Case definition in outbreak 2: Confirmed - An employee or inmate at correctional facility Y with onset of fever over 100°F and cough lasting 3 or more days since November 2009 AND either a chest x-ray positive for pneumonia or a positive PCR test for *C. pneumoniae* infection. Probable - An employee or inmate at correctional facility Y with onset of fever over 100° F and cough lasting 3 or more days since November 2009.

Line Lists

Data from outbreak investigations are usually stored in one or more of three formats: hardcopy, database and line list. Hard copies of medical records, interview forms and investigation notes should be kept in accordance with the health department's record retention policy. Databases are often used to enter and store the extensive data collected from record reviews and interviews. Epi Info is an example of a database that is frequently used in public health to enter, store and analyze outbreak investigation data. A line list is a line by line listing of key information on each case in an outbreak investigation. Line lists can be created using almost any word processor or spreadsheet such as Microsoft Excel.

Basic line lists allow for quick review of key case characteristics. Each line on the list represents one person or case. Some line lists may also include close contacts or controls. The following information is typically captured on a line list:

- Demographics
- Symptoms
- Date of onset
- Hospitalization status
- Outcome (recovered/died)
- Lab test results
- Immunization history
- Travel history
- Epidemiologic links

The exact information collected in a line list depends on the specific illness or setting. For example, symptoms can be expanded or removed to capture the symptoms of interest in the investigation. In a respiratory outbreak investigation, the investigator should capture immunization status for influenza and pneumococcal disease. In a norovirus outbreak investigation, vaccination status for influenza is not relevant and would not be captured in the line list.

Here is an example of a simple line list with case definitions:

Case status*	Case initials	Age	Home zip code	Date of onset	Fever	Headache	Cough	Sore throat	Flu test result	Previously vaccinated	Attended gathering	Notes
C	CM	39	78665	07/01/11	Y	N	Y	Y	PCR +	N	Y	
P	LB	35	78755	07/01/11	Y	N	N	N	Rapid test +	Y	Y	Vaccinated on 06/28/11
C	IB	29	78664	06/29/11	Y	Y	N	Y	Rapid test +	N	Y	Ill at gathering
P	MF	37	78756	07/02/11	Y	Y	Y	N	Not done	N	N	Friend of IB

*All cases must have had onset after 06/28/11 and either attended the gathering or are close contacts of someone who attended the gathering.
C: confirmed case meets ILI definition AND has a positive influenza test (includes rapid test)
P: probable case meets ILI definition but does not have a positive influenza test OR does not meet ILI definition but has a positive rapid test

Template line list for public health department use with an influenza outbreak:

General Patient Information									
Case status	Case ID	First name	Last name	Age	Sex	Race	Ethnicity	City of residence	Affiliation
Confirmed	*123*	*Example*	*Example*	*71*	*M*	*W*	*H*	*Austin*	*Resident*
Probable	*456*	*Example*	*Example*	*45*	*F*	*B*	*NH*	*Hutto*	*Staff*
Not a Case	*789*	*Example*	*Example*	*62*	*M*	*A*	*NH*	*Austin*	*Resident*

Medical Information								
Date of onset of flu symptoms	Cough	Sore throat	Fever	SOB	Date symptoms resolved	Underlying conditions	Hospitalized	Died
2/4/2011	*Yes*	*Yes*	*Yes*	*Yes*	*2/7/2011*	*Heart Disease*	*Yes*	*No*
2/6/2011	*No*	*Yes*	*Yes*	*No*	*2/9/2011*	*Asthma*	*No*	*No*
2/1/2011	*Yes*	*No*	*No*	*No*	*2/2/2011*	*None*	*No*	*No*

Flu Test			Flu Treatment/Prophylaxis		
Flu test	Flu test result	Flu test collection date	Date antivirals given	Date antivirals ended	Name of antiviral given
PCR	*H3N2*	*2/5/2011*	*2/5/2011*	*2/7/2011*	*Tamiflu*
Rapid Test	*Flu A*	*2/6/2011*	*n/a*	*n/a*	*n/a*
Not Done	*Negative*	*2/1/2011*	*n/a*	*n/a*	*n/a*

Vaccination			Other
Vaccinated for flu this season	Date of most recent flu vaccination	Date of pneumococcal vaccination	Notes
No	*Unknown*	*10/15/2011*	*index case*
Unknown	*Unknown*	*Unknown*	
Yes	*10/15/2010*	*n/a*	*1 day of cough, no other symptoms, tested negative*

In addition to helping public health departments describe outbreaks, line lists can also be used by infection preventionists to monitor outcomes of cases and contacts of cases within a facility. The line lists used by infection preventionists will likely include more information than needed by the health department. It may also be necessary for the infection preventionist to maintain separate lists on patients or residents and on staff.

Facility influenza line list template for residents or patients:

General Patient Information								
Case status	Patient ID	First name	Last name	Date of birth	Room #	Date Admitted	Date assigned to current room	Date discharged
Case	123	Example	Example	04/04/62	4a	1/31/2011	2/1/2011	2/11/2011
Contact–Minimal	456	Example	Example	08/08/58	5d	2/1/2011	2/2/2011	2/8/2011
Contact – High	789	Example	Example	12/12/80	4b	2/5/2011	2/5/2011	2/19/2011

Symptoms						
Date of onset of flu symptoms	Cough	Sore throat	Fever	SOB	Date symptoms resolved	Outcome
2/4/2011	Yes	Yes	Yes	Yes	2/7/2011	recovered
n/a	No	No	Yes	No	n/a	n/a
n/a	No	No	No	No	n/a	n/a

Flu Test			Flu Treatment/Prophylaxis		
Flu test	Flu test result	Flu test collection date	Date antivirals given	Date antivirals ended	Name of antiviral given
Rapid Test	Flu A	2/5/2011	2/5/2011	2/7/2011	Tamiflu
PCR	Negative	2/6/2011	n/a	n/a	n/a
Not Done	n/a	2/6/2011	2/5/2011	2/7/2011	Relenza

Vaccination			Infection Control		Other
Vaccinated for flu this season	Date of most recent flu vaccination	Date of pneumococcal vaccination	Date droplet precautions initiated	Other patient specific control measures	Notes
No	Unknown	10/15/2011	2/4/2011	Visitation restricted	1st case
Unknown	Unknown	Unknown	n/a	Hand hygiene sign on door	Fever associated with septicemia infection
Yes	2/5/2011	2/5/2011	n/a	Hand hygiene sign on door	Spent several hours visiting patient 123

Facility influenza line list template for staff:

General Information						
Status	**First name**	**Last name**	**Date of birth**	**Station number**	**Shift**	**Worked in room with flu case**
Contact - Minimal	*Example*	*Example*	*10/10/1975*	*1*	*A*	*No*
Contact - Minimal	*Example*	*Example*	*01/01/1965*	*2*	*A*	*Yes*
Contact - High	*Example*	*Example*	*05/05/1970*	*1*	*B*	*Yes*

Symptoms						
Date of onset of flu symptoms	**Cough**	**Sore throat**	**Fever**	**SOB**	**Date last worked before onset of flu symptoms**	**Date symptoms resolved**
n/a	*No*	*No*	*No*	*No*	*No*	*n/a*
n/a	*No*	*No*	*No*	*No*	*No*	*n/a*
n/a	*Yes*	*No*	*No*	*No*	*No*	*n/a*

Flu Test			Flu Treatment/Prophylaxis		
Flu test	**Flu test result**	**Flu test collection date**	**Date antivirals given**	**Date antivirals ended**	**Name of antiviral given**
Not Done	*n/a*	*n/a*	*2/5/2011*	*2/7/2011*	*Tamiflu*
Not Done	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
PCR	*Negative*	*2/6/2011*	*n/a*	*n/a*	*n/a*

Vaccination		Other
Vaccinated for flu this season	**Date of most recent flu vaccination**	**Notes**
No	*n/a*	*Contraindication for flu vaccine*
Yes	*10/14/2010*	*Called in sick for 2 days for non-respiratory illness*
Yes	*10/19/2010*	*Cough associated with allergen*

Epi Curves

An epidemic curve or epi curve is a graphical representation of the number of cases occurring over time. Epi curves are typically histograms. The y-axis is the number of cases and the x-axis is a specific time interval that depicts when onset occurred. The time interval of onset may be in minutes, hours, days or even weeks depending on the pathogen. Day representing date of onset is the most commonly used time interval. Epi curves facilitate visualization of the start, magnitude, duration and end of the outbreak. Epi curves can also help determine whether the exposure was a one-time exposure or is ongoing. Epi curves can be hand-drawn or created in a program like Microsoft Excel.

Hand-Drawn Epi Curve Template:

Example Epi Curve

Count	09/29/11	09/30/11	10/01/11	10/02/11	10/03/11	10/04/11	10/05/11	10/06/11	10/07/11	10/08/11	10/09/11	10/10/11	10/11/11	10/12/11	10/13/11	10/14/11	10/15/11	10/16/11	10/17/11
5																			
4								X											
3							X	X	X										
2							X	X	X		X			X	X				
1			X			X	X	X	X	X	X		X	X	X		X		

Instructions for creating a basic epi curve using Microsoft Excel 2010

1. Start with a line list in an Excel workbook
- Each row should represent one case
- There needs to be a column for date of onset

Note: If you created the line list in another program (Access, Epi Info, etc.), you can usually export it to Excel or a CSV file which Excel can read

2. Create a pivot table
- Click on any cell with data in it.
- From the menu at the top of the screen go to 'Insert' then find the button for 'PivotTable'. Using the down arrow under this button, select PivotChart
- The Create PivotTable box will open
  - Under 'Choose the data that you want to analyze', select your data source if it is not already selected
  - Under 'Choose where you want the PivotTable report to be placed', select the location (default is New Worksheet, which is recommended)
  - Click 'OK'
- One new sheet will be added to your workbook. The sheet contains the PivotTable and PivotChart shells, and the PivotTable field list.
- In the PivotTable Field List, drag the variable name for the column with date of onset to the area that says 'Row Labels' (if PivotTable is selected) or 'Axis Fields (Categories)' (if PivotChart is selected).
- The x-axis should now display all of the dates of onset.
- Drag the variable name for the column with the person's name (or any other variable that is a text only field and is entered for all cases) to the area that says 'Σ Values'.

3. Turn the chart into an epi curve
- The pivot chart should have defaulted to a column chart. If it did not, then you will need to right-click on the white area around the chart and select 'Change Chart Type'. Select 'column' as the chart type.
- An epi curve is actually a histogram, not a column chart. A histogram should not have any spaces between the columns. To remove the spaces, right-click on any of the columns. In the Format Data Series box, make sure you are on the tab labeled 'Series Options'. Under Gap Width, change the gap width to 0.

4. Improve the appearance of the epi curve
- Remove the legend: Make sure you have clicked on the PivotChart to select it. In the menu bar at the top of the screen, under PivotChart Tools, select the 'Layout' tab, then the 'Legend' tab, and then 'None'.
- Change the title: The title defaults to total. Double-click on the word 'total'. The word 'total' will be highlighted. Type in your new title for the epi curve.

- You now have a basic epi curve that you can print out or copy and paste into a Word document.

5. What to do when the date range in the x-axis does not include every date in the time frame
Before you start creating the epi curve, check to see what onset dates you have. Look at the range from the first onset date to the last onset date. Are there any dates between the first onset and the last onset where no one had an onset? If yes, then you will need to add an extra row to your line list for each missing date. The only data that should be entered on the row is the date of onset. Do not enter any other information. Now when you create the epi curve, the x-axis will have a label for every date in your date range and it will show 0 cases for the dates you inserted.

This same technique can be used to add dates before or after the dates you have cases. Adding the extra days before or after also makes your epi curve more attractive and demonstrates a baseline of cases before or after the outbreak.

This is what your epi curve should look like:

Example EpiCurve
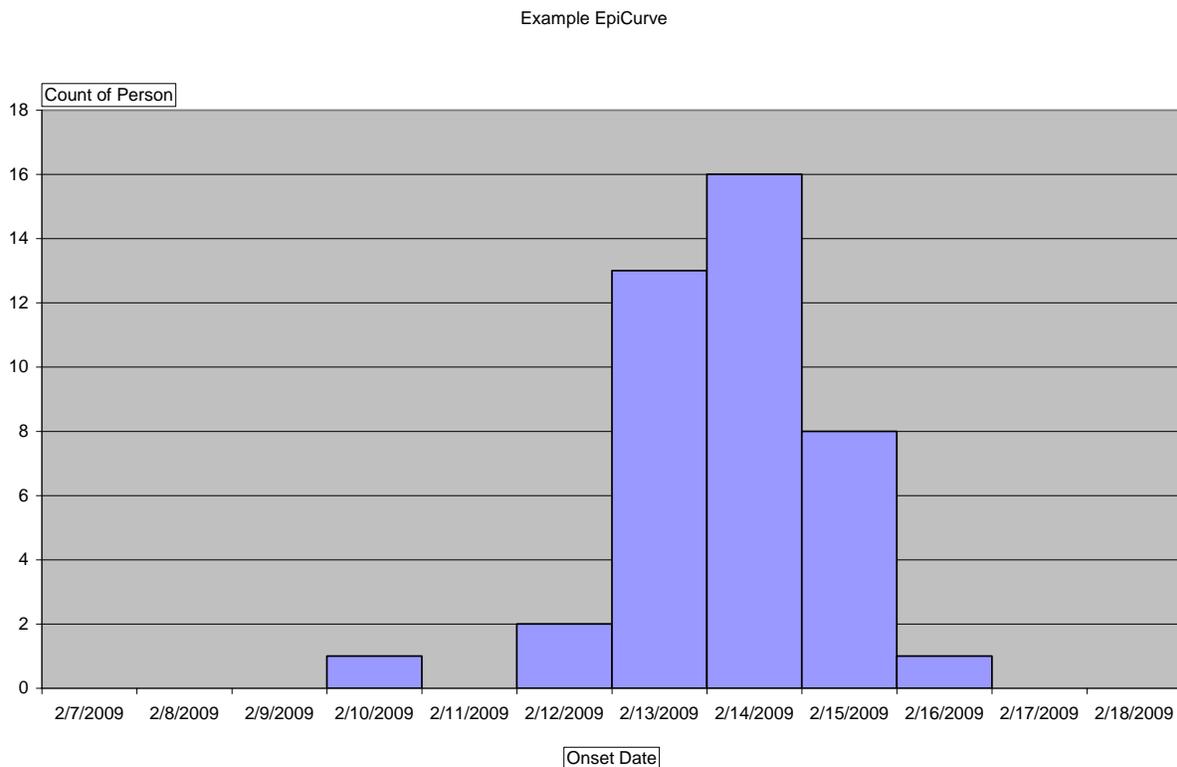
6. Need to stratify the data?
Pick the variable by which you want to stratify your data. For example, you may want to show if the cases were male/female, residents/staff, or primary/secondary cases.
In the PivotTable Field List, drag the variable name that you want to stratify by to the area that says 'Column Labels' (if PivotTable is selected) or 'Legend Fields (Series)' (if PivotChart is selected). If the new variable causes the bars to display beside instead of on top of each other, you will need to change the chart type to a Stacked Column (see #3 above to change the chart type).

Other outbreak graphs

Once you have mastered creating epi curves, you can explore other graphical methods of visually displaying your data. The graph below was created by Kelly Johnson, an epidemiologist with Harris County Public Health and Environmental Services. It shows both date of onset and incubation period for each case.
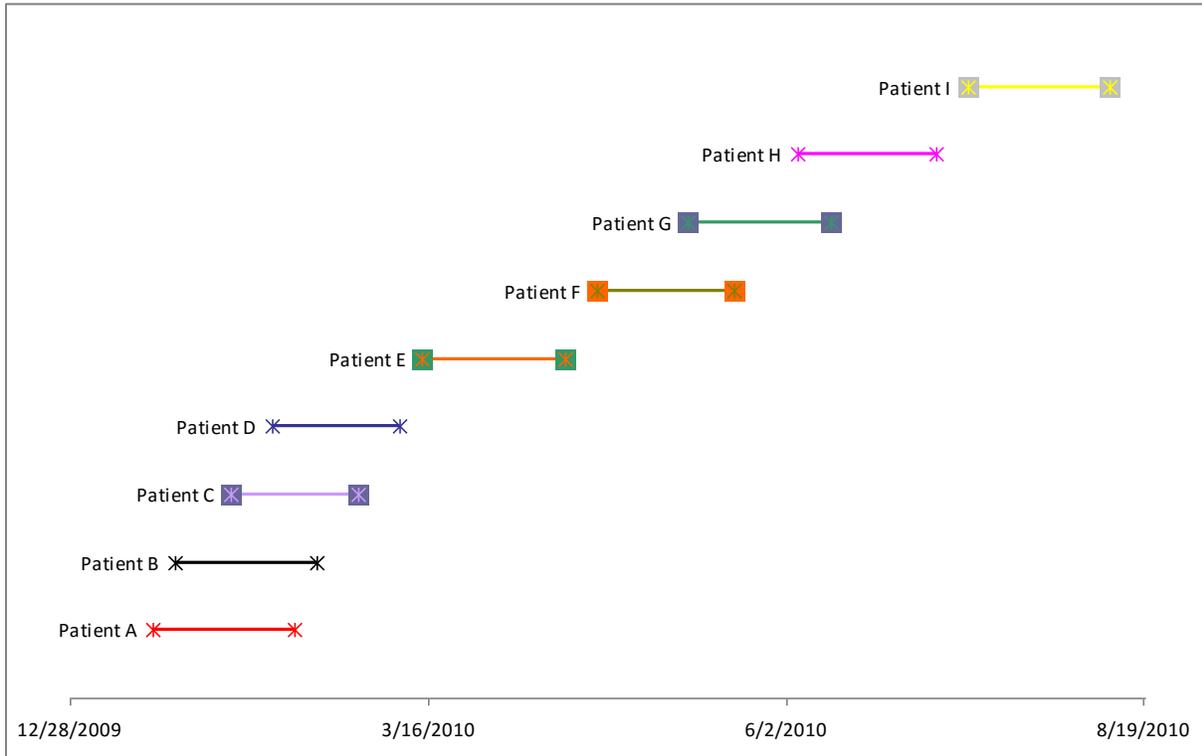
Case Confirmation

One of the essential steps in an outbreak investigation is to confirm the existence of an outbreak. Do all of the initially reported "cases" actually have the same illness? The first thing to do is to review the symptoms of the initial "cases" to see if they have similar patterns of illness suggesting a common cause. Once the key symptoms have been identified, a case definition can be created to guide what will be considered a case. See page VII.10 for information on creating a case definition. The clinical picture of the cases can also be used to help narrow down what etiologic agent may be causing the outbreak. The CDC has a spreadsheet showing basic risk factors for and clinical characteristics of many common respiratory pathogens. The spreadsheet can be found at http://www.cdc.gov/urdo/differential.html.

Laboratory testing can be performed to identify the actual pathogen. In an outbreak in a facility, the facility can use its usual laboratory for the majority of testing and should do so for any clinical testing. The DSHS laboratory can provide support by helping with the preliminary identification of the pathogen and, for some pathogens, performing advanced testing such as serotyping, antimicrobial resistance testing or pulsed-field gel electrophoresis (PFGE). It is important to notify the DSHS Emerging and Acute Infectious Disease Branch (EAIDB) when collecting specimens for an outbreak investigation. The EAIDB works with the DSHS laboratory to approve specimen testing in outbreaks.

In most outbreaks, every case does not need to be tested by the DSHS laboratory. Ideally between 5 and 10 specimens should be collected when the outbreak is first detected to identify what pathogen is responsible. If the outbreak is ongoing, consult with EAIDB to determine if and how many specimens should be collected from future cases for testing by DSHS.

In order to decide from which cases to collect specimens, look for patients with the most recent dates of onset (preferably within the last two days) who are unrelated and (when possible) who have not started antimicrobial (antibiotic/antiviral) treatment yet. Please do not delay treatment for cases while waiting for testing supplies or test results.

All specimens submitted to the DSHS laboratory must follow the guidelines from the DSHS laboratory Manual of Reference Services found at http://www.dshs.texas.gov/lab/default.shtm.

Each specimen must be accompanied by the appropriate laboratory submission form: G-2V for viral testing and G-2B for bacterial or fungal testing. The specimen must be clearly labeled with the patient's first name, last name and date of birth. The information on the specimen needs to match the information on the laboratory submission form.

Nasopharyngeal (NP) swabs are the preferred specimen source for identifying viral respiratory pathogens. Instructions for collecting an NP swab can be found in the appendix of this handbook. For guidance on acceptable specimens for identifying bacterial pathogens, review the DSHS laboratory guidance at http://www.dshs.texas.gov/lab/mic-cb_tests.shtm.

Basic Control Measures for Influenza

General recommendations for the public

- Get vaccinated for influenza every year. Influenza vaccination is recommended for everyone six months of age or older.
- Wash hands frequently with soap and water, especially after coughing or sneezing.
- Use alcohol-based hand sanitizers when facilities are not available for hand washing.
- Cover coughs and sneezes with a disposable tissue or your arm/sleeve.
- Avoid touching your eyes, nose or mouth.
- Avoid close contact with people who are sick.
- When you are sick, limit contact with others and stay home until you are fever-free for 24 hours without the use of fever-reducing medications.
- Seek medical care immediately if you develop any of the following: difficult or painful breathing, shortness of breath at rest, wheezing, coughing up bloody sputum, pain or pressure in the chest or abdomen, sudden dizziness, extreme drowsiness or difficulty waking, confusion or disorientation, severe earache, severe or persistent vomiting, fever lasting three to four days without improvement, or improvement followed by sudden high fever and return of symptoms.

General recommendations for long-term care facilities (*5,6,10*)

- Provide annual influenza vaccination to all residents who do not have a medical contraindication and do not refuse vaccination. Don't forget to vaccinate new residents who may have arrived after the vaccinations were given to other residents.
- Actively promote annual influenza vaccination of all healthcare personnel, volunteers and other staff.
- When a person is suspected or confirmed to have influenza, implement standard and droplet precautions for seven days after onset or until symptom-free for 24 hours, whichever is longer. Standard and droplet precautions should be continued even if the patient was / is on antiviral therapy.
- Administer influenza antiviral medications for treatment when influenza is detected.
- Implement prevention strategies and educational campaigns, such as respiratory hygiene/cough etiquette programs. Post signs for staff, residents and visitors.
    - Examples at www.cdc.gov/flu/professionals/infectioncontrol/resphygiene.htm
- Conduct surveillance and influenza testing even outside of influenza season to identify cases.
- Discourage ill staff and volunteers from coming to work until they are fever-free for at least 24 hours without the use of fever-reducing medications.
- Discourage ill family and friends from visiting.
- Ensure that healthcare personnel who are not directly employed by the facility are also aware of the policies.
- When influenza is confirmed in at least one person and at least two people develop symptoms of influenza within a 72-hour period in the facility, consider the following:

- o Conduct active surveillance on a daily basis including influenza testing to detect new cases. Active surveillance should continue for at least one week after the last confirmed influenza case occurred.
  - o Offer influenza vaccination to any unvaccinated staff and patients/residents who do not have medical contraindications.
  - o All non-ill residents should be given chemoprophylaxis regardless of vaccination status. Unvaccinated staff—including staff that have been recently vaccinated—are also recommended to receive chemoprophylaxis. Chemoprophylaxis should be continued for a minimum of two weeks and should continue 7 to 10 days after the last influenza case is detected. Use clinical judgment to determine if chemoprophylaxis should be continued longer if extended viral shedding is suspected (as may occur with young children or in severely immunocompromised patients).
  - o Staff should be monitored for symptoms of illness and treated with antivirals at the first sign of illness. Staff are not recommended for chemoprophylaxis unless they are unvaccinated, they were recently (i.e., within the past two weeks) vaccinated with TIV or the influenza strain detected in the facility does not match the vaccine.
  - o Isolate or cohort ill residents/patients.
  - o Restrict staff movement between wards/buildings/wings especially between ill and non-ill residents/patients.
  - o Screen for and restrict ill visitors and personnel from entering the facility.
  - o Assign staff returning to work after illness to work with currently ill patients/residents. This protects well staff from ill patients/residents and ensures that previously ill staff do not infect well patients/residents if they return to work while still infectious.
  - o Follow the CDC's Interim Guidance for Influenza Outbreak Management in Long-Term Care Facilities at http://www.cdc.gov/flu/professionals/infectioncontrol/ltc-facility-guidance.htm.
- Additional information on infection control and outbreak response in long term care facilities can be found in the Centers for Medicare State Operations Manual available online at www.cms.gov/manuals/downloads/som107_Appendicestoc.pdf and http://cms.gov/manuals/Downloads/som107ap_pp_guidelines_ltcf.pdf.
- Detailed guidance for healthcare and other settings can also be found on the CDC website at http://www.cdc.gov/flu/professionals/infectioncontrol/healthcaresettings.htm, http://www.cdc.gov/HAI/settings/outpatient/outpatient-settings.html, https://www.cdc.gov/correctionalhealth/rec-guide.html and http://www.cdc.gov/HAI/settings/settings.html.

General recommendations for schools (*11*)
- Encourage annual influenza vaccination for all students and those staff who do not have medical contraindications.
- Suggest early treatment of students and staff at higher risk for influenza complications.
- Facilitate use of respiratory etiquette and hand hygiene by students and staff.

- Ensure that sick students and adults do not come to the facility. According to the Texas Administrative Code Title 25 Part 1 Chapter 97 rule §97.7, any student with a fever is required to be excluded until the fever free for at least 24 hours without the use of fever-suppressing medications.
- Discourage attendance at school events by sick people.
- Identify symptomatic individuals as soon as possible and separate them from asymptomatic individuals.
- Perform routine environmental cleaning.
- During influenza outbreaks or if illness is unusually severe, consider the following:
    - Increase social distancing within the school environment.
    - Advise that students with sick household members stay home.
    - Ensure that symptomatic individuals do not return to school until 24 hours after fever has resolved without the use of fever-reducing medications.
    - Consider selective school dismissal for high risk individuals.
    - Consider school dismissals. The superintendent of independent school districts has the authority to close schools. This decision should be made only after consultation with the local health authority and the local health department.

Use of antivirals for prophylaxis ($5,6,10,12$)
Antiviral chemoprophylaxis should be used for controlling influenza outbreaks in nursing homes and other long-term care facilities that house large numbers of patients at higher risk for influenza complications. Antiviral chemoprophylaxis can also be considered for controlling influenza outbreaks in closed or semi-closed settings (e.g., correctional facilities or other settings in which persons live in close proximity).

Antiviral chemoprophylaxis is not recommended for use in controlling influenza outbreaks in groups of healthy children or adults based on potential exposures in the community, workplace, school or other settings. Instead, early recognition of illness and prompt treatment is recommended.

When antiviral chemoprophylaxis is given to control an outbreak in an institutional setting, it should be given to all non-ill patients/residents regardless of vaccination status. Antiviral chemoprophylaxis is also recommended for unvaccinated health care personnel. For newly-vaccinated staff, antiviral chemoprophylaxis can be administered for up to two weeks (the time needed for antibody development) following influenza vaccination. Chemoprophylaxis may also be considered for all employees, regardless of their influenza vaccination status, if the outbreak is caused by a strain of influenza virus that is not well-matched by the vaccine. Chemoprophylaxis should be continued for a minimum of two weeks and should continue 7 to 10 days after the last influenza case is detected.

Updated antiviral recommendations are available on the CDC website at
http://www.cdc.gov/flu/professionals/antivirals/index.htm.

Environmental cleaning information (*11, 13-15*)
According to the CDC, influenza viruses can generally survive on inanimate objects from two to eight hours. Influenza viruses are fragile, so standard cleaning and disinfection are sufficient when done properly.

- Perform routine cleaning of hard surfaces that are frequently touched by using water and soap (or detergent). Common household cleaners that kill germs can also be used. Always follow the label directions on cleaning products. Hard surfaces that are frequently touched may include doorknobs, bedside tables, bathroom sinks, toilets, counters, phones, toys and computer keyboards or mice.
- Wash bed sheets and towels with normal laundry soap and tumble dry on a hot dryer setting. Hold all dirty laundry away from your face and body. Wash your hands right after touching dirty laundry. It is okay to wash a sick person's bedding or clothes with other people's laundry.
- Wash the sick person's eating utensils and dishes with normal dish soap or place them in the dishwasher. It is okay to wash the sick person's eating utensils and dishes with other people's dishes.
- Avoid touching used tissues and other waste when emptying waste baskets. Wash your hands immediately after emptying waste baskets or touching used tissues.

Notes on using these recommendations for non-influenza outbreaks
Influenza is a respiratory illness spread primarily through droplets. The basic control measures described in this section are applicable to most infectious respiratory diseases because the measures target pathogens spread via droplets. Respiratory hygiene, hand hygiene and droplet infection control measures are critical for preventing infectious respiratory disease outbreaks.

For details on prophylaxis, vaccination and other control measures specific to a non-influenza respiratory pathogen refer to the Control of Communicable Diseases Manual, the Red Book and the CDC website.

Resources and Training

Books
- Control of Communicable Diseases Manual (20th Edition). Heymann, D.L. (Ed). American Public Health Association: Washington; 2015.

- Red Book: 2015 Report of the Committee on Infectious Diseases (30th Edition). Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. American Academy of Pediatrics: Elk Grove Village, IL; 2015.

- Pink Book: Epidemiology and Prevention of Vaccine-Preventable Diseases (13th Edition). Hamborsky J, Kroger A, Wolfe S (Eds). Centers for Disease Control and Prevention; 2015. Available online at http://www.cdc.gov/vaccines/pubs/pinkbook/index.html

- Infectious Disease Epidemiology: Theory and Practice (3rd Edition). Nelson, K.E. and Williams, C.M., (Eds). Jones and Bartlett Publishers: Burlington; 2014.

- Field Epidemiology (3rd Edition). Gregg, M. (Ed). Oxford University Press: New York, NY; 2008.

- A Dictionary of Epidemiology (4th Edition). Last, J.M. (Ed). Oxford University Press: New York, NY; 2001.

Websites
  DSHS websites
  - www.dshs.texas.gov/
  - www.texasflu.org
  - www.dshs.texas.gov/idcu/investigation/
  - www.dshs.texas.gov/idcu/disease/influenza/

  CDC websites
  - www.cdc.gov
  - https://www.cdc.gov/flu/www.cdc.gov/flu/other_flu.htm
  - https://www.cdc.gov/urdo/
  - www.cdc.gov/mmwr/preview/mmwrhtml/rr5908a1.htm

  Other health department websites
  - www.azdhs.gov/phs/oids/pdf/manuals/Arizona_Respiratory_Outbreak_Guidelines.pdf
  - http://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/Outbreaks/Pages/respdisease.aspx
  - www.health.state.ny.us/diseases/communicable/control/respiratory_disease_checklist.htm

Trainings

      North Carolina Center for Public Health Preparedness has a variety of free online trainings including basic epidemiology, outbreak investigations and ICS for public health at https://nciph.sph.unc.edu/tws/index.php.

      North Carolina Center for Public Health Preparedness also has a series called Focus on Field Epidemiology. Focus on Field Epidemiology is set up for use as a self-study course and has materials that instructors can use for training. http://sph.unc.edu/nciph/focus/

      The Centers for Disease Control and Prevention has a variety of epidemiology training tools at http://www.cdc.gov/AppliedEpiCompetencies/. These trainings include a self-study course called Principles of Epidemiology in Public Health Practice, and case studies (www.cdc.gov/epicasestudies/ and http://www.cdc.gov/eis/casestudies.html).

      The Centers for Disease Control and Prevention also has an e-learning center with resources for several public health trainings at www.cdc.gov/learning/.

      FEMA has free online trainings for ICS.
      http://training.fema.gov/

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3. State Operations Manual. Centers for Medicare and Medicaid Services. Accessed 10 May 2012. Available from http://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/r55soma.pdf.

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5. Guidelines for Investigating Outbreaks of Influenza-like Illness or Respiratory Disease. Arizona Department of Health Services; 2013 [28 Sep 2016]. Available from http://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/disease-investigation-resources/outbreak-investigation-guidelines.pdf.

6. Interim Guidance for Influenza Outbreak Management in Long-Term Care Facilities [Internet]. Centers for Disease Control and Prevention (CDC), Department of Health and Human Services; 18 Mar 2016 [26 Sep 2017]. Available from http://www.cdc.gov/flu/professionals/infectioncontrol/ltc-facility-guidance.htm

7. Harper SA, Bradley JS, Englund JA, et al. Seasonal Influenza in Adults and Children – Diagnosis, Treatment, Chemoprophylaxis and Institutional Outbreak Management: Clinical Practice Guidelines of the Infectious Disease Society of America. Clinical Infectious Diseases, 2009:48 Available from IDSA https://academic.oup.com/cid/article-lookup/doi/10.1086/598513

8. Norman, DC Fever in the Elderly. Clinical Infectious Diseases. Vol 31 Issue 1 p148-151.2000 http://cid.oxfordjournals.org/content/31/1/148.full

9. Severe Influenza Among Children and Young Adults with Neurologic and Neurodevelopmental Conditions – Ohio 2011. MMWR 6 January 2012; 60(51); 1729-1733. Available from: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6051a1.htm?s_cid=mm6051a1_w

10. Influenza Antiviral Medications: Summary for Clinicians [Internet]. Centers for Disease Control and Prevention (CDC), Department of Health and Human Services; 26 May 2016 [28 Sep 2016]. Available from http://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm.

11. CDC Guidance for State and Local Public Health Officials and School Administrators for School (K-12) Responses to Influenza during the 2009-2010 School Year [Internet]. Centers for Disease Control and Prevention (CDC), Department of Health and Human Services; 22 Feb 2010 [28 Sep 2016]. Available from http://www.cdc.gov/h1n1flu/schools/schoolguidance.htm.

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13. How to Clean the Sick Room [Internet]. Centers for Disease Control and Prevention (CDC), Department of Health and Human Services; 13 Aug 2010 [04 Oct 2016]. Available from http://www.cdc.gov/h1n1flu/homecare/cleansickroom.htm.

14. How to Clean and Disinfect Schools to Help Slow the Spread of Flu [Internet]. Centers for Disease Control and Prevention (CDC), Department of Health and Human Services; 31 Oct 2014 [04 Oct 2016]. Available from http://www.cdc.gov/flu/school/cleaning.htm.

15. Prevent Seasonal Flu [Internet]. Centers for Disease Control and Prevention (CDC), Department of Health and Human Services; 26 Aug 2017 [28 Sep 2016]. Available from https://www.cdc.gov/flu/prevent/index.html .