This portion of today’s training will describe the protocols and definitions for the Ventilator-associated Pneumonia option of the Device-associated Module of the Patient Safety Component of the NHSN.
This training session is designed for those who will collect and analyze Ventilator-associated Pneumonias in the Patient Safety Component of NHSN. This may include:
- NHSN Facility Administrator
- Patient Safety Primary Contact
- Infection Control Professional (ICP)
- Epidemiologist
- Microbiologist
- Respiratory Therapy Staff
- Data entry staff

This training session is designed for those of you who will collect and analyze ventilator-associated pneumonias and/or their associated denominators. This may include any of the individuals listed on the slide.
At the end of this training, you should be able to outline the structure, methodology and purpose of the device-associated module of NHSN and describe the protocols and definitions used in the ventilator-associated pneumonia option of the device-associated module.
The NHSN Website is the primary resource for data collection forms, protocol, definitions, and trainings.
Using this module means that you must use active, patient-based, prospective surveillance of VAPs and their corresponding data by a trained infection control professional (ICP). This means that the ICP shall seek out infections during a patient’s stay by screening a variety of data sources, such as laboratory, pharmacy, admission/discharge/transfer and radiology/imaging, and pathology databases, patient charts, including history and physical exam notes, nurses/physician notes, temperature charts, etc.

Others may be trained to screen data sources for these infections, but the ICP must make the final determination. Laboratory-based surveillance should not be used alone, unless all possible criteria for identifying an infection are solely determined by laboratory evidence.

Retrospective chart reviews should be used only when patients are discharged before all information can be gathered.
This slide illustrates the basic structure of the Patient Safety Component of NHSN. The Device-associated Module is shown at the top of the diagram in red. This is the module in which the catheter-associated urinary tract infection protocol can be located.
This slide illustrates the further breakdown of the Device-associated module. There are five separate options in this module: Central Line-associated Bloodstream Infections (CLABSI), Ventilator-associated Pneumonia (VAP) Catheter-associated Urinary Tract Infection (CAUTI), Central Line Insertion Practices (CLIP) and Dialysis Event (DE). We will discuss only ventilator-associated Pneumonia during this training session.
Pneumonia is the second most common healthcare associated infection in the United States and is associated with substantial morbidity and mortality. Patients with mechanically assisted ventilation have a high risk of developing pneumonia.

Prevention and control of healthcare-associated pneumonia is discussed in the CDC/HICPAC document, Guideline for the Prevention of Nosocomial Pneumonia. The guideline strongly recommends that surveillance be conducted for bacterial pneumonia in ICU patients who are mechanically ventilated to facilitate identification of trends and for interhospital comparisons.

http://www.cdc.gov/nhsn/PDFs/pscManual/6pscVAPcurrent.pdf
The following slides outline the various definitions and assessment criteria that you’ll need to understand the surveillance criteria used for ventilator associated pneumonia. We’ll define VAP, Ventilator, and the three criteria that can be used to define pneumonia.
So...when is a pneumonia considered ventilator-associated? A ventilator associated pneumonia is a pneumonia that occurs in a patient who was intubated and ventilated at the time of or within 48 hours before the onset of the pneumonia. Please notice that there is no requirement that the patient be on a vent for 48 hours before the pneumonia is vent-associated. What this means is that when the patient meets the criteria for pneumonia, you take a look-back at the previous 48 hours. If the patient was on the ventilator continuously at any time during that 48 hours, then the developing pneumonia is ventilator-associated.

Just to better clarify the location to which the VAP is attributed, if the patient develops the pneumonia within 48 hours of discharge from a location, indicate the discharging location on the infection report, not the current location of the patient.
What, then, is a ventilator? You may think it’s obvious, but we don’t leave this definition open to interpretation. A ventilator is a device to assist or control respiration continuously, inclusive of the weaning period, through a tracheostomy or by endotracheal intubation. The rest of the slide describes what is not included in the definition – basically, any device that does not deliver mechanical ventilation through any route that is not endotracheal or through a tracheostomy.
So now that we’ve defined a VAP, and we’ve defined a Ventilator, it’s time to move to the definition of Pneumonia. The CDC has defined pneumonia using three specific sets of criteria. Pneumonia 1 is clinically defined pneumonia, Pneumonia 2 is pneumonia with common bacterial pathogens, and Pneumonia 3 is used for Immunocompromised patients. These criteria use a combination of radiologic, clinical, and laboratory criteria. We’ll cover each criterion briefly, and I suggest that you review this after the training using the Pneumonia Flow Diagram in the NHSN Users Manual/Patient Safety Protocol. Until you become more familiar with the pneumonia criteria, the flow diagram is definitely the easiest way to work your way through the surveillance definition. It’s also helpful to read through all the comments and footnotes that accompany the pneumonia in order to make certain that you’re using them correctly.

### Pneumonia Criteria

- **Indicate the specific type of VAP***
  - **PNU1** – Clinically Defined Pneumonia
  - **PNU2** – Pneumonia with Common Bacterial Pathogens
  - **PNU3** – Pneumonia in Immunocompromised Patients

*See NHSN Manual: Patient Safety Component Protocol*
Beginning at the top of the flow diagram, the first criteria for ALL pneumonias is the chest x-ray. On the right side, we see the patient without underlying pulmonary disease – for this patient, the criteria requires one chest x-ray that identifies one of the following: New or progressive and persistent infiltrate, Consolidation, Cavitation, Pneumatoceles, in <1 y.o. On the left, we see that if the patient has underlying pulmonary disease, such as COPD, congestive heart failure, etc. then 2 or more serial chest x-rays are required. If you read through the footnotes and comments in the definition, you’ll find other words that may be acceptable to describe a pneumonia process on chest x-ray.

The positive chest x-ray is the first, and most important criteria for all the pneumonia definitions. If you do not meet this criteria, throw it out – it is not a pneumonia according to the surveillance definition. If the patient has underlying pulmonary disease and has one positive chest ray followed by a chest x-ray that shows improvement, throw it out, it does not meet the surveillance definition of pneumonia.
After the chest x-ray criterion is met, for Pneumonia 1, move next to the clinical criteria, or signs and symptoms. The patient must have at least one of the symptoms in the left box and at least two of the symptoms in the right box. On the flow diagram, follow the arrows that go down the left side of the page. If these criteria are met, then the patient meets the definition for Pneumonia 1. No other laboratory or other evidence is required.
Moving now to Pneumonia 2 – back to the top of the flow diagram. The chest x-ray criteria are exactly the same as they were for Pneumonia 1. Moving next to the signs and symptoms area of the flow diagram...
Pneumonia 2 still requires that at least one of these signs or symptoms are present. If they are present, then you move down and are also required to have --
At least two of the symptoms in the box on the left (just like in Pneumonia 1) or you can identify just one of these symptoms, identified in the box to its right. If the patient demonstrates only one of the symptoms, however, then you must also identify laboratory criteria.
Either – one of the laboratory criteria in the left box or one from the right box. The criteria on the left are used to identify a bacterial pneumonia and the one on the right is used for viral, fungal, or more uncommon pathogens. Please take a good look at Comment #9 on the back of the flow diagram – it clearly states that an endotracheal aspirate does not meet the laboratory criteria – it must be a minimally contaminated specimen,-- a specimen obtained bronchoscopically.

If the patient meets the definition of both Pneumonia 1 and Pneumonia 2, it should be reported as Pneumonia 2
Moving now to Pneumonia 3 – this criteria may be used with a patient that is immunocompromised. Please note, however, that you may also use Pneumonia 1 or Pneumonia 2 for the immunocompromised patient.

As with pneumonias 1 and 2, Pneumonia 3 begins with the same x-ray criteria. If this criterion is not met, the patient does not meet the surveillance definition of Pneumonia.
Next, identify one of the signs or symptoms listed here. You’ll note that there are symptoms included here, such as hemoptysis and pleuritic chest pain that are more appropriate for the immunocompromised patient.
And finally, one of these laboratory findings which identify fungi. Notice that any of the laboratory criteria for PNU2 can also be used for PNU3.
These are specimens that are acceptable for Pneumonia 2 and 3

Quantitative culture from minimally contaminated LRT specimen
  - Obtained with or without bronchoscope
    - Bronchoalveolar lavage (BAL)
    - Protected specimen brushing

Lung parenchyma
  - Open lung biopsy specimens
  - Immediate post-mortem specimens obtained by transthoracic or transbronchial biopsy
This is an example of a completed PNEU form for a PNU2 VAP event. This information can be entered into the NHSN Reporting application.
For each identified VAP, you can list up to 3 pathogens (in rank order of importance.) For each pathogen, complete information about antimicrobial susceptibilities. Only certain bug/drug combinations are required but up to 20 drugs can be listed with susceptibilities.
Using the denominator form that is appropriate for the location, at the same time each day, someone on the monitored unit records the number of patients and the number of patients on ventilators on that unit.
This is the denominator form that is used for collecting denominators for an ICU or other non-NICU/SCA location, showing the appropriate columns for recording patient days and patients using ventilators. The numbers are totaled at the end of the month and entered into the NHSN internet application.

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Record the number of patients and the number of patients on a ventilator each day.
Denominators in the NICU are collected by birthweight category – again, at the same time each day

# patients on ventilators and # patients (i.e., patient days)
This is the formula that is used to calculate the VAP rate for a given unit. In the NICU, this is calculated separately for each birthweight category.
The Device Utilization Ratio gives us a measure of how much ventilators are used on a given unit and there are DU ratios available in the NNIS/NHSN Report that you can use for comparison. The DU ratio is calculated by dividing the number of ventilator days by the number of patient days. There is no multiplier used for this.

\[
\text{Ventilator DU Ratio} = \frac{\# \text{ Ventilator Days}}{\# \text{ Patient Days}}
\]

DU Ratio measures the proportion of total patient-days in which ventilators were used.
This an example of VAP Analysis that was performed in NHSN. This is a VAP Rate Analysis for a specific time period of your choice. The analysis documents the units being monitored (click), the number of VAPs on the unit, the number of ventilator or device days, the calculated VAP rate for each unit, the NNIS/NHSN VAP pooled mean for comparison the Central Line Device Utilization Ratio for that unit and the NNIS/NHSN DU rate for comparison.
Questions?

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