Fundamentals of Healthcare Associated Infection Definitions

Robert Garcia, Infection Control Professional
A Webber Training Teleclass

Fundamentals of Healthcare Associated Infection Definitions (HAIs)

Robert Garcia, BS, MT(ASCP), CIC
Infection Control Professional

Hosted by Paul Webber
paul@webbertraining.com

www.webbertraining.com

- Robert Garcia has received educational grants in the past from the following groups:
  - Bard
  - Tri-State Hospital Supply
  - Sage Products
  - Johnson & Johnson
  - Covidian
  - Baxter Healthcare
  - Cardinal Health

Learning Objectives

1. Explain why applying uniform definitions are necessary
2. Describe a well-accepted central line-associated bacteremia (CLAB) definition and provide case scenarios
3. Describe a well-accepted ventilator-associated pneumonia (VAP) definition and provide case scenarios
4. Provide formulas that determine rates of infection

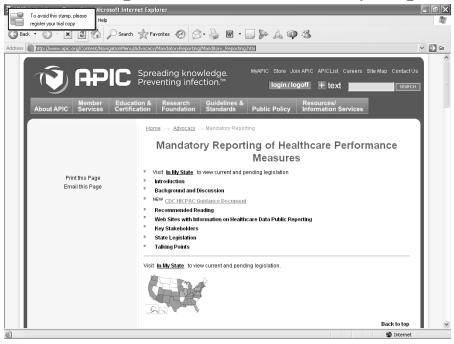
The Pressures to Determine Accurate Rates

Prime Issue: Reduce Mortality

- *Institute for Healthcare Improvement: 5,000,000 Lives Campaign*
- National initiative to reduce healthcare errors, infections, and associated death
- >3200 U.S. hospitals currently participating
- Addresses specific healthcare-acquired infections
  - CLAB
  - VAP
  - SSI
  - "bundle" approach = revision of system components based on scientific evidence of effectiveness

http://ihi.org/IHI/Programs/Campaign/Campaign.htm

The Local "Report Card": Mandatory Reporting



http://www.apic.org/Content/NavigationMenu/Advocacy/MandatoryReporting/Manditory_Reporting.htm

Hosted by Paul Webber paul@webbertraining.com
www.webbertraining.com

Fundamentals of Healthcare Associated Infection Definitions

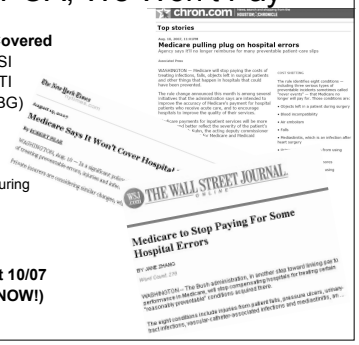
Robert Garcia, Infection Control Professional
A Webber Training Teleclass

New CMS Guidelines: If It's Not POA, We Won't Pay

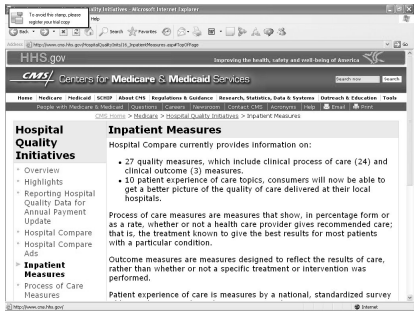
Conditions No Longer Covered

- Catheter-associated BSI
- Catheter-associated UTI
- Mediastinitis (after CABG)
- Pressure Ulcers
- Injury to patients
- "Never Events"
  - Objects left in body during surgery
  - Air embolisms
  - Blood incompatibility

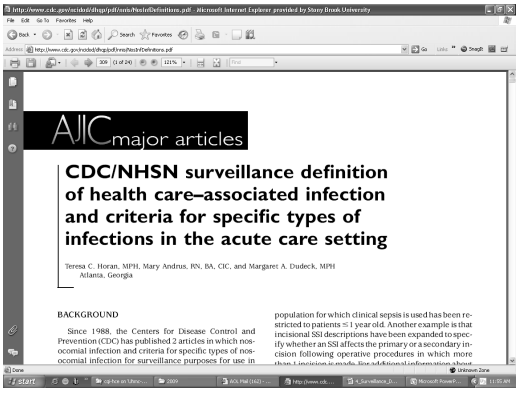
- **POA Tracking to start 10/07**
- **Non-payment 10/08 (NOW!)**



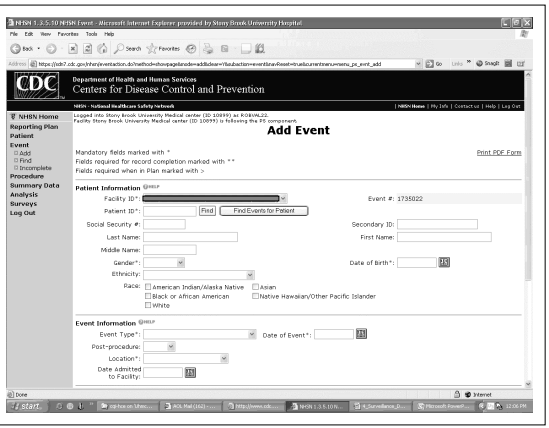
$ Reimbursement $



Reference: www.cms.hhs.gov



Available at http://www.cdc.gov/incidod/dhqp/pdf/nnis/NosInfDefinitions.pdf



Definitions Applying to Bloodstream Infection (BSI)

Laboratory-Confirmed BSI

LCBI must meet one of the following three criteria (Criterion 1 and 2 may be used for patients of any age including patients ≤1 year of age):

Criterion 1: Patient has a recognized pathogen from one or more blood cultures and organism cultured from blood is not related to an infection at another site.

Criterion 2: Patient has at least one of the following signs or symptoms: fever (>38°C), chills, or hypotension

and signs and symptoms and positive laboratory results are not related to an infection at another site

and common skin contaminant (i.e., diptheroids [corynebacterium spp.], *Bacillus* [not *B.anthracis*] spp. *Propionibacterium* spp., coagulase-negative staphylococci [including *S.epidermidis*], viridans group streptococci, *Aerococcus* spp., *Micrococcus* spp.) is cultured from two or more blood cultures drawn on separate occasions.

Fundamentals of Healthcare Associated Infection Definitions

Robert Garcia, Infection Control Professional
A Webber Training Teleclass

Laboratory-Confirmed BSI (cont'd)

Criterion 3: Patient ≤1 year of age has at least one of the following signs or symptoms: fever (>38°C, rectal), hypothermia (<37°C, rectal), apnea, or bradycardia

and signs and symptoms and positive laboratory results are not related to an infection at another site

and common skin contaminant (i.e., diptheroids [corynebacterium spp.], *Bacillus* [not *B.anthracis*] spp. *Propionibacterium* spp., coagulase-negative staphylococci [including *S.epidermidis*], viridans group streptococci, *Aerococcus* spp., *Micrococcus* spp.) is cultured from two or more blood cultures drawn on separate occasions.

LCBI Notes

- In criterion 1, the phrase "one or more blood cultures" means that at least one bottle from a blood draw is reported by the laboratory as having grown organisms (i.e., a positive blood culture) ***Note: a blood culture set usually is comprised of one aerobic and one anaerobic blood culture bottle.*
- In criterion 1, the term "recognized pathogen" does not include organisms considered common skin contaminants (see Criterion 2 and 3). A few of the recognized pathogens are *S.aureus, Enterococcus* spp., *E.coli, Pseudomonas* spp., *Klebsiella* spp., *Candida* spp., etc. ***Note: add Serratia* spp., *Acinetobacter* spp.

Surveillance Tip 1

- When conducting surveillance rounds, especially if performed with a team (e.g., IHI Rounds)
  - Review initial results on all BCs as reported by the Microbiology Lab *and* take immediate investigative action before the organism is definitively identified
  - E.g., patient has CL in MICU and after five days has a positive BC tentatively identified as "gram negative rods". This is the time to decide to order cultures from other sites, e.g., urine, (UTI?), sputum (pneumonia?), decubitus ulcers, other drainage, etc.

Surveillance Tip 2

- When a BC is initially reported as growing "gram positive cocci" it will most likely mean
  - Patient is growing *Staph aureus*, perhaps MRSA (a pathogen under Criterion 1), or
  - Patient is growing *Streptococcus* which could be Group D enterococci, i.e., *Enterococcus*, perhaps VRE (again a pathogen under Criterion 1), or
  - Patient is growing another *Staphylococcus sp.*, e.g., S. epidermidis, if which case Criterion 2 would have to be met in order for the event to be a CLAB.

Gram Positive Bacteria: Staphylococcus

	Description	Infections	Lab note
S. aureus	GP cocci in clusters	Abscess, pneumonia, osteomyelitis, bacteremia, endocarditis	May be reported as MRSA; Coagulase-positive
S. epidermidis	GP cocci in clusters; normal flora of ski n and mucous membranes	Prosthetic devices, indwelling catheters, sepsis, sepsis, meningitis, endocarditis	Coagulase-negative
S. haemolyticus, saprophyyticus	GP cocci in clusters	UTIs, urethritis, meningitis, endocarditis	Coagulase-negative

Gram Positive Bacteria: Streptococcus

	Description	Infections	Lab note
S. Pyogenes	GP cocci in chains or pairs	Pharyngitis, respiratory, ear infections, skin infections, soft tissue infection, abscesses, endocarditis, meningitis	Grp. A Strep
S. Agalactiae	GP cocci in chains or pairs; normal flora GI tract and female GU tract	Neonatal sepsis, meningitis, pneumonia, urinary and genital tarct infections, endocarditis, skin-soft tissue infections	Grp. B Strep
S. Dysgalactiae	GP cocci; normal skin flora, nasopharynx, GI and GU tracts	Bacteremia, endocarditis, septic arthritis, skin infections	Grp. C Strep
Enterococcus	GP cocci in pairs; normal GI and female genital tract flora	UTI, bloodstream, wound infections, endocarditis, intra-abdominal/pelvic wounds	Grp. D Strep E. Faecium E. Faecalis Either can be VRE

Fundamentals of Healthcare Associated Infection Definitions

Robert Garcia, Infection Control Professional
A Webber Training Teleclass

Surveillance Tip 2 (cont'd)

- Consider the following:
  - If BC positive for *Staph aureus ……order additional cultures from other sites*
  - If BC positive for *Enterococcus*, *……order additional cultures from other sites* (Don't wait for final species!)
  - If BC positive for *S*. epidermidis, *remember that other parts of Criterion 2 must be met for the case to be a CLAB.*

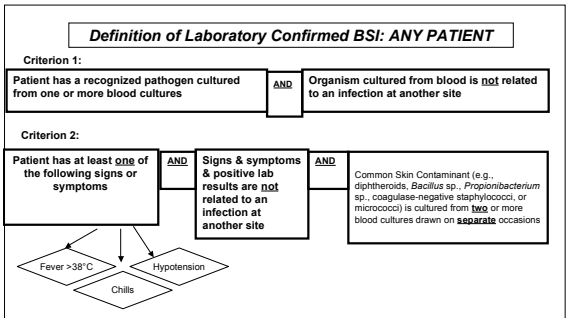
LCBI Notes (cont'd)

- In criterion 2 and 3, the phrase "two or more blood cultures drawn on separate occasions" means
  - (1) that blood drawn from at least two blood draws were collected within two days of each other (*bloods drawn Monday and Wednesday = good!; Monday and Thursday = bad!)* and
  - (2) that at least one bottle from each blood draw is reported by the laboratory as having grown the same common skin contaminant organism (for a pediatric draw it may consist of a single bottle due to volume constraints)

"Sameness of Organisms"

- If the common skin contaminant is identified to the species level from one culture, and a companion culture is identified with only a descriptive name (i.e., to the genus level), then it is assumed that the organisms are the same.

Culture	Companion Culture	Report as…
S.epidermidis	*Coagulase-negative staphylococci*	*S.epidermidis*
Bacillus spp. (not anthracis)	*B.cereus*	*B.cereus*
S.salivarius	*Strep viridens*	*S.salivarius*



Scenario #1

- 54 y/o male, DM, A-FIB, obese, complains chest pain
- Day 0: admit ER, RFM CL inserted
- Day 1: admit MICU, RFM removed, LIJ placed
- Day 5: T101.8, blood culture coag-neg Staph, cath tip coag-neg Staph, WBC 13.1
- *Is it a CLAB?*

Scenario #2

- 72 y/o male, MVA, broken ribs, leg injury, abdominal trauma
- Day 0: admit ER, transfer to OR, RSC inserted, abd surgery to repair liver laceration
- Day 1: admit SICU, urinary cath, chest tube
- Day 8: T102.2, WBC 14.3, RSC changed over guidewire, abdominal pain, CT scan shows abd abscess
- Day 10: blood culture reported as GPC in chains (final: *Enterococcus faecalis Grp D)*
- *Is it a CLAB?*

Fundamentals of Healthcare Associated Infection Definitions

Robert Garcia, Infection Control Professional

A Webber Training Teleclass

Gastrointestinal Infection Definition

Gastrointestinal tarct (espohagus, stomach, small and large bowel, and rectum) excluding gastroenteritis and appendicitis:

1. Patient has an abscess or other evidence of infection seen during a surgical operation or histopathologic examination.

2. Patient has at least two of the following signs or symptoms with no other recognized cause and compatible with infection of the organ or tissue involved: fever (>38°C), nausea, vomiting, abdominal pain, or tenderness
   - and at least one of the following:
   - Organisms cultured from drainage or tissue obtained during a surgical operation or endoscopy or from a surgically placed drain
   - Organisms seen on gram's or KOH stain or multinucleated giant cells seen on microscopic examination of drainage or tissue obtained during a surgical operation or endoscopy or from a surgically placed drain
   - Organisms cultured from blood
   - Evidence of pathologic findings on radiographic examination
   - Evidence of pathologic findings on endoscopic examination (e.g. *Candia* espohagitis or proctitis

Scenario #3

- 66 y/o female, DM, cellulitis, GI bleed
- Day 0: admit ER, PIV inserted
- Day 1: admit medical unit, PICC placed
- Day 5: Hypotension, resp failure, intubated, transferred to MICU
- Day 6: T99.5, WBC 12.1, blood culture *E.coli* ESBL+, line removed, cath tip *S.epi*
- Day 7: urine culture *E.coli ESBL+,* 100,000cfu

Is it a CLAB?

Urinary Tract Infection Definition

A symptomatic UTI must meet at least 1 of the following criteria:

- Patient has at least 1 of the following signs or symptoms with no other recognized cause: fever (>38°C), frequency, dysuria, or suprapubic tenderness *and*
  Patient has a positive urine culture that is ≥105 microorganisms per cc of urine with no more than 2 microorganisms

2. Patient has at least two of the following signs or symptoms with no other recognized cause: fever (>38°C), dysuria, or suprapubic tenderness *and*
   - and at least one of the following:
   - Positive dipstick for esterase and/or nitrate
   - Pyuria (≥10 WBC/mm 3 or ≥3 WBC/high-power field of unspun urine)
   - Organisms on gram stain of unspun urine
   - At least 2 urine cultures with isol. of same uropathogen
   - ≥10 5 colonies/ml of single uropathogen (GNR) in pt. being treated with an effective antimicrobial agent for UTI
   - Physician diagnosis of UTI
   - Physician institutes appropriate therapy for UTI

Scenario #4

- 49 y/o female, cervical CA, Hickman catheter inserted 3 mths prior to hospitalization, pain and weakness
- Day 0: admit ER, admit medical unit
- Day 6: Resp failure, intubated, transferred to MICU
- Day 7: T100.4, BP 100/55, bld cult coag-neg Staph (1/2 bottles)
- Day 8: bld cult neg
- Day 9: T100.8, WBC 12.7, blood culture *S.epi* (1/2 bottles)
- Day 11: bld cult *Staph haemoliticus*
- Day 11: bld cult *Staph haemoliticus*

Is it a CLAB?

Scenario #5

- 32 y/o male, ruptured appendix
- Day 0: admit ER, OR, abd surgery, admit SICU
- Day 5: T99.4
- Day 6: T101.2, BP 105/62, bld cult *K.pneumoniae*
- Day 7: T100.3, WBC 10.1
- Day 8: CXR no infiltrates, consolidation, or congestion
- Sputum culture *K.pneumoniae*

Is it a CLAB?

Pneumonia Definitions

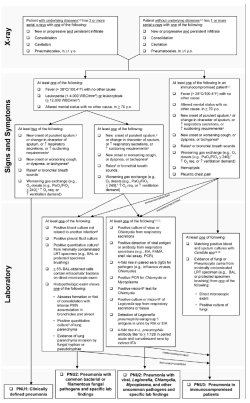
- HAP: Hospital-acquired pneumonia
  - Defined as pneumonia that occurs ≥48 hours after admission and was not incubating at the time of admission
- VAP: Ventilator-associated pneumonia
  - Defined as pneumonia that arises more than 48-72 hours after endotracheal intubation
- HCAP: Healthcare-associated pneumonia
  - Includes any patient who was hospitalized in an acute care hospital for two or more days within 90 days of the infection; resided in an extended-care facility; received recent IV antibiotics, chemotherapy or wound care within the past 30 days of the current infection; or attended a hospital or hemodialysis center

Torres A, et al. The new American Thoracic Society/Infectious Disease Society of North America guidelines for the management of hospital-acquired, ventilator-associated and healthcare-associated pneumonia: a current view and new complementary information. Curr Opin Crit Care. 2006 Oct;12(5):444-5

Fundamentals of Healthcare Associated Infection Definitions

Robert Garcia, Infection Control Professional
A Webber Training Teleclass

Definitions Applying to VAP



NHSN: Pneumonia 1

1. 2 or more serial X-rays with one of the following:
   - New or progressive and persistent infiltrate
   - Consolidation
   - Cavitation
   - Pneumoceles, in ≤1 y.o.
2. At least 1 of the following:
   - Fever (>38 C/100.4 F) with no other cause
   - Leukopenia (<4000 WBC/mm 3) or leukocyctosis (>12,000 WBC/mm 3)
   - Altered mental status
3. At least 1 of the following:
   - New onset of purulent sputum or change in character of sputum, or ↑ resp secretions, or ↑ suctioning requirements
   - New onset or worsening cough, or dyspnea, or tachypnea
   - Rales or bronchial breath sounds
   - Worsening gas exchange (e.g. O2 desats [e.g. PaO2/FiO2 ≤240] req. or increase ventilation demands

VAP Q&A

- Question I: If the patient is intubated pre-admission, how should we determine the VAP?
  - If the patient was symptom free at the time of the intubation by the paramedic or emergency department, and meets the CDC NHSN criteria/algorithm for VAP, it is a positive device-associated pneumonia. However, if the patient was intubated and received care at another hospital and subsequently transferred to your facility, then you need to apply the 48 hour rule. Only pneumonias appearing 48 hours post admission would be consider a VAP.

Questions and Answers are posted in response to questions asked by participants in a Quality Improvement Project In New York State. Ventilator Associated Pneumonia Prevention (VAPP) Project FAQs
http://jeny.ipro.org/showthread.php?t=2025

VAP Q&A

- Question II: If a VAP occurs within 48 hours of intubation, it is considered hospital-acquired?
  - Yes, the development of a VAP can occur within 48 hours of intubation.
- Question III: What is the minimum time frame?
  - There is no minimum period of time that the ventilator must be in place in order for the pneumonia to be ventilator-associated except for the transferred in example in question # 2.

VAP Q&A

- Question IV: Do we call it a VAP if the patient aspirated on intubation?
  - If the patient was symptom free and had obvious aspiration at the time of the intubation, it is a hospital-associated event. If the patient met VAP criteria, the answer is yes.
- Question V: What is the definition of a VAP?
  - It 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 pneumonia

Fundamentals of Healthcare Associated Infection Definitions

Robert Garcia, Infection Control Professional

A Webber Training Teleclass

VAP Q&A

- Question VI: I rarely have a VAP defined as a PNEU 2 or PNEU 3, what am I doing wrong?
  - You are not doing anything wrong. In general, the majority of VAPs identified through surveillance fall into PNU1. This is because most ventilator-associated pneumonias are clinically diagnoses without specific lab findings to confirm the exact etiology that would place them into the PNEU-2 category.
- Question VII: Why do we use PNU1, PNU2, and PNU3?
  - PNEU1 is the domain where all the "clinically" defined pneumonias are tracked. Clinically defined meaning the use of chest x-rays along with the patients signs and symptoms. PNEU2 tracks the pneumonias with specific lab confirmation (positive blood or pleural cultures, quantitative cultures, PCR, or antibodies, etc.) and PNEU 3 tracks the pneumonias in immunocompromised patients.

VAP Q&A

- Question VI: I rarely have a VAP defined as a PNEU 2 or PNEU 3, what am I doing wrong?
  - You are not doing anything wrong. In general, the majority of VAPs identified through surveillance fall into PNU1. This is because most ventilator-associated pneumonias are clinically diagnoses without specific lab findings to confirm the exact etiology that would place them into the PNEU-2 category.
- Question VII: Why do we use PNU1, PNU2, and PNU3?
  - PNEU1 is the domain where all the "clinically" defined pneumonias are tracked. Clinically defined meaning the use of chest x-rays along with the patients signs and symptoms. PNEU2 tracks the pneumonias with specific lab confirmation (positive blood or pleural cultures, quantitative cultures, PCR, or antibodies, etc.) and PNEU 3 tracks the pneumonias in immunocompromised patients.

VAP Q&A

- Question VIII: Regardless, is it correct that the first step is a chest x-ray finding?
  - Correct, you are looking for a new or progressive and persistent infiltrate, consolidation, cavitation or pneumatoceles in < 1 y.o. per chest x-rays. The other clarification comes with determining if the patient is with or without underlying disease. If the patient does not have underlying disease, one or more serial x-rays with one of the findings is enough. If the patient does have underlying disease, two or more serial x-rays with findings is necessary.

Note: underlying disease includes patients with pulmonary or cardiac disease (e.g., interstitial lung disease or congestive heart failure). Also, radiologists may report pneumonia as "air-space disease", "focal opacification", or "patchy areas of increased density"

VAP Case Scenarios

Patient is 62 y/o male, Hx bypass surgery, COPD, renal failure; admitted to MICU

Intubation Day	WBC	Temp	Sput	BP	CXR
-2	10.8	100.1	Scant	112/67	CT Scan: diffuse nodules across both lung fields with groundglass opacities, may be due to infectious process. Bronchi appear completely obstructed and may indicate bronchopneumonia
0	16.6	101.2	Thick	118/69	Endotracheal tube; diffuse airspace disease, increased infiltrates in rt. Lung base.
1	15.4	100.8	Thick	109/65	Diffuse patchy consolidations and nodules, congestion
3	14.6	101.3	Thick	114/83	Opacities of both lungs, no change
4	111.8	102.5	Thick	122/93	Ct scan: marked progression of groundglass opacities. Bronchopneumonia, new consolidation BL upper lobes and less extensive lower lobes, progression of bronchopneumonia vs. ARDS

VAP Case Scenarios

Patient is 67 y/o female, Hx emphysema, recent bypass surgery, diabetes; admitted to CICU

Intubation Day	WBC	Temp	Sput	BP	CXR
0	6.2	98.4	Thin	112/72	Endotracheal tube, Severe emphysema, no consolidation, effusion, or congestion
5	7.1	98.5	Thin	104/67	Severe emphysema unchanged
12	8.0	100.1	Clear	109/77	No consolidations, congestion, effusions
15	7.7	100.7	Thick	111/70	Trach; emphysema, lungs clear
20	5.4	101.2	Tan	109/71	Moderate congestion, edema
23	4.5	100.8	--	104/67	Bilateral infiltrates, no change
24	4.3	101.4	Tan	106/73	Bilateral infiltrates both lower lungs, RUL
26	4.2	100.8	Thick	111/65	Dense consolidation, RML. Both LL

VAP Case Scenarios

Patient is 48 y/o female, Hx HBP, renal disease, patient intubated 4 days prior at another facility, admitted to MICU

Intubation Day	WBC	Temp	Sput	BP	CXR
0	12.8	101.4	Clear	122/75	Endotracheal tube; left lower lobe nodule; no consolidation, effusion, or congestion
1	13.5	100.5	Thick	124/77	Congestion, RUL density
2	21.6	101.4	Thick	110/67	RUL and RML consolidation, LUL patchy density
3					Patient expires

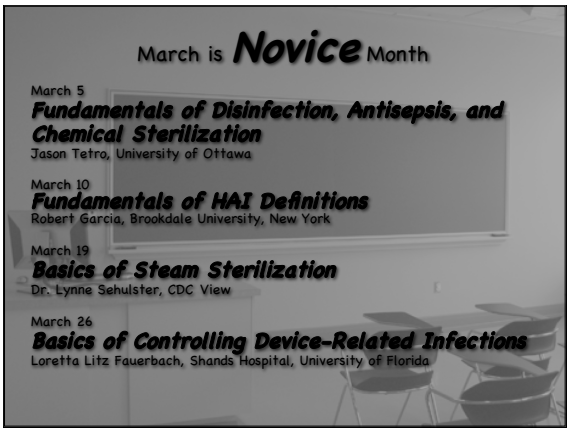
Fundamentals of Healthcare Associated Infection Definitions

Robert Garcia, Infection Control Professional

A Webber Training Teleclass

Thank you for listening. Questions?

Robert Garcia, BS, MT(ASCP), CIC
Infection Control Professional
P.O. Box 211, Valley Stream NY 11580
516.810.3093
rgarciaicp@aol.com



Hosted by Paul Webber paul@webbertraining.com
www.webbertraining.com