Welcome to Week 6, entitled “Data Collection & Interpretation”. This is Part I of II. In Part I, we will focus on Data Collection principles, using practical recommendations regarding collecting surveillance data. In addition, we will discuss meaningful use and electronic health surveillance.

In Week 3, one assigned reading was an article entitled “Recommended Practices for Surveillance: Association for Professionals in Infection Control & Epidemiology (APIC), Inc.”. We listed and described the 7 recommended surveillance practices. During this week, we are going to cover more detail regarding Recommended Practice #IV: the collection of surveillance data, focusing on healthcare facility surveillance data for the principles. Then in Part 2, we will use national disease surveillance data for the practical application examples.

One of the most important steps in designing a surveillance program is the selection of appropriate health-related events to monitor. Surveillance programs should measure outcomes of healthcare, processes of healthcare, and selected events of importance to the organization. Some monitored events should focus on personnel. The events chosen should be based on the following:

- Type of healthcare setting
- Populations being studied (including patients, residents, and healthcare personnel)
- Procedures performed and services provided
- Acuity of care
- A risk assessment that identifies risk factors for infection and other adverse events in the populations studied
- State, federal, accrediting, and other relevant agency requirements, including mandatory reporting requirements
- Available resources, both personnel and non-personnel
- Availability of the data required
- Public health needs
- Performance improvement initiatives
- Organizational objectives
It is common to monitor high-volume, high-risk events in a specific population. Events that have the potential to provide information that can be used to improve outcomes and infection prevention practices should be targeted for monitoring. Examples of outcome events that may be monitored include the following:

- HAIs
- Infection or colonization with a specific organism
- Phlebitis related to peripheral intravascular therapy
- Pyrogenic reaction or pus, redness, or increased swelling at a dialysis vascular access site in hemodialysis patients
- Sharps injuries and communicable disease or blood/body fluid exposures; tuberculin skin test conversions, and hepatitis B immunization rates, in healthcare personnel and
- Influenza immunization rates in personnel, residents, or patients

Process events should also be monitored. Examples of process events include personnel compliance with infection prevention protocols, such as Standard Precautions, Isolation Precautions; central line insertion, maintenance, and removal; hand hygiene; urinary catheter insertion, care, and removal; safe injection and medication handling practices; and tuberculin skin testing, to name a few.

Finally, there may be other events of significance to monitor. Examples of other events of significance that may be monitored include the following: occurrence of reportable diseases and conditions; communicable and potentially communicable diseases in personnel, organisms or syndromes indicative of a bioterrorist event, results of quality assurance testing (e.g., monitoring of negative airflow in airborne infection isolation rooms, biological monitoring of sterilizers, and testing of high-level disinfectants); and admission of a patient or resident known to be infected or colonized with a multi-drug resistant organism.

Surveillance data should be collected for each indicator consistently and for a defined period, such as a month, quarter, or year. It is difficult to interpret rates for events that rarely occur and procedures that are infrequently performed. Therefore, if uncommon events are measured and rates are calculated, it is necessary to use an observation period that is long enough to accumulate a sufficient number of events for the measurement to be valid.
To accurately trend surveillance data over time within a facility, or compare rates between facilities, surveillance criteria (i.e., case definitions) must be consistently used to determine the presence of an HAI, occurrence of an event, or compliance with a process. If a case definition is changed, this should be noted in the surveillance report because the number of cases identified will likely change and the rate will be affected. It is important to use criteria that reflect generally accepted definitions of the disease or event being monitored. Criteria have been published for defining HAIs in a variety of healthcare settings, including hospitals, LTC, and home care. In the United States, the majority of healthcare facilities, and many government mandatory reporting programs, use the National Healthcare Safety Network (NHSN) criteria and methodology (which you learned about in Week 3).

Individuals who conduct surveillance activities and identify HAI cases must apply surveillance criteria precisely. It should be noted that criteria used to define a case for surveillance purposes may be different than criteria used clinically for diagnosis and treatment. This is because surveillance definitions, such as those used in the NHSN, were developed for epidemiologic surveillance and not for clinical diagnosis. For instance, the NHSN surveillance criteria used to identify a central line-associated bloodstream infection (aka CLABSI) can differ from the clinical criteria used to diagnose and treat a catheter-related bloodstream infection. Therefore, a patient may fit the surveillance criteria for a CLABSI but may not be clinically diagnosed as having a catheter-related infection.

Before data collection is initiated, the statistical measures that will be used to analyze the data must be determined so the requisite data can be collected. If rates or ratios will be calculated, the values corresponding to each numerator and denominator must be defined, and the appropriate data needed to calculate each rate or ratio must be collected.

Whenever possible, data should be expressed as rates or ratios that are calculated using the same methodology as a nationally validated surveillance system. This allows an organization to compare its rates with another organization or a recognized benchmark. For instance, if ventilator-associated events (VAEs) are monitored using the NHSN criteria and methodology, both the number of cases in a specified population that fit the VAE criteria (numerator data) and the total number of ventilator-days in that population (denominator data) must be identified to calculate VAE rates that can be properly compared with NHSN data.
The data elements that should be collected depend on the event being monitored and the statistical measures used to analyze the data. To use time and personnel resources efficiently, data collection should be limited only to those elements that are needed to identify a case and determine whether the case criteria are met for the condition or event being studied.

Data elements that may be collected include the following.

**For an infectious event:** Case name; sex; age; unique identifier such as medical record or account number; unit or location in the facility; physician name and service; date of admission; date of onset of infection; type of infection; and date of discharge, transfer, or death.

Information needed to determine whether the case definition is met: results of laboratory and diagnostic tests specified in the case definition, and dates performed; sites and dates cultured and organisms isolated; antibiotic susceptibility of significant isolates; and clinical signs and symptoms specific for the infection being monitored.

Risk factors for the infection being monitored: host factors such as underlying conditions and diseases; surgical procedure and date performed; surgeon; use of intravascular catheters, including date of insertion, duration of use (vascular catheter-days), catheter type and body site; use of a urinary catheter, including date of insertion and duration of use (urinary catheter-days); mechanical ventilation and dates and duration of use (ventilator-days).

**For a noninfectious event:** Case name; sex; age; unique identifier such as medical record or account number; unit or location in the facility; physician name and service; date of admission; primary diagnosis; date, time, and location of event; outcome (e.g., severity of injury); personnel involved; risk factors for the event; and date of discharge, transfer, or death.

Determination of the appropriate approach to surveillance should be influenced by the issue being surveyed and available resources. Data may be collected concurrently (while a person is still under the care of the organization) or retrospectively (closed-record review after discharge). Concurrent (aka prospective) surveillance should be used when the patient is still under the care of the facility, as it enables capture of data in real time. The advantages of concurrent surveillance are as follows: data collectors may interview caregivers or observe the patient or resident if the chart does not include the information needed to fulfill the case criteria; immediate prevention and control measures, such as isolation precautions, may be instituted; clusters and outbreaks can be detected in a timely manner; and infection prevention personnel are available to identify and correct potential problems and provide education to personnel, visitors, and patients or residents. The disadvantages of concurrent surveillance are the time involved in locating records on a medical record.
care unit (if paper records are being used), it is more costly, and it may result in limited sensitivity if there is a delay in completing the medical records (incomplete data).

Even though the retrospective approach does NOT permit interviews with ongoing caregivers, it does allow for a comprehensive review of sequential events. The major advantage of retrospective review is that the medical record is more complete. The disadvantage of retrospective surveillance is that important findings, such as the identification of an outbreak, may be delayed and missing information may not be obtainable after discharge.

It is important to realize that passively obtained data may be biased, for example, if it is incomplete due to underreporting. It is recommended that careful analysis be applied to data that have been passively collected. This is especially true of reports by caregivers, such as medications errors, patient falls, and occupational injuries (e.g., needlesticks). In such cases, it is important that caregivers recognize the importance of reporting such events.

Post-discharge surveillance is important for outcomes that occur once a patient has left a facility. Examples include surgical site infections and adverse drug reactions. If included, post-discharge surveillance strategies need to be clearly outlined in the surveillance plan. It is important to note that there remains no consensus on the efficacy or validity of various post-discharge surveillance methods. Therefore, caution should be taken when making inter-facility comparisons of performance in this area.

Persons who will conduct data collection for surveillance need to be trained in data collection methods that are specific to each surveillance objective. Data collectors may include the following: 1) Infection Preventionists (IPs) 2) other professionals 3) those interested in performing data collection or 4) staff with responsibility for performing data collection. Oversight of the surveillance program, whenever possible, should be by an Infection Preventionist who is certified in infection control (C.I.C. certified).
It might be prudent to develop standardized training methods for staff involved in data collection. For those who only collect denominator data, methods such as one-on-one instruction or review in a staff meeting, might be all that is necessary. For those who are responsible for applying infection surveillance definitions or performing detailed risk factor potential collection, a more formal method of training may be required. One option would be to conduct an in-person workshop training with case examples to classify and provide and receive feedback to the trainees. If persons from different geographic locations need to be trained, options include self-study modules, web-based sessions and conference calls.

The ability to use information technology—including word processing, spreadsheet, database, and graphics programs, the Internet, and email—is a basic requirement for the IP. At a minimum, IPs should subscribe to email discussion and announcement groups, such as those from the CDC, health departments, and professional organizations, such as the Association for Professionals in Infection Control and Epidemiology (APIC). These mailings inform subscribers about a variety of topics, including the occurrence of disease outbreaks, emerging infectious diseases, and MDROs; new and proposed mandatory reporting requirements; and the release of evidence-based practices for preventing infections. They also provide Internet links for obtaining more information, including prevention and control measures. IPs can also use a variety of social media to obtain and share information related to surveillance activities.

Automated surveillance can be defined as the process of obtaining useful information from infection prevention data “through the systematic application of medical informatics and computer science technologies.” Because manual methods for obtaining and evaluating the data needed to identify HAIs are time consuming, error prone, and labor intensive, data should be collected, managed, and analyzed using information technology whenever possible. Automated surveillance programs that use existing electronic clinical, laboratory, pharmacy, and other health data can improve the sensitivity, accuracy, and objectivity of surveillance and decrease the burden of data collection. A variety of automated systems exist, including programs developed internally by a healthcare organization and those available commercially. APIC has a position paper that discusses and supports the use of automated surveillance technologies, which is one of your readings for this week. APIC provides related information that can be accessed by entering the key words “surveillance technology” into the search function on the APIC home page (www.apic.org). IPs should support this movement by participating in planning the development of automated & semi-automated reports, to ensure that key data elements are captured and retrievable for epidemiologically meaningful analysis. An example would be device-
associated infection incidence density rates. Two commercially available surveillance software systems IPs should be familiar with are Epi-Info and EPINet.

The American Reinvestment & Recovery Act (ARRA) was enacted on February 17, 2009. ARRA includes many measures to modernize the nation’s infrastructure, one of which is the "Health Information Technology for Economic and Clinical Health (HITECH) Act". The HITECH Act supports the concept of electronic health records - meaningful use [EHR-MU], an effort led by Centers for Medicare & Medicaid Services (CMS) and the Office of the National Coordinator for Health IT (ONC). HITECH proposes the meaningful use of interoperable electronic health records throughout the United States health care delivery system, as a critical national goal. Meaningful Use is defined by the use of certified EHR technology in a meaningful manner (for example electronic prescribing); ensuring that the certified EHR technology is connected in a manner that provides for the electronic exchange of health information to improve the quality of care; and that in using certified EHR technology the provider must submit to the Secretary of Health & Human Services (HHS) information on quality of care and other measures.

CMS grants an incentive payment to Eligible Professionals (EPs) or Eligible Hospitals (EHs), who can demonstrate that they have engaged in efforts to adopt, implement or upgrade certified EHR technology. This is an evolving and complex issue. If you wish to read more about this topic, please go to the link listed on the slide as well as provided in the transcripts: http://www.cdc.gov/EHRmeaningfuluse/index.html

As a reinforcement of material covered in Week 3, there are numerous data sources available from which to collect data in healthcare facilities. Numerous examples are reiterated on this slide: administrative database, patient charts/records, communication with caregivers, ancillary service reports (e.g., laboratory, radiology, pharmacy), admission diagnosis reports, and surgical schedules/databases.

When selecting or developing a data collection tool, there are several practical points that should be considered. First, the tool should be specific to a given objective after determining the necessary data elements. Data collection should be limited to what is absolutely necessary for the specific surveillance objective. There are a variety of media which can be used for collecting surveillance data, which include but are not limited to the following: 1) internet-based forms, 2) computerized data-entry screens, 3) handheld personal digital assistant devices and/or 4) paper forms.
Data should be collected using standardized data collection forms. These should be designed to collect only those elements needed to identify a case and determine if the case criteria are met for the condition or event being studied. To facilitate rapid data collection, a form should be designed so that data elements can be circled, checked, or otherwise selected (e.g., yes/no, procedures, treatments, and risk factors). Limit narrative entries as much as possible. The data collection forms used in the NHSN can be used as-is or as a guide in designing a form for a specific event. Whenever possible, collect data via information technology and have it downloaded into an accessible database.

Up until now, we have focused on collecting surveillance data from healthcare facilities. Forms used to collect data are important, for reasons mentioned previously in this lecture. Please be sure to view the 2 sample data collection forms in Required Reading #2 for this week.

In Week 3, we learned about the National Healthcare Safety Network (NHSN) and the healthcare personnel safety component. Many other modules have been added since then. Just for hospitals and acute care facilities (ACFs) there are numerous types of surveillance conducted. These include but are not limited to surveillance for intravenous & urinary catheters, blood safety, ventilator-associated pneumonia, surgical site infections. For each module or type of surveillance, there are specific data collection forms. Please go to the link provided on this slide to check out the different modules and also click on a few data collection forms.
This is an example of a form used by the Birmingham VA to collect surveillance data. It is entitled “Ventilator and Central Venous Lines Monthly Report”. This is designed for collecting the denominator data for determining 3 different rates: central lines infections in patients, dialysis line infections, and cases of ventilator-associated pneumonia. Please review this form applying the concepts we have covered in the first part of this lecture. Note that this form has been designed to meet 3 specific surveillance objectives. In terms of providing training, there are simple instructions attached to the form. No more items have been included than are necessary to determine the denominator information. Here are the instructions supplied right on the form:

“The Infection Control Committee greatly appreciates your help with CVL (central venous line) surveillance. The magnitude of the potential to cause morbidity and mortality resulting from infectious complications has been well documented. Treatment of line related infections are estimated to cost between $34,000 to greater than $56,000 per patient.”

“INSTRUCTIONS:
Please document the date and unit in the appropriate blanks following instructions.
Please count the number of patients with central venous lines every day at the same time and record the number in the second column.
A separate column requests the number of patients with catheters for dialysis. Do not include these in the total number of central lines.
Please do the same count of the number of patients on the ventilator.

*Please submit this form to Infection Control by the end of the first week of each month.*”

This concludes Week 6, Part I.