THE NATIONAL GUIDELINE ON INFECTION PREVENTION AND CONTROL

PART B
HEALTHCARE ASSOCIATED INFECTION PREVENTION AND SURVEILLANCE

MINISTRY OF HEALTH
REPUBLIC OF MALDIVES

World Health Organization
Maldives

GUIDELINE ON PREVENTION AND SURVEILLANCE OF HOSPITAL ASSOCIATED INFECTIONS

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1. PREVENTION OF HEALTHCARE ASSOCIATED INFECTION (HAI)

Healthcare associated Infections (HAIs)occur as a result of healthcare interventions and are one of the most common adverse events in care delivery. Based on data from a number of countries, it can be estimated that each year, hundreds of millions of patients around the world are affected by HAI. The burden of HAI is several folds higher in low- and middle-income countries than in high-income ones. At any one time, up to 7% of patients in developed and 10% in developing countries will acquire at least one HAI. HAIs prolong hospital stays, results in significant morbidity, increased mortality, and added health care cost high costs. HAI also increases the resistance of microorganisms to antimicrobials with some studies reporting more than 50% of surgical site infections to be antibiotic resistant.

HAI is a threat to patient safety. Establishment of effective Infection Prevention and Control (IPC) practices and HAI prevention is of high priority at both the facility and national levels. Effective IPC leads to more than 30% reduction in HAI rates. In some centers strong implementation of IPC practices resulted in reduction of CLABSI by 50%, SSI by 17% and MRSA rates by more than 50%.

Types of HAI

- Surgical site infection (SSI): This infection occurs at the site of surgical incision and may manifest as pain, redness and pus discharge from local site with fever.
- Catheter associated urinary tract infection (CAUTI): occurs after the urinary catheter is introduced in the patient.
- Ventilator associated pneumonia (VAP): occurs in patients who are intubated and are put on ventilator. This manifests as pneumonia with patch of consolidation in lungs.
- Central line associated blood stream infections (CLABSI): Also known as CRBSI: catheter related blood stream infections/ Catheter associated blood stream infection (CABSI) : This infection occurs in patients who have various kinds of lines inserted in their veins/arteries
- Other HAIs which may occur during an admission include;
    - Hospital acquired Pneumonia (HAP or nosocomial pneumonia)
    - Septicemia
    - Influenza virus infection and other respiratory viral infections acquired from other patients or health care staff
    - Acute gastroenteritis (e.g. norovirus associated diarrhea)

- C. difficile associated diarrhea
- Blood borne viral infections like Hepatitis B, HIV , hepatitis C

Resources:

WHO, 2018. Improving infection prevention and control at the health facility: Interim practical manual supporting implementation of the WHO Guidelines on Core Components of Infection Prevention and Control Programmes. (WHO/HIS/SDS/2018.10). Licence: CC BY-NC-SA 3. 0 IGO. Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps. who. int/iris.

https://www.who.int/infection-prevention/tools/core-components/facility-manual.pdf

World Health Organization. (2002). Prevention of hospital-acquired infections : a practical guide / editors : G. Ducel, J. Fabry and L. Nicolle, 2nd. ed. World Health Organization. https://apps.who.int/iris/handle/10665/67350

Centers for Disease Control and Prevention(CDC), 2019. Winnable battles final report: Healthcare Associated Infections.

https://www.cdc.gov/winnablebattles/report/docs/wb-hai.pdf

Allegranzi B., WHO (2018), The core components of infection prevention and control programs: from guidelines to implementation in real life. Link https://www.paho.org/hq/index.php?option=com_docman&view=download&category_slug=webinar-materias-presentations-9016&alias=46622-the-core-components-of-infection-prevention-and-control-programs-from-guidelines-to-implementation-september-2018&Itemid=270&lang=en)

1.1 PREVENTION OF CATHETER ASSOCIATED URINARY TRACT INFECTION (CAUTI)

Definition of indwelling urinary catheter:

A drainage tube that is inserted into the urinary bladder (includes neobladder) through the urethra, is left in place, and is connected to a collection system. Condom or straight in-and-out catheters are not included nor are nephrostomy tubes, ileoconduits, or suprapubic catheters unless a Foley catheter is also present. Indwelling urethral catheters that are used for intermittent or continuous irrigation are included in CAUTI surveillance.

https://www.cdc.gov/nhsn/PDFs/pscManual/7pscCAUTIcurrent.pdf

CDC 2009 CAUTI prevention guideline

1.1.1 Recommendations on CAUTI prevention

Table 1: Catheter Associated UTI (CAUTI) prevention

A Verification of need prior to insertion	B Insert urinary catheter using aseptic techniques	C Proper techniques for maintenance of urinary catheter
○ Minimize urinary catheter use and duration of use in all patients ○ Appropriate indications for indwelling urethral catheter use* ○ Avoid use of urinary catheters in patients and nursing home residents for management of incontinence**	○ Hand hygiene *(fig:1)* ○ Ensure that only properly trained persons who know the correct technique of aseptic catheter insertion and maintenance are given this responsibility ○ Catheter insertion kit with sterile gloves, drapes, cleaning supplies, sterile single used packed lubricant jelly, sterile urinary catheter attached to a drainage bag	○ Maintain a closed drainage system ○ Secure catheter to prevent irritation of the urethra ○ Maintain an unobstructed flow, maintain the drainage bag below the level of the floor ○ Perform hand hygiene before and after each contact ○ Provide individual labeled collection container at the bedside ○ Review urinary catheter necessity daily, remove catheter promptly when not needed

1.1.1.1 Verification of need prior to insertion and leave in place only as long as needed.

1.1.1.1.1*Examples of Appropriate Indications for Indwelling Urethral Catheter Use

- Patient has acute urinary retention or bladder outlet obstruction.
- Need for accurate measurements of urinary output in critically ill patients.
- Perioperative use for selected surgical procedures. Remove the catheter as soon as possible postoperatively, preferably within 24 hours, unless there are appropriate indications for continued use;
  - Patients undergoing urologic surgery or other surgery on contiguous structures of the genitourinary tract.
  - Anticipated prolonged duration of surgery (catheters inserted for this reason should be removed in PACU).
  - Patients anticipated to receive large-volume infusions or diuretics during surgery.
  - Need for intraoperative monitoring of urinary output.
  - To assist in healing of open sacral or perineal wounds in incontinent patients.
  - Patient requires prolonged immobilization (e.g., potentially unstable thoracic or lumbar spine, multiple traumatic injuries such as pelvic fractures).
  - To improve comfort for end of life care if needed.

1.1.1.1.2 **Examples of Inappropriate Uses of Indwelling Catheters

- As a substitute for nursing care of the patient or resident with incontinence (substitute with other means condom catheter).
- As a means of obtaining urine for culture or other diagnostic tests when the patient can voluntarily void.
- For prolonged postoperative duration without appropriate indications (e.g., structural repair of urethra or contiguous structures, prolonged effect of epidural anaesthesia, etc.).
- Consider using alternatives to indwelling urethral catheterization in selected patients when appropriate.
  - Consider using external catheters as an alternative to indwelling urethral catheters in cooperative male patients without urinary retention or bladder outlet obstruction.
  - Consider alternatives to chronic indwelling catheters, such as intermittent catheterization, in spinal cord injury patients.
  - Intermittent catheterization is preferable to indwelling urethral or suprapubic catheters in patients with bladder emptying dysfunction.

- Consider intermittent catheterization in children with myelomeningocele and neurogenic bladder to reduce the risk of urinary tract deterioration.
- Minimize urinary catheter use and duration of use in all patients, especially for those at higher risk for CA UTI or mortality from catheterization such as women, the elderly, and patients with impaired immunity

1.1.1.2 Insert urinary catheter using aseptic techniques

- Perform hand hygiene immediately before and after insertion or any manipulation of the catheter device or site.
- Ensure that only properly trained persons (e.g., hospital personnel, family members, or patients themselves) who know the correct technique of aseptic catheter insertion and maintenance are given this responsibility.
- In the hospital setting, insert urinary catheters using aseptic technique and sterile equipment.
  - Use sterile gloves, drape, sponges, an appropriate antiseptic or sterile solution for periurethral cleaning, and a single-use packet of lubricant jelly for insertion.
  - Routine use of antiseptic lubricants is not necessary.
  - Further research is needed on the use of antiseptic solutions vs. sterile water or saline for periurethral cleaning prior to catheter insertion.

Figure 1: Indwelling Urinary Catheter insertion using surgical Aseptic Non Touch Technique (ANTT)

1.1.1.3 Proper Techniques for Urinary Catheter Maintenance

- Following aseptic insertion of the urinary catheter, maintain a closed drainage system
  - If breaks in aseptic technique, disconnection, or leakage occur, replace the catheter and collecting system using aseptic technique and sterile equipment.
- Maintain unobstructed urine flow.
  - Keep the catheter and collecting tube free from kinking.
  - Secure catheter to prevent irritation of the urethra
  - Keep the collecting bag below the level of the bladder at all times. Do not rest the bag on the floor.
  - Empty the collecting bag regularly using a separate, clean collecting container for each patient; avoid splashing, and prevent contact of the drainage spigot with the nonsterile collecting container.
- Use Standard Precautions, including the use of gloves and gown as appropriate, during any manipulation of the catheter or collecting system.
- Changing indwelling catheters or drainage bags at routine, fixed intervals is not recommended. Rather, it is suggested to change catheters and drainage bags based on clinical indications such as infection, obstruction, or when the closed system is compromised.
- Unless clinical indications exist (e.g., in patients with bacteriuria upon catheter removal post urologic surgery), do not use systemic antimicrobials routinely to prevent CAUTI in patients requiring either short or long-term catheterization.
- Do not clean the periurethral area with antiseptics to prevent CAUTI while the catheter is in place. Routine hygiene (e.g., cleansing of the meatal surface during daily bathing or showering) is appropriate.
- Unless obstruction is anticipated (e.g., as might occur with bleeding after prostatic or bladder surgery) bladder irrigation is not recommended.
- Clamping indwelling catheters prior to removal is not necessary.
- Specimen Collection
  - Obtain urine samples aseptically.
    - If a small volume of fresh urine is needed for examination (i.e., urinalysis or culture), aspirate the urine from the needleless sampling port with a sterile syringe/cannula adapter after cleansing the port with a disinfectant.
    - Obtain large volumes of urine for special analyses (not culture) aseptically from the drainage bag.

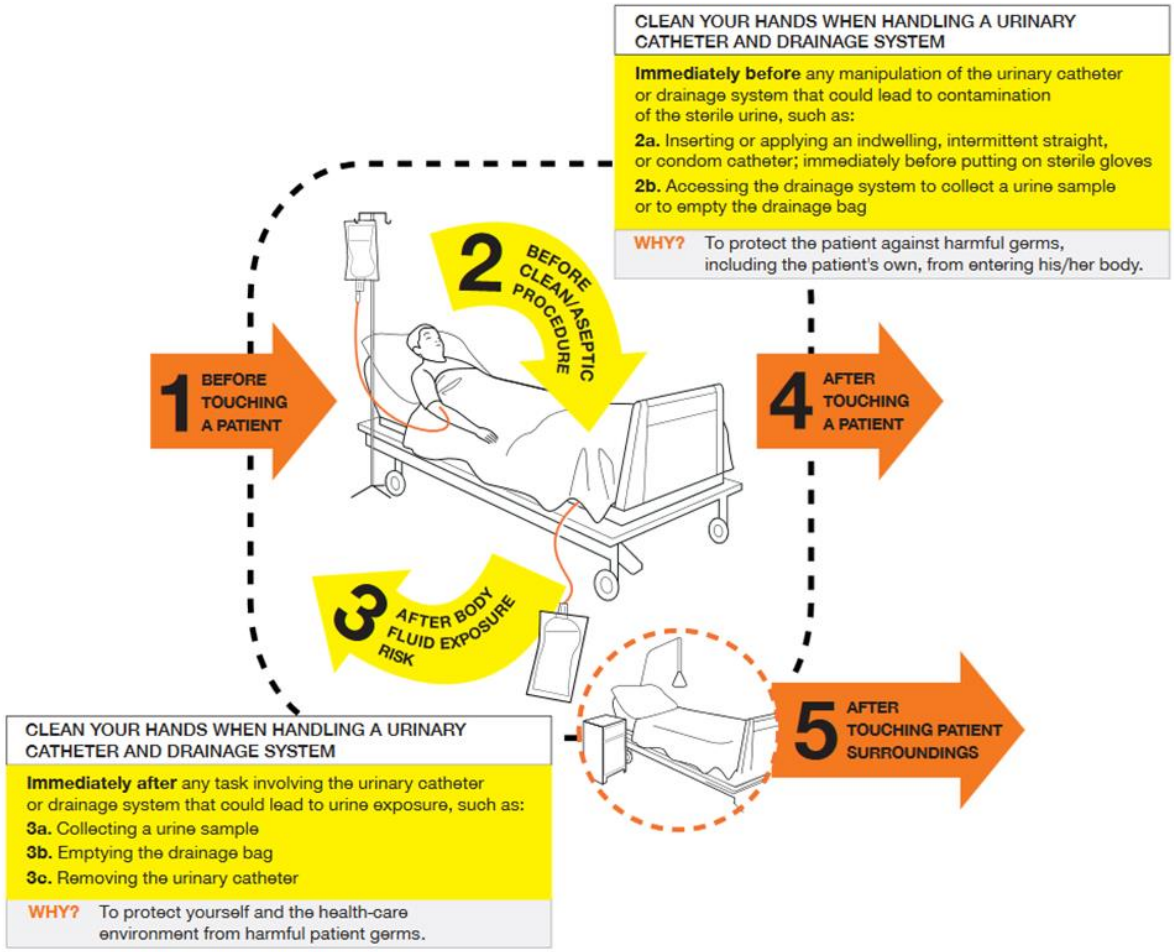


Figure 2: My 5 Moments for Hand Hygiene – Focus on caring for a patient with a urinary catheter

Key considerations
• Make sure that there is an appropriate indication for the indwelling urinary catheter. • Use a closed urinary drainage system, and keep it closed. • Insert the catheter aseptically using sterile gloves. • Assess the patient at least daily to determine whether the catheter is still necessary. • Patients with indwelling urinary catheters do not need antibiotics (including for asymptomatic bacteriuria), unless they have a documented infection

1.1.1.4 Role of Quality Improvement Programs in preventing CAUTI

Implement quality improvement (QI) programs or strategies to enhance appropriate use of indwelling catheters and to reduce the risk of CAUTI based on a facility risk assessment.

1.1.1.4.1 The purposes of QI programs should be:

- to assure appropriate utilization of catheters
- to identify and remove catheters that are no longer needed (e.g., daily review of their continued need) and
- to ensure adherence to hand hygiene and proper care of catheters

1.1.1.4.2 System of documentation

Consider implementing a system for documenting the following in the patient record: indications for catheter insertion,

- Date and time of catheter insertion,
- Individual who inserted catheter,
- Date and time of catheter removal.

Ensuring that documentation is accessible in the patient record and recorded in a standard format for data collection and quality improvement purposes is suggested.

Resources:

WHO (2009). Infection Prevention and Control; Hand Hygiene training tools. https://www.who.int/teams/integrated-health-services/infection-prevention-control/hand-hygiene/training-tools

Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of Healthcare Quality Promotion (DHQP). Last reviewed 2015. Guideline for Prevention of Catheter-Associated Urinary Tract Infections (2009). https://www.cdc.gov/infectioncontrol/guidelines/cauti/index.html

Association for Safe Aseptic Practice (ASAP). ANTT Procedure Guidelines https://www.antt.org/antt-procedure-guidelines.html

1.2 PREVENTION OF CENTRAL LINE ASSOCIATED BLOOD STREAM INFECTIONS (CLABSI)

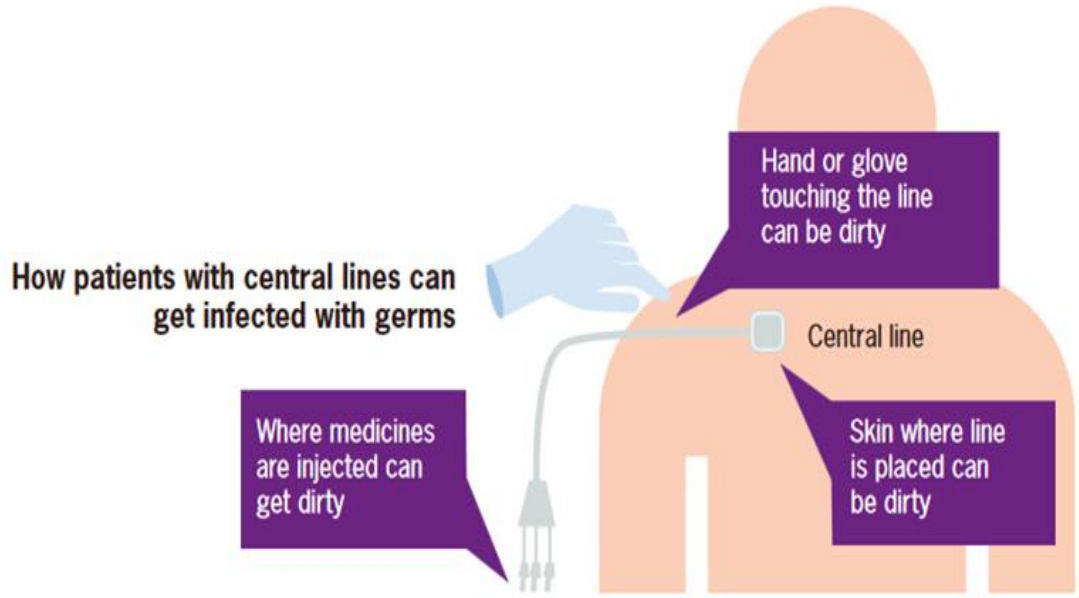
Central venous catheters (CVCs) have now become indispensable in intensive care units and are amongst the most frequently performed invasive procedures.

Central line (CL) is defined as: An intravascular catheter that terminates at or close to the heart, OR in one of the great vessels that issued for infusion, withdrawal of blood, or hemodynamic monitoring. Consider the following great vessels when making determinations about CLABSI events and counting CL device days:

- Aorta
- Pulmonary artery
- Superior vena cava
- Inferior vena cava
- Brachiocephalic veins
- Internal jugular veins
- Subclavian veins
- External iliac veins
- Common iliac veins
- Femoral veins
- In neonates the umbilical artery/vein.

Factors associated with increased risk of CLABSI

- Prolonged hospitalization before catheterization
- Prolonged duration of catheterization
- Heavy microbial colonization at the insertion site
- Heavy microbial colonization of the catheter hub
- Internal jugular catheterization
- Femoral catheterization in adults
- Neutropenia
- Prematurity (ie, early gestational age)
- Reduced nurse-to-patient ratio in the ICU
- Total parenteral nutrition
- Substandard cathetercare (eg, excessive manipulation of the catheter)
- Transfusion of blood products (in children)



1.2.1 Recommendations for prevention of CLABSI

A Before Insertion	B At insertion	C After insertion
• Minimize CVC use and duration of use in all patients • Appropriate indications for CVC insertion • Education of healthcare personnel involved in insertion, care, and maintenance of CVCs about CLABSI prevention • Bathe ICU patients over 2 months of age with a chlorhexidine preparation (2%-4% Chlorhexidine) on a daily basis.	• Ensure and document adherence to aseptic technique • Perform hand hygiene prior to catheter insertion or manipulation (Fig--) • Avoid using the femoral vein for central venous access in adult patients • Use an all-inclusive catheter cart or kit • Use ultrasound guidance for central catheter insertion (if available) • Use maximum sterile barrier precautions during CVC insertion • A mask, cap, sterile gown, and sterile gloves are to be worn by all healthcare personnel involved in the catheter insertion procedure • Use an alcoholic chlorhexidine antiseptic for skin preparation • Before catheter insertion, apply an alcoholic chlorhexidine solution containing (2% CHG containing solutions)	After insertion • Ensure appropriate nurse-to-patient ratio (recommended 1:2) • Disinfect catheter hubs, needleless connectors, and injection ports before accessing the catheter with by vigorously apply mechanical friction with an alcoholic chlorhexidine preparation, 70% alcohol, or povidone-iodine. Alcoholic chlorhexidine may have additional residual activity compared with alcohol for this purpose. • Remove nonessential catheters • For non-tunneled CVCs in adults and children, change transparent dressings and perform site care with a chlorhexidine-based antiseptic every 5–7 days or immediately if the dressing is soiled, loose, or damp; change gauze dressings every 2 days or

	• The antiseptic solution must be allowed to dry before making the skin puncture. • Place a sterile gauze dressing or a sterile, transparent, semipermeable dressing over the insertion site.	earlier if the dressing is soiled, loose, or damp • Replace administration sets not used for blood, blood products, or lipids at intervals not longer than 96 hours. • Change administrations sets for continuous infusions no more frequently than every 4 days, but at least every 7 days. • If blood or blood products or fat emulsions are administered change tubing every 24 hours. • If propofol is administered, change tubing every 6-12 hours or when the vial is changed • Use antimicrobial ointments for hemodialysis catheter-insertion sites. Polysporin "triple" (where available) or povidone-iodine ointment should be applied to hemodialysis catheter insertion if compatible with the catheter material. Mupirocin ointment should not be used due to the risks of facilitating mupirocin resistance and the potential damage to polyurethane catheters

CHG- Chlohexidine Gluconate

1.2.1.1 Before insertion of an a central venous catheter (CVC) consider;

(NHMR n CDC)

- Carefully consider the need for vascular access and consider the need for central vs peripheral vascular access
- Take in to account which device would poses the lowest risk to the patient
- Assess the physical status and vascular access history of the patient
- Assess type and duration of therapy required
- Use a CVC with the minimum number of ports or lumens essential for the management of the patient.
- Do not lose sight of the patient as the focus for your decision

- Use a fistula or graft in patients with chronic renal failure instead of a central venous cathether for permanent access for dialysis.
- Importance of removing the central line when it is no longer needed or a safer alternative can be used.
- Ensure clear documentation of all key events in the clinical record

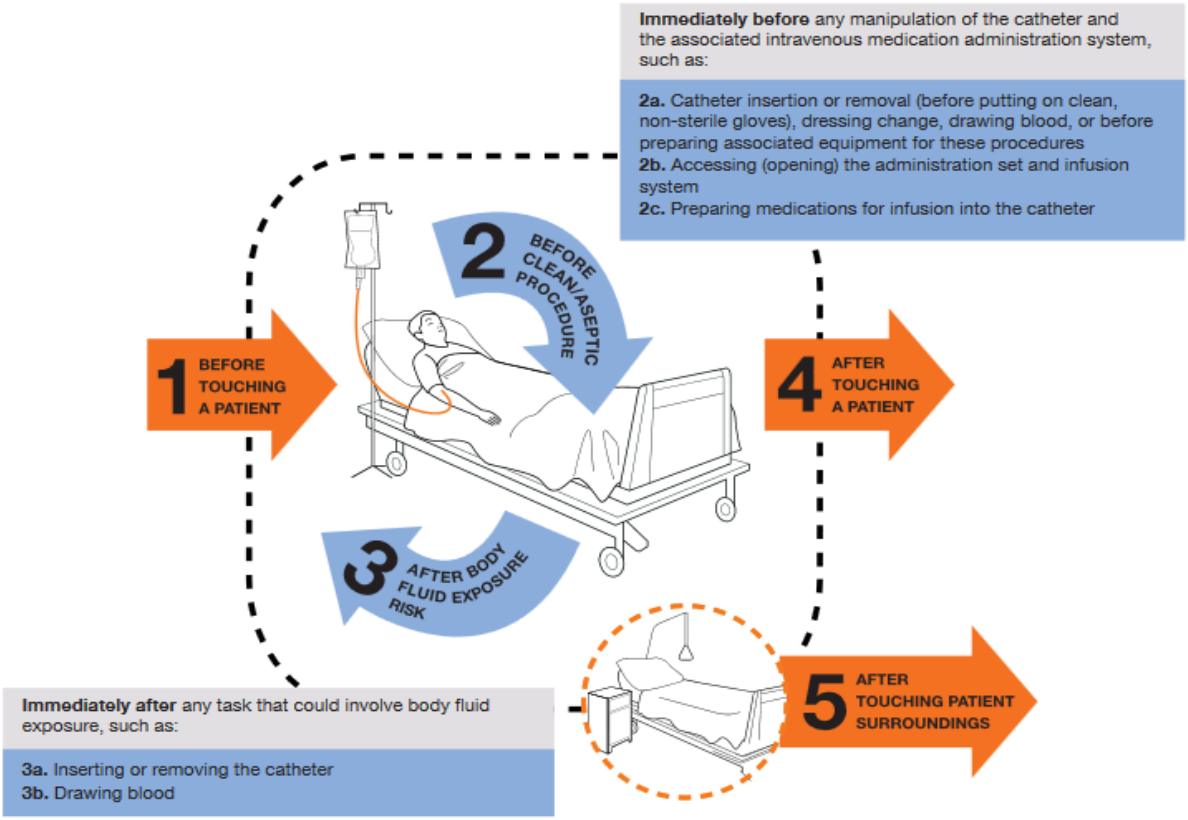
1.2.1.2 At the time of insertion and after insertion of central line

https://www.cdc.gov/infectioncontrol/guidelines/bsi/index.html#rec2

- Do not use antimicrobial prophylaxis for short-term or tunneled catheter insertion or while catheters are in situ. Systemic antimicrobial prophylaxis is not recommended.
- In case of chlorhexidine allergy use 5% alcohol-based povidone-iodine solution or 10% aqueous povidone-iodine if insertion is through or close to mucous membranes
- When central line is inserted in situations where adherence to aseptic technique cannot be ensured (i.e., catheters inserted during a medical emergency), replace the catheter as soon as possible, i.e., within 48 hours.
- Monitor the catheter sites visually when changing the dressing or by palpation through an intact dressing on a regular basis, depending on the clinical situation of the individual patient. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or bloodstream infection, the dressing should be removed and a thorough examination of the site undertaken to rule out infection.
- Do not routinely replace central venous catheters
- unless evidence of infection is present
- Use clinical judgment regarding the appropriateness of removing the catheter if infection is evidenced elsewhere or if a noninfectious cause of fever is suspected.

Hand hygiene to minimize CLABSI (CDC)
Before donning gloves
Before palpating the site for catheter insertion
After palpating the site for catheter insertion
Before insertion of the catheter
After insertion of the catheter
Before accessing, replacing, repairing, or dressing the catheter
After accessing, replacing, repairing, or dressing the catheter
After removing gloves

5 moments for hand hygiene for a patient with a peripheral venous catheter



WHO (2015), 5 moments of Hand Hygiene. Focus on caring for a patient with a peripheral venous catheter

Figure 3: 5 moments of hand hygeine for patient with peripheral venous catheter

https://www.who.int/gpsc/5may/HH15_PeripheralCatheter_WEB_EN.pdf

Key additional considerations for peripheral intravenous catheter
1. Indication: Ensure that a peripheral venous catheter is indicated. Remove the catheter when no longer necessary/clinically indicated. 2. Insertion/maintenance/removal a. Prepare clean skin with an antiseptic (70% alcohol, tincture of iodine, an iodophor, or alcohol-based 2% chlorhexidine gluconate) before catheter insertion. b. Wear clean, non-sterile gloves and apply an aseptic procedure (with non-touch technique) for catheter insertion, removal, and blood sampling. c. Replace any dry gauze-type dressings every 2 days. d. Consider scheduled catheter change every 96 hours (peripheral lines only) e. Change tubing used to administer blood, blood products, chemotherapy, and fat emulsions within 24 hours of infusion start. Consider changing all other tubing every 96 hours. 3. Monitoring: Record time and date of catheter insertion, removal and dressing change, and condition (visual appearance) of catheter site every day (NOTE FOR CVC NO SCHEDULE CATHETER REMOVAL, BUT CHANGE WHEN CLEAR INDICATION IS PRESENT)

1.2.2 CLABSI diagnosis

Central line in place > 2 days or removed within prior 24 hours

Fever, chills, or hypotension with **no other likely source** of infection (look for pulmonary, abdominal, urinary tract, bone/joint, or skin/soft tissue infection sites)
May have erythema, pain, swelling, or purulence at the central line insertion site: highly specific 94-99% but less sensitive <5%, maybe seen in only 20% of cases ref

PLEASE ALERT LAB write suspected CLABSI/CRBSI:

- Write site and time of collection
- Send 2 blood cultures one from peripheral and one central line sample. If unable to obtain peripheral take at least ≥ 2 samples from different lumens of the catheter (cultures from all sites should be drawn within 15 minutes)

Diagnosis of CLABSI (IDSA 2009):
Same organism recovered from central and percutaneous sample with no other source and;

- Growth detected in the central line sample **2 hours before** the peripheral sample (DTP= Differential Time to Positivity)
- Quantitative cultures with a ≥3:1 ratio central line versus peripheral blood culture
- Catheter tip culture growth of >15 colonies of the same organsim compared to the peripheral culture

Note: Central line maybe colonized by skin contaminants and every effort should be made to get a peripheral/percutaneous blood

Clinical unstable start Presumptive antibiotics for most likely organism & susceptibility pattern

To diagnose a true BSI need:

- ≥ 1 blood culture positive for *S. aureus,* enterococci, Enterobacteriaceae (eg, *Escherichia coli*, *Klebsiella* species, *Enterobacter* species), *Pseudomonas aeruginosa, Acinetobacter baumanii.*, *Candida* species, *Bacillus* species
- ≥ 2 positive cultures positive for coagulase-negative staphylococci or other common commensals (like *Corynebacterium* species)

Make every effort to remove catheter once CLABSI is diagnosed or if high clinical suspicion present

Duration of treatment with **no** secondary complications

- *Staphylococcus aureus*: 14 days (do echo)
- Coagulase-negative staphylococci: 7 days
- Enterococci and Gram-negative bacilli: 10 to 14 days
- *Candida*: 14 days (do optha exam)

Secondary complications (treat for 4-6 weeks)

- Endocarditis (Staphycococccus aureus, enterococcus, gram negative bacilli and candida). Retinitis: Ophtha exam for candidia sepsis; Other: Osteomyelitis

Suspected infusate contamination: (eg, clinical signs of sepsis that start abruptly after catheter infusion), the infusate should be sent for culture. **PLEASE ALERT LAB**. Cultures should be obtained from the catheter after removal of the old needleless connector (which was protected with an antiseptic barrier cap) or through a new connector after the old connector is discarded.
DTP= Differential time to positivity done by taking same volume of blood from central and peripheral sites and comparing the time it takes to detect a growth in the cultures
BSI=blood stream infection; CRBSI=catheter related blood stream infection;
Ref: CDC https://www.cdc.gov/antibiotic-use/core-elements/collecting-cultures.html and IDSA 2009 CLABSI guideline

National Healthcare Safety Network (NHSN). Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central Line Associated Bloodstream Infection) https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf)

WHO (2009). Infection Prevention and Control; Hand Hygiene training tools. https://www.who.int/teams/integrated-health-services/infection-prevention-control/hand-hygiene/training-tools

Mermel LA, Allon M, Bouza E, et al. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 update by the Infectious Diseases Society of America, Clin Infect Dis, 2009, vol. 49 (pg. 1-45) https://academic.oup.com/cid/article/49/1/1/369414?login=true

WHO (2009). Infection Prevention and Control; Hand Hygiene training tools. https://www.who.int/teams/integrated-health-services/infection-prevention-control/hand-hygiene/training-tools

1.3 PREVENTION OF VENTILATOR ASSOCIATED PNEUMONIA (VAP)

Ventilator Associated Pneumonia (VAP) is defined by the United States Centers for Disease Control and Prevention as pneumonia occurring 48 h after the initiation of mechanical ventilation, VAP is associated with increased rates of multidrug-resistant infections, increased antibiotic use, prolonged mechanical ventilation time, increased ICU length of stay, and increased hospital length of stay

VAP occurs when bacteria are introduced into the normally sterile lower respiratory tract and overwhelm the host defence mechanisms. Disease causing bacteria enter the lower airways through endogenous or exogenous sources. The endogenous source includes aspiration of the bacteria colonising the upper airways or surrounding gastrointestinal tract while exogenous source includes bacteria colonising or forming biofilm on the endotracheal tube (ET) tube or the ventilator circuit.

Risk factor

- Patient related factors
- Age
- Burns
- Coma
- Lung disease
- Immunosuppression
- Malnutrition
- Blunt trauma

Intervention related

- Invasive ventilation
- Duration of invasive ventilation
- Reintubation
- Medication
- Prior antiobiotic treatment
- Sedation

1.3.1 Ventilator Associated Pneumonia (VAP) bundle

https://www.wfsahq.org/components/com_virtual_library/media/5e63c8f14e8a46c186bb0f73eafa2950-atow-382-00-01.pdf

Preventive aim	Preventive measure
Reducing aspiration	• Nurse in a semi recumbent position (30-45 degrees) • Maintain tracheal tube cuff pressure > 20 cm H2O • Subglottic tube insertion for patients requiring mechanical ventilation >72 hours • Avoid unnecessary endotracheal tube changes
Optimising the patient's microbial ecology	• Stop stress ulcer prophylaxis in low-risk patients • Basic oral hygiene • Infection control (eg, hand hygiene, PPE and disinfection of respiratory equipments adequately) • Avoid unnecessary circuit changes
Minimizing the duration of mechanical ventilation	• Daily sedation breaks • Daily assessment for extubation
Optimising unit microbial ecology	• Monitor VAP rates • Local input from Microbiology regarding antimicrobial selection and antimicrobial resistance patterns

1.3.2 Strategies to reduce VAP

- Avoid endotracheal intubation if possible by using noninvasive positive ventilation whenever feasible
- Use of oral, rather than nasal, endotracheal tubes
- Minimize the duration of mechanical ventilation
- Encourage early mobilization
- Draining of ventilator tubing should be placed downwards and away from the patient.
- Ventilator circuits are to be when visibly soiled or malfunctioning
- Nebuliser sets should be attached to the dry circuit of the ventilator humidifier for all patients regardless of whether a nebuliser is required or not.
- Store and disinfect respiratory equipment effectively

1.3.2.1 Suction practices:

Secretions can become contaminated and must be eliminated where possible by following the practices as given below:

- Appropriate size suction catheters should be used for each patient.
- Appropriate hand hygiene should be performed before suctioning (moment 2) and after suctioning (moment 3)
- Suction catheters are single use only.
- Suction catheters should only be opened just prior to use to prevent cross contamination.
- Yankeur suction tubes are to be replaced after each use.
- Water galipots for flushing suction tubing should be discarded after each use.
- Sterile water bottles to be replaced every 24 hours or if contaminated.
- Suction containers should be changed every 24 hours or sooner if required.
- Suction baskets are to be washed in between patient use or if visibly soiled.
- Naso and oropharyngeal secretions should be removed in intubated patients and the mouth should always be suctioned prior to nasal suctioning

1.3.2.2 Ventilator circuits and machinery

- Maintain a closed ventilation circuit where possible
- Ventilator circuits are changed as needed when visibly soiled or if malfunctioning, rather than on fixed schedule.
- Ventilator tubing should be discarded post extubation
- Should a patient require re-intubation new ventilator tubing should be used to minimize cross contamination
- All nebulisers sets are connected to the dry side of the humidifier for each patient. This will minimize disconnection from the ventilator in the event that a nebuliser must be administered. Nebulisers are for single patient use only.
- Ventilator equipment must be cleaned as per hospital policy, upon each patient discharge and if visibly soiled.
- Water for humidification should be in date and must be replenished if depleted.
- Heated humidification must be provided for all invasively ventilated patients.
- Ventilator filter must be changed every 24 hours

1.3.2.3 Oral care

Develop and implement a comprehensive oral hygiene program fo r patients in critical care an d acute care settings who are at high risk for ventilator-associated pneumonia (VAP).

- Hand hygiene prior to oral hygiene(moment 2) and after carrying out oral hygiene (moment 3)
- Brush teeth, gums and tongue at least twice a day using a soft pediatric or adult toothbrush.
- Provide oral moisturizing to oral mucosa and lip s every 2 to 4 hours
- Use an oral chlorhexidine gluconate (0.12%) rinse twice a day during the periop erative pe riod for adult patients who undergo cardiac surgery.
- Teeth must be brushed for a minimum of 2 minutes where the child's condition allows.
- Ensure that the tongue is brushed gently.
- Suction out any excess toothpaste but do not rinse.
- Rinse toothbrush after use and allow to air dry.
- Store the toothbrush in a designated container for each patient.
- Sterile water and gauze is to be used for infants who do not have any teeth present every 2 hours.

Resources:

American Association of Critical Care Nursing. Event planning Oral care in patients with risk of VAP https://www.aacn.org/docs/EventPlanning/WB0011/oral-care-patients-at-risk-vap-r44spvmp.pdf

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1.4 SURGICAL SITE INFECTION (SSI)

Surgical site infections (SSIs) are often the result of contamination during surgery or surgical wound after the procedure. Microorganism causing SSI may occur from endogenous (derived from patients own flora such as the organisms present on the skin) or exogenous infections (organisms from instruments or the operating environment).

Factors associated with increased risk of SSI

- Procedures that increased risk of endogenous contamination
  - Like those that involve parts of the body with a high concentration of normal flora such as the bowel
- Procedures that increase the risk of exogenous contamination
  - Suh as prolonged operations that increase the length of time that tissues are exposed
- Associated factors that diminish the efficacy of the immune response:
  - General immune response: diabetes, malnutrition, or immunosuppressive therapy with radiotherapy, chemotherapy or steroids
  - Local immune response; foreign bodies, damaged tissue or formation of a haematoma.

Wound Classification

Surgical Wound Classification Grade (I-IV) as defined by CDC	
Class I Clean	An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow nonpenetrating (blunt) trauma should be included in this category if they meet the criteria.
Class II Clean-contaminated	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.
Class III Contaminated	Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation is encountered are included in this category.
Class IV Dirty-infected	Old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

1.4.1 Prevention of SSI

To prevent infection as a result of surgery, the following broad areas need to be considered:

- Environmental controls during surgery
- Peri-operative measures (pre-, intra and postoperative)- SSI bundle

1.4.1.1 Environmental controls (LIBERIA)

1.4.1.1.1 Infrastructural prerequisites

- Ensure that ceilings in operating theatres are smooth, washable, and made of a solid surface free from cracks and crevices;
- Seal all ceiling-mounted lights or fixtures;
- Ensure that walls are water-impermeable, cleanable and resistant to cracks;
- Keep floors smooth, slip resistant and robust enough to withstand frequent washings and harsh cleaning/ scrubbing.

1.4.1.1.2 Ventilation and temperature controls

- Maintain good ventilation. Ideally air should flow from the most to least clean areas (positive pressure differential – air flowing from operating theatre to corridor with ≥15 ACH);
- Introduce air at the ceiling and exhaust near the floor;
- If the operating theatre is not equipped with a positive pressure system, focus on less expensive strategies, such as:
  - Keeping doors and windows closed. If this is not possible, ensure they are covered with insect proof netting;
  - Keeping personnel to a minimum during a procedure and restrict personnel once the operation has started (unless it is absolutely essential);
  - Absolutely minimizing talking, moving, and opening and closing of doors;
- Keep the temperature of the operating theatre between 20°C – 23°C (68°F – 75°F] and if feasible, general humidity levels at 30-60%.

1.4.1.1.3 Cleaning

- All theatres should be cleaned at the start and end of each day, as well as between patients/cases (ref to OT cleaning procedures in section 3)
- Always keep operating theatres clean, dry and dust free;

- Avoid unnecessary clutter to aid cleaning. The theatre should be free of all items other than the equipment necessary to perform the surgical procedures;
- Do not clean any instrument in the operating theatre after an operation but rather send to the designated decontamination area.

1.4.1.2 Peri-operative measures (pre-, intra and postoperative)- SSI prevention bundle

1. Antimicrobial prophylaxis
2. Pre-Operative skin antisepsis
3. Peri-operative Skin antisepsis
4. Peri-operative safety check list (WHO safety check list)
5. Normothermia
6. Glucose control
7. Additional strategies to prevent SSI

<table>
<tr><th colspan="2">1. Antimicrobial prophylaxis*</th></tr>
<tr><td colspan="2">• Prophylactic antibiotic agents based on the patient's Body Mass Index (BMI) or the patient's weight in kilograms.
• Ensure that antibiotics are dosed (within one hour) prior to incision (or within two hours if administering vancomycin or fluoroquinolones) and
• re-dosed appropriately in surgeries lasting longer than 4 hours</td></tr>
<tr><th>2. Pre-Operative skin antisepsis</th><th>3. Peri-operative Skin antisepsis</th></tr>
<tr><td>Develop a pre-operative skin antisepsis protocol for surgical patients that includes patient bathing or showering with soap or antiseptic agent prior to surgery
• Before surgery, patients should shower or bathe (full body) with soap (antimicrobial or non-antimicrobial) or an antiseptic agent on at least the night before the operative day
• Joint replacements such as hip, knee or shoulder to bathe or shower with Chlorhexidine Gluconate (CHG) soap for three days pre-operatively
• CHG need to be on skin 5min before rinsing
• Applying lotions and deodorants after cleansing will reduce the benefits of the antiseptic residue.</td><td>• The most effective antiseptic to combine with alcohol has not been determined.
• 2% CHG is the preferred agent and method for peri-operative skin antiseptis , and povidone iodine as alternative when CHG is contraindicated
• CHG may have advantages over povidone-iodine, increased amount of CHG on the skin leads to enhanced activity, longer residual activity and activity in the presence of blood or serum.</td></tr>
<tr><th>4. Peri-operative safety check list</th><th>5. Normothermia</th></tr>
<tr><td>Adapting practices that decrease errors and adverse events, and increase teamwork and communication in surgery (WHO)
• Before induction
• Before skin incision
• Before patient leaves operating room</td><td>• Room temperature, anesthesia, intravenous and irrigation fluids, anxiety and skin exposure can cause patients to become clinically hypothermic during surgery
• Patient should be warmed for a minimum of 15 minutes prior to the induction of anesthesia</td></tr>
</table>

6. Glucose control	7. Supplement oxygen
• Maintenance of blood glucose level less than 200mg/dl in diabetic and non-diabetic patients	• Perioperative supplemental oxygen lowers risk of SSI. 80% fraction of oxygen intraoperatively and, if feasible immediate post operative period of 2 to 6 hours.
8. Additional strategies to prevent SSI	
• Surgical hand hygiene (ABHR or antiseptic soap) • Appropriate PPE • Double gloves in circumstances where risk gloves perforation is high like in (prosthetic surgery)	

1.4.1.2.1 Surgical antimicrobial prophylaxis

Follow the national surgical antimicrobial guideline for the indication, agent and duration of surgical prophylaxis

General comments:

Prophylactic antibiotic agents based on the patient's Body Mass Index (BMI) or the patient's weight in kilograms. Example of dosing of cefazolin:

BMI <30 (or <120 kg) should receive 2 grams of a Cefazolin

BMI ≥30 (or ≥120 kg) should receive 3 grams

Choice of drug

- A single dose of antibiotic with a long enough half-life to achieve activity throughout the operation is recommended.
- Usually, a single first-generation cephalosporin for operations not expected to encounter anaerobes or a single second-generation cephalosporin with anaerobic operations based on local susceptibility patterns is sufficient.
- For clean operations on the skin and subcutaneous tissues that do not involve any portion of the gastrointestinal tract, a semi synthetic penicillin resistant to penicillinases, such as oxacillin or cloxacillin, is probably effective.
- Administration of antibiotics that are active against enteric anaerobes for procedures involving the lower gastrointestinal tract should be considered routine.
- Procedures on the upper gastrointestinal tract should involve use of antibiotics with activity against Gram-positive cocci and common Gram-negative organisms but which are not active against anaerobes.
- Procedures that do not enter any portion of the intestinal or genitourinary tract are sufficiently covered with antibiotics that are primarily active against Gram-Positive cocci.
- β-Lactam allergies are often cited as a contraindication for antibiotic prophylaxis
- For operations in which the risk is primarily from skin organisms vancomycin or teicoplanin is a common choice for patients allergic to β-Lactam. If local susceptibility patterns are favourable, clindamycin can be used.

- First-generation cephalosporins are the most commonly used agents for prophylaxis in caesarean section. Concern about neonatal exposure to antibiotics and the effect on neonatal sepsis have led to delays in administering antibiotics until after the umbilical cord has been clamped. In cesarean section procedures, antimicrobial prophylaxis should be administered before skin incision.
- Prophylactic antibiotic is solely given for prevention of infections following surgery and are not recommended for UTI or respiratory tract infection following surgery.

Timing

- Antimicrobial therapy should be initiated within 60 minutes prior to surgical incision to optimize adequate drug tissue levels at the time of initial incision. The half-life of the antibiotic should be considered: administration of Vancomycin or a fluoroquinolone should begin within 120 minutes before surgical incision because of the prolonged infusion times requires for these drugs.

Dose and duration

- For surgeries less than 4hrs: Only a single dose is given
- For surgeries greater then 4hrs: Only 2-3 doses depending on the duration of surgery
- For open heart surgeries: duration of prophylaxis should not be more than 48 hours.
- In general, repeat antimicrobial dosing following wound closure is not necessary and may increase the risk for the development of antimicrobial resistance

1.4.1.2.2 Pre-Operative skin antisepsis

Develop a pre-operative skin antisepsis protocol for surgical patients that includes patient bathing or showering with soap or antiseptic agent prior to surgery

Sample Instruction to patient on showing/bathing technique pre-surgical for antiseptic (CHG) soap

1. Get completely wet
2. Turn off water if using shower/step out of tub if using bath
3. Gently apply Antiseptic Soap to neck and move down your body using a clean washcloth
4. Pay special attention to surgical area
5. Do NOT apply to face or genitals (use regular soap for these areas)
6. Keep soap on your skin for 5 minutes; the soap will not make a rich lather
7. Turn water back on and rinse off soap; the soap might feel ‘sticky’ until completely dry
8. Dry with a freshly washed towel
9. Put on freshly washed clothes

Caution/Reminder: DO NOT use Antiseptic Soap if you are allergic to chlorhexidine. Once you have started using the Antiseptic Soap, avoid using regular soap other than on your face and genitals

1.4.1.2.3 Peri-operative skin antisepsis

2% CHG is the preferred agent and method for peri-operative skin antiseptis , and povidone iodine as alternative when CHG is contraindicated example for those who are allergic to CHG and for those less than 2 months (providers must carefully weigh the potential benefit in children under 2 months and the risks of CHG, recognizing that term and preterm infants may have different risks). Alternative agents, such as povidone-iodine or alcohol, can be used in this age group.

1.4.1.2.4 Peri-operative safety check list

Adapting practices that decrease errors and adverse events, and increase teamwork and communication in surgery by using a surgical safety check list (such as the WHO surgical safety check list).

WHO Surgical safety check list

Before induction of anesthesia (with at least nurse and anesthetist)	Before skin incision (with nurse, anesthetist and surgeon)	Before patient leaves operating room (with nurse, anesthetist and surgeon)
Has the patient confirmed his/her identity, site, procedure, and consent? □ Yes	□ Confirm that all team members have introduced themselves by name and role	Nurse Verbally Confirms: □ The name of the procedure □ Completion of the instrument, sponge and needle counts □ Specimen labelling (read specimen labels aloud, including patients name □ Whether there are any equipment problems to be addressed
Is the site marked? □ Yes □ Not applicable	□ Confirm the patients name, procedure, and where the incision will be made	
Is the anesthesia machine and medication check complete □ Yes	□ Confirm the patients name, procedure, and where the incision will be made	To Surgeon, Anesthetists and Nurse: □ What are the key concerns for recovery and management of this patient
Is the pulse oximeter on the patient and functioning? □ Yes	Has the antibiotic prophylaxis been given within the last 60 minutes? □ Yes □ Not applicable	
Does the patient have a: Known allergy? □ No □ Yes	Has the antibiotic prophylaxis been given within the last 60 minutes? □ Yes □ Not applicable	

Difficult airway or aspiration risk? □ No □ Yes, and equipment/ assistance available Risk of >500ml blood loss (7ml/kg in children)? □ No □ Yes, and two IVs / central venous access and fluid planned	Anticipated Critical Events To surgeon: □ What are the critical non routine steps? □ How long will the case take? □ What is the anticipated blood loss? To Anesthetist: □ Are there any patient specific concerns? To the Nursing Team: □ Has sterility (including indicator results been confirmed)? □ Are there equipment issues or concerns	
	Is essential imaging displayed? □ Yes □ Not applicable	

1.4.1.2.5 Normothermia

Room temperature, anesthesia, intravenous and irrigation fluids, anxiety and skin exposure can cause patients to become clinically hypothermic during surgery. Studies have demonstrated that both pre-operative and intra-operative warming reduces SSI rates and other complications. Keep the temperature of the operating theatre between 20°C – 23°C (68°F – 75°F] and if feasible, general humidity levels at 30-60%. Patient should be warmed for a minimum of 15 minutes prior to the induction of anesthesia.

1.4.1.2.6 Glucose control

Opportunities for hyperglycemia exist during each surgical phase and therefore must be monitored at each phase. Maintenance of blood glucose level less than 200mg/dL in diabetic and non-diabetic patients is recommended.

1.4.1.2.7 Supplement oxygen

Perioperative oxygen administration is a simple, low cost SSI prevention strategy. A meta-analysis concluded that perioperative supplemental oxygen led to a relative risk reduction of 25%.

1.4.1.2.8 Additional Strategies

(NHMR)

Strategies	Comments
Hand Preparation	• Operating team members should remove hand jewelry before operations • Operating team members should not wear artificial nails or nail polish during operations • If hands are visibly soiled, perform hand hygiene with liquid soap prior to scrubbing. • • Remove debris from underneath fingernails using a nail cleaner, preferably under • running water • • Using a suitable antimicrobial soap, preferably with a product ensuring sustained activity, • scrub hands and forearms for the length of time recommended by the manufacturer • Before subsequent operations, perform hand hygiene using an antiseptic surgical solution. • If hands are soiled during a procedure, hand hygiene should be performed again with an antiseptic surgical solution
Operation suit/ room or procedure	• Operation team members should wear sterile operation or procedure attire (appropriate PPE) • All operating suite/room staff who are not operating within the critical aseptic field must wear dedicated non-sterile attire in all areas where operations are undertaken. • Movements in and out of the operating area should be kept to a minimum.
Patient preparation	• Ensure pre-surgical antisepsis • Avoid routine removal of hair—if clinical circumstances require hair removal, it should be clipped on the day of surgery or as close as possible to the time of operation. Hair must never be shaved. • In areas where MRSA is a problem consider screening for MRSA carriage and decolonisation with nasal mupirocin ointment and chlorhexidine body washes before elective surgery such as cardiac and implant surgery. • During surgery if If diathermy is to be used, ensure that antiseptic skin preparations are dried by evaporation and there is no pooling of alcohol-based preparations • • If an incise drape is required, use an iodophor-impregnated drape unless the patient has an • iodine allergy. Do not use non-iodophor-impregnated incise drapes routinely for surgery as they may increase the risk of surgical-site infection. Ensure skin preparation is dry before • draping the patient.
Wound management	Avoid routine use of wound irrigation or intracavity antibiotic lavage as measures to reduce surgical-site infection • Avoid routine use of intraoperative skin re-disinfection or topical cefotaxime as measures to reduce the risk of surgical-site infection in abdominal surgery • It is recommended that at the end of the operation, surgical incisions are covered with an appropriate dressing such as semi-permeable film membrane with or without an absorbent island
Wound dressing	Use aseptic technique for changing or removing surgical wound dressings (see Section B5.4.2) • Avoid the routine use of topical antimicrobial agents for surgical wounds that are healing by primary intention as measures to reduce the risk of surgical-site infection

	• Avoid the use of Eusol and gauze, or moist cotton gauze or mercuric antiseptic solutions to manage surgical wounds that are healing by secondary intention • Use an appropriate dressing (such as semi-permeable film membrane with or without an absorbent island) to manage surgical wounds that are healing by secondary intention
Cleansing	Use sterile saline for wound cleansing up to 2 days after surgery • Advise patients that they may shower safely 2 days after surgery
Management of surgical site infections	When surgical-site infection is suspected, take a specimen for culture and then give the patient an antibiotic that covers the likely causative organisms as per the national antimicrobial stewardship guideline. Consider local resistance patterns in choosing an antibiotic and review the selection in light of results of microbiological tests • Avoid the use of Eusol and gauze, or dextranomer or enzymatic treatments for debridement in the management of surgical-site infection

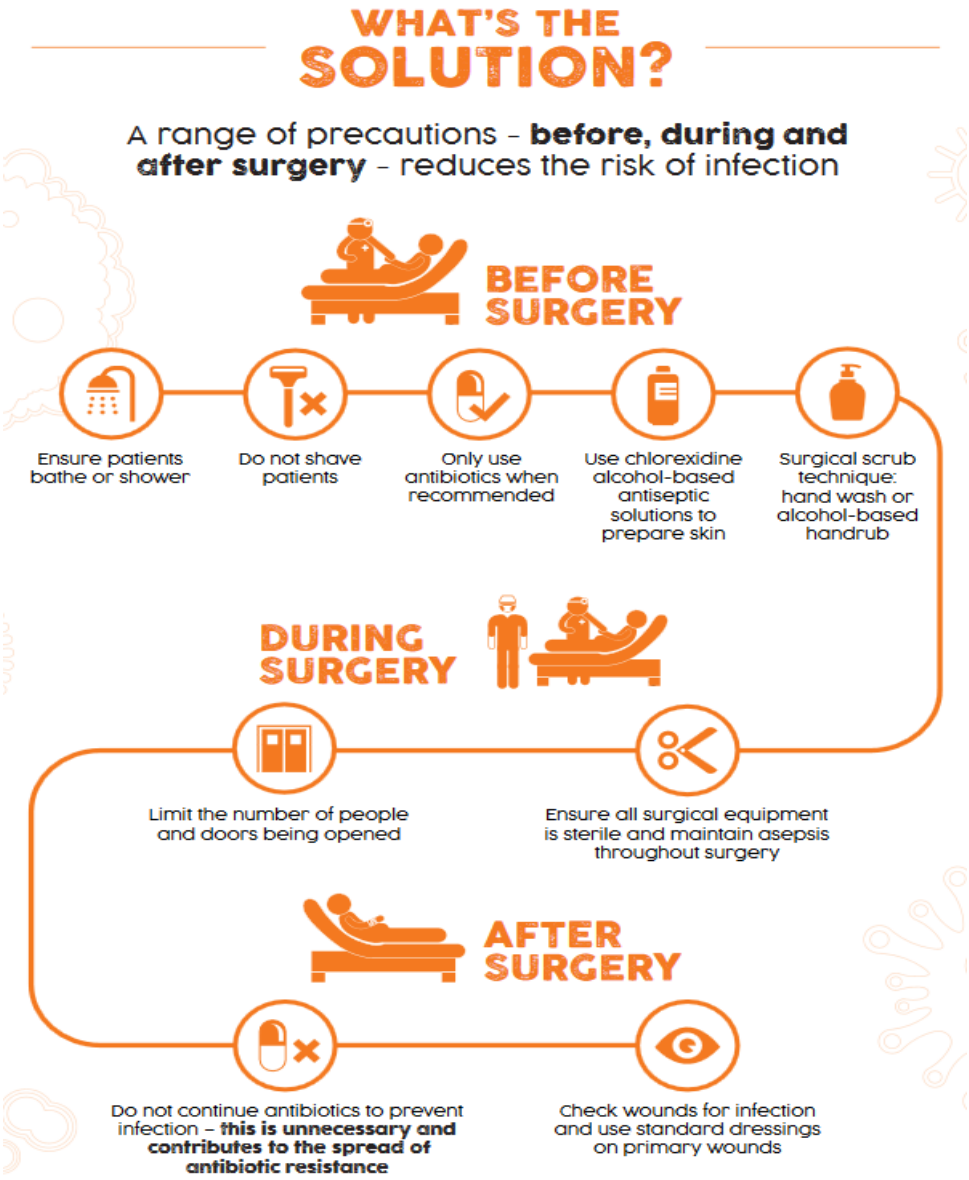

Figure 4: Reducing risk of SSI

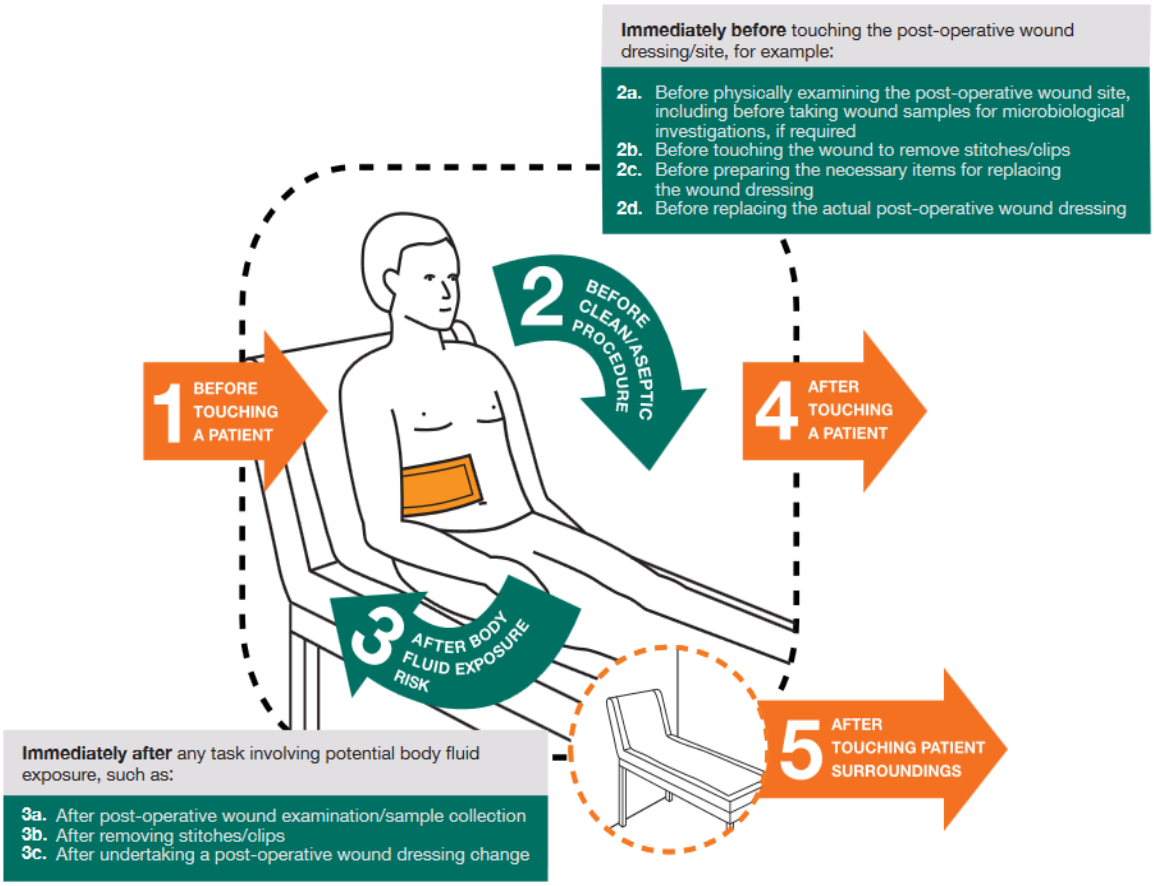

Figure 5: 5 moments of hand hygiene for SSI prevention

Key additional considerations for post-operative wounds
• Avoid unnecessary touching of the post-operative wound site, including by the patient. • Wear gloves if contact with body fluids is anticipated; the need for hand hygiene does not change even if gloves are worn, as per the WHO 5 Moments. • Follow local procedures regarding use of aseptic non-touch technique for any required dressing changes/wound procedures. • Don't touch dressings for at least 48 hours after surgery, unless leakage or other complications occur. • Routine post-operative wound dressings should be basic dressing types (e.g. absorbent or low adherence dressings). • When approaching a patient for the examination of a wound, the health worker may also perform other tasks (e.g. accessing a venous catheter, drawing blood samples, checking urinary catheter). Hand hygiene may be needed before and after these specific tasks, to once again fulfill Moments 2 and 3, for example (refer to WHO dedicated 5 Moments posters for line or catheter management). • When indicated, pre-operative surgical antibiotic prophylaxis (SAP) should be administered as a single parenteral dose 2 hours or less before the surgical incision, while considering the half-life of the antibiotic. Do not prolong administration of SAP after completion of the operation. • Antibiotic therapy for any proven surgical site infection should ideally be administered based on wound sample culture and sensitivity results. • Common signs and symptoms of wound infection are: pain or tenderness; localized swelling; erythema; heat, or purulent drainage from the superficial incision. • This guidance does not include information on complicated post-operative wound care, when specific treatments or therapies may be required. (Liberia)

Resources:

WHO (2009). WHO guidelines for safe surgery 2009: safe surgery saves lives https://www.who.int/teams/integrated-health-services/patient-safety/research/safe-surgery

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1.5 DECREASING ANTIMICROBIAL RESISTANCE BUNDLE-ICU

Antibiotic prescription in the critical care setting is a complex task. The primary aim of the bundle recommendations is reduction of the three most influential factors contributing to the development and transmission of MDR, namely; adequate prescription of antibiotics, early detection and prevention of cross-colonization of MDR and elimination of reservoirs

Recommendations

1. Ensure a responsible intensivist/ physician in ICU to ensure rational use of antibiotics
2. Reserved antibiotics (those for MDR pathogens should be started empirically in case of severe sepsis/ septic shock or in those case with high risk for MDR infection
3. One nurse in ICU should be responsible for implementation of Infection Prevention and Control practices
4. Screening for MDR pathogens colonisation; depending on available resources this maybe for all patients admitted to ICU or only for those with risk factors.
5. Patients admitted to who have high risk of acquisition of MDR pathogens should be cared under contact precautions till the screening culture results(fourth recommendation) are available
6. Monitor and audit compliance to preventive measures (hand hygiene, contact precautions, IPC measures etc.)
7. All Units should develop a cleaning protocol for rooms/ cubicles of patients with MDR pathogens.
8. Document all the existing equipment in the ICU with its updated respective cleaning protocols.
9. Include products containing 4% chlorhexidine in daily patient hygiene if colonized or infected with MDR pathogens.
10. If an outbreak is suspected it is recommended to initiate outbreak response as soon as possible and try to identify the causative organism especially with molecular typing methods (if available).

1.5.1 Adequate prescription of antibiotics

1.5.1.1 In each ICU, at least /physician intensivist will be designated as responsible for the use of antimicrobials

a. Antimicrobials should be started after careful consideration. This implies choosing optimal empirical antibiotics, appropriate mode of administration, and correct dosage Factors to take into account include:

   I. Severity of infection
   II. Host underlying conditions
   III. Antibiotic characteristics such as penetration and local susceptibility pattern

b. Evaluation of the appropriateness of the antimicrobial and the correct administration (dosing, intervals and duration)
   I. Consider the age, weight, renal status etc.

c. Evaluation of de-escalation of antimicrobial therapy or even antimicrobial cessation.
   I. Follow up the cultures

Prompt and adequate antimicrobial therapy reduces morbidity and mortality in severe sepsis and septic shock. However, as soon as microbiological information is available, empiric therapy should be adapted, if appropriate, by either reduction in number and/or narrowing of antimicrobial spectrum. Recent studies have shown that de-escalation is safe even in critically ill patients with severe sepsis or immunosuppression. Correlate the clinical presentation and the culture results; avoid treating colonizations).

1.5.1.2 Empirically administer antimicrobials active against MDR pathogens only in cases of severe sepsis or septic shock and high risk of MDR pathogen(s) based on patient risk factors and/or knowledge of local ecology.

Otherwise, narrow-spectrum or withholding of antimicrobials is recommended until microbiological results become available and targeted therapy with antibiotics active against MDR pathogens (carbapenems, colistin, tigecycline, glycopeptides, daptomycin, linezolid) should be started if needed. In all cases, samples for culture of the potential sources of infection should be obtained before starting antibiotic therapy.

1.5.1.3 In each Unit, at least one nurse will be designated and responsible for infection control measures aimed at reducing transmission of MDR pathogens.

Nurses play a critical role in preventing and controlling infectious diseases and measures to prevent patient-to-patient transmission are a significant component of care.

A multidisciplinary team approach is necessary to develop and implement strategies to prevent infection in the critically ill patient.

1.5.2 Early detection and prevention of cross-colonization of MDR

1.5.2.1 Perform an active search for MDR pathogens in all patients or those with high risk factors on admission to unit and at least once a week throughout their stay.

These samples will be processed to identify MDR pathogens according to the local epidemiology and in collaboration with the Microbiology Service and Infection Control Team.

Rationale: The implementation of contact precautions in patients colonized or infected with MDR is widely accepted. In contrast, the use of routine surveillance cultures in MDR management is still a matter of debate and not widely performed. Initial screening is specially recommended for MRSA, although the same principles and practices apply to Gram-negative MDR organisms, which actually now constitute the main threat.

Active surveillance programs are time and resource-consuming. The type and number of samples are selected according to local resources and epidemiology and should include at least nasal, rectal and oropharyngeal swabs (bronchial aspirates in intubated patients). In addition, other samples may be necessary to control potential reservoirs (infections, skin ulcers, etc.).

Concerning surveillance cultures, two approaches are acceptable: All patients are screened at ICU admission or only those patients with at least one of the risk factors included in the checklist (see Fifth Recommendation).

1.5.2.2 At admission to the ICU, a 'Checklist' of risk factors must be completed to identify patients at high risk of MDR pathogen carriage.

Patients meeting at least one of the risk factors must be cared for under application of contact precautions pending culture results (table 5 and table 6).

a) Hospital admission lasting > 5 days, during last 3 months
b) Institutionalized (prison, healthcare and social centers, geriatric centers, etc.)
c) Known colonization or infection with MDR pathogens
d) Antibiotic therapy ≥ 7 days in previous month (particularly 3rd and 4th generation cephalosporins, flouroquinolones and carbapenems)
e) End-stage renal disease under chronic dialysis or ambulatory peritoneal dialysis.
f) Comorbidities associated with high incidence of colonization or infection with MDR pathogens: Cystic fibriosis, bronchiectasis, chronic skin ulcers, etc.

1.5.2.3 Compliance with preventive measures including those based on transmission mechanisms should be routinely enforce and measured.

Contact precaution and hand hygiene are the mainstay for reducing transmission of microorganisms. Correct practice includes:

a) Use of a contact precautions sign for every patient colonized/infected by MDR pathogens;
b) availability of contact precautions equipment at patient room entry (hand hygiene products, gown and gloves);
c) barrier disposal containers inside patient room;
d) monitoring of adherence to the contact precautions protocol by staff/visitors.

1.5.3 Elimination of reserviors

1.5.3.1 All Units should develop a cleaning protocol for rooms of patients with MDR pathogens.

Many published outbreaks of MDR pathogens detect a common source on environmental surfaces and in moist areas. The cleaning protocol should include fixed structures (floors and walls) as well as the bed (including main structure, rails and mattress) and details on daily cleaning and final cleaning at patient discharge. The protocols for rooms occupied by patients with MDR pathogens must specify methodology, frequency of cleaning and disinfectant products. Because different cleaning products are approved in each hospital, the exact composition or trademark should be specified in the protocol.

1.5.3.2 Document/ file all the existing equipment in the ICU with its updated respective cleaning protocols.

Any clinical or technological equipment could act as a microbiological reservoir for MDR pathogens. Therefore, the first action is to remove all expendable materials, leaving work surfaces as free as possible. Equipment should be filed and information on the following aspects provided: Staff responsible for cleaning, cleaning schedule and cleaning methodology (disinfection, sterilization). Each healthcare worker is responsible for cleaning and disinfection of equipment for personal use (stethoscopes, flashlights, laptops, mobiles etc.)

1.5.3.3 Use of products containing 4% chlorhexidine in daily patient hygiene if colonized or infected with MDR pathogens.

Several observational studies and single-center trials have concluded that daily chlorhexidine bathing of ICU patients reduces the acquisition of MDR pathogens and the incidence of certain infections.

1.5.3.4 If an outbreak is suspected it is recommended initiate outbreak response as soon as possible and to identify the causative organism especially with molecular typing methods (if available).

Studies of outbreaks based on the phenotypic characteristics of microorganisms (antigenic properties, metabolic or antibiotic resistance) are limited and do not provide conclusive differences or similarities between them. Therefore, molecular typing methods, to be able to recognize epidemiologically-linked isolates derived from a common precursor microorganism, should be performed. This will also provide understanding of the mechanism of transmission and dissemination and allow strategies to control and eradicate the epidemic to be designed

1.5.3.4.1Targeted Screening for MDR organisms

Table 5: Targeted screening for MRGN and VRE

Organism	Suggested targeted screening dependent on local acquisition rates and risk factors	Frequency of screening	Sample collection
Multidrug resistant Gram negative (MRGN) ESBLs, plasmid Amp C, MR-Pa, MR-Ab, Transferable carbapenemase producing organisms	**High risk units** –– Intensive care unit –– Speciality centres (e.g. burns, neurosurgery) • Patients epidemiologically linked to single-strain outbreak in health care facility **Patients at high risk of carriage** • Those with recent broad spectrum antibiotic therapy (carbapenem, quinolones, and 3rd and 4th generation cephalosporins) • Long duration of stay and severity of illness • Chronic disease and impaired functional status • Presence of invasive medical devices	At admission and weekly	Multiple sites including rectal or perianal swabs, • Reasonable sites to include nares, groin, wounds and respiratory secretions or tracheal aspirates depending on the infectious agent
Vancomycin Resistant Enterococcus (VRE)	**High risk units** –– Intensive care unit –– Nephrology –– Haematology • Patients epidemiologically linked to single-strain outbreak in health care facility **Patients at high risk of carriage** • Dialysis patients • Recent hospitalisation in any health care facility • Critical illness in intensive care units • Long duration of stay and severity of illness • Chronic disease and impaired functional status • Patients with urinary catheters • Prolonged or broad-spectrum antibiotic use, particularly vancomycin	• For endemic VRE screen on admission to intensive care unit, discharge and once weekly • For VRE in ambulatory haemodialysis unit, or an haemotology/ oncology facility screen periodically every 3-6 months	• Multiple sites including rectal or perianal swabs, • Reasonable sites include groin, wounds and respiratory secretions or tracheal aspirates depending on the infectious agent
Management **Staff screening and decolonization is not recommended for VRE and MRGN** Apply stringent hand hygiene, contact precautions (gloves and gown) and core strategies for isolating including;, Cohorting, increased environmental cleaning and dedicated patient equipment. Patients positive for VRE or MRGN should have an electronic or other alert placed on their case record for easy identification on readmission.			

Table 6: Targeted screening for MRSA

Organism	Screen who	Screen when	Sample collection
Methicillin Resistant MRSA	• Patients at high risk of carriage: –– those who are known to have been previously infected or colonized with MRSA –– frequent re-admissions to any healthcare facility –– transfers from other acute care facility –– residence in long term care facilities –– patients with chronic wounds –– recent inpatients at hospitals known or likely to have a high prevalence of MRSA –– locales or populations where community-acquired strains of MRSA are prevalent	• Screened routinely at the time of admission unless they are being admitted directly to isolation facilities and it is not planned to attempt to clear them of MRSA carriage	• Multiple sites including one from the nose and a mucosal surface • Reasonable sites to swab include nares, skin lesions and wounds, sites of catheters, catheter urine, groin/perineum, tracheostomy and other skin break in all patients, and sputum from patients with a productive cough • Where maximum sensitivity is required, consideration should be given to adding a throat swab. The umbilicus should be sampled in all neonates
	• Healthcare workers epidemiologically linked to single-strain outbreak in health care facility	• After confirmation of epidemiological evidence • 2 weeks after decolonization therapy	
	• Patients in high-risk units –– ICU/high dependency unit (admission and discharge) –– Spinal unit –– Burns unit –– Pre-operative clinics –– Patients with planned prosthetic surgery (joint replacement, cardiothoracic surgery)	• All patients on admission, discharge and once weekly	

Management

Apply stringent hand hygiene, contact precautions (gloves and gown) and core strategies including; isolating and Cohorting patients, increased environmental cleaning and dedicated patient equipment. Patients positive for MRSA have an electronic alert placed on their case record for easy identification on readmission.

Consider topical plus/minus systemic decolonisation for:

• Healthcare workers epidemiologically linked to transmission

• Patients having prolonged hospitalisation

• Patients with chronic conditions likely to be readmitted (e.g. haemodialysis).

• Patients before undergoing high-risk elective surgery such as cardiac and implant surgery

Resources:

Garnacho Montero, J., Lerma, F.Á., Galleymore, P.R. et al. Combatting resistance in intensive care: the multimodal approach of the Spanish ICU "Zero Resistance" program. Crit Care 19, 114 (2015). https://doi.org/10.1186/s13054-015-0800-5

https://ccforum.biomedcentral.com/articles/10.1186/s13054-015-0800-5

2. HAI SURVEILLANCE

Facility-based HAI surveillance should be an essential and well-defined component of the IPC program. Timely feedback of results should be provided to health care workers and managers, as well as through national networks, and should guide IPC interventions. Surveillance of HAI and AMR can provide critical information on the incidence and prevalence of HAIs and AMR in health care facilities to;

- Guide IPC strategies and priorities and assess the effectiveness and impact of interventions
- Develop benchmarking and assess trends over time
- Detect clusters or outbreaks of importance and inform wider public health decision-making and actions
- Assist national decision-makers and the IPC national team to identify priorities for IPC

HAI surveillance includes data collection, analysis and interpretation, and feedback leading to interventions for preventive action. The infection control team must be trained for surveillance. A written protocol must describe the methods used, the data to be collected and the analysis that can be expected. There are two types of surveillance i.e prevalence rate and incident rates.

Types of surveillance:

Prevalence rate = The number of all infected patients (or the number of infections) at the time of study as a percentage of the number of patients observed at the same time.

Incidence rate = The number of new nosocomial infections acquired per 1000 patient days (or 10 or 100 days)

HAI infection Rates (incidence rates)	Formulae
CA-UTI rate	No. of UTI cases in those with a urinary catheter/ total no. of catheter days
CLABSI rates	No. of CLABSI cases in those with a central line/ total no. of central line days
VAP rates	Number of VAP cases in intubated patients/ total no. of ventilator days
SSI rates	No. of SSI/ No. of surgeries done during the period x 100

Surveillance can be conducted as

- Outcome based:
  - HCAI like CA UTI, VAP, CLABSI, SSI or infection or colonization with a specific organism.
- Process based
  - Compliance with Hand hygiene practices, Central line insertion practices, surgical care process
- Event based surveillance
  - Occurrences of reportable diseases and conditions (e.g. measles, chicken pox)

Process based surveillance should be conducted in all health care facilities depending on the services provided. Suggested process based surveillance measures include;

Recommended processes and indicators to be monitored /audited (WHO)

- Hand hygiene compliance (using the WHO hand hygiene observation tool or equivalent)
- Intravascular catheter insertion and/or care
- Urinary catheter insertion and/or care
- Key measures to prevent surgical site infections
- Transmission-based precautions implementation for MDROs and highly transmissible infectious diseases
- Cleaning of the ward environment
- Disinfection and sterilization of medical equipment/instruments
- Consumption/use of alcohol-based hand rub or soap
- Consumption/use of antimicrobial agents

2.1 MINIMUM CAPACITY OF PARTICIPATING HOSPITALS FOR SURVEILLANCE:

An established IPC Program for the prevention of healthcare-associated infections:

Hospitals should also have a program for the prevention and control of healthcare-associated infections that is responsible for setting policy, objectives, strategies, and legal and scientific bases for the prevention and control of hospital infections. The program will also be responsible for the surveillance of those in-fections. The hospital program should have qualified, dedicated staff with defined responsibilities and duties, and have a budget sufficient to meet the tasks programmed in their work plans

Trained local staff:

- The responsibilities of these staff members are to detect cases (numerators) and identify the exposed population (denominators), keep records, and consolidate and analyze collected data. In general, these duties are carried out by nursing personnel dedicated to infection control, although other clinicians familiar with the topic may participate depending on the organization of the facility or hospital and of the surveillance system. These responsibilities include;
- Review the charts of patients with exposure factors in order to detect infections.
- In the event that an infection is suspected, use case definition criteria to classify it as such, if appropriate.
- Record infection information for all confirmed cases (numerators): pneumonia, urinary tract infection, or bloodstream infection (dates and etiologic agents).
- For patients with confirmed HAI record epidemiological information in order to establish numerators: patient identification, name, hospital identification, bed, primary underlying disease, sex, age, date of ICU admission, date of Icu discharge, reason for discharge, and length of exposure to mechanical ventilation, indwelling urinary catheter, or central venous catheter. Keep information for later consolidation. the professional in charge of surveillance should have the time necessary to perform tasks and receive training. The time that surveillance activities require depends on the number of patients and the quality of records kept by the facility or hospital, as well as on the frequency of surveillance rounds in the intensive care units.

For device associate HAI surveillance in addition to the above there should be ICU capacity:

For this purpose, an intensive care unit is defined as the hospital unit in which beds are reserved for the care of critically ill patients who require specialized medical and nursing care 24 hours a day, in addition to specialized life-support equipment

2.2 IMPLEMENTATION AND REPORTING OF FACILITY BASED HAI AND AMR SURVEILLANCE

The steps of implementation of surveillance (table --) and reporting (fig--) are given below. Surveillance data should be collected by all health care facilities, fulfilling the minimum capacity of participating hospitals. Monthly feedback should be given to the relevant staff or departments in the hospital and 3monthly (quarterly) data should be shared with all departments of the hospital. All surveillance reports should be shared with the regional and central IPC team.

Implementation of a facility based HAI surveillance program: Sample action plan WHO (Adapted)

Requirements	Actions required for obtaining the required areas	Lead person and other team members	Timeline	Budget/resources
Resources for surveillance: • Financial resources • Human resources (IPC trained staff) • Informatlcs support (equipment, mobile technologies, electronic health records)	• There would be a at least an Atoll IPC focal point from each Atoll who would be trained and would be required to go and train others in the Atoll and undertake overall monitoring of the IPC program of the specific Atoll. • In case Atoll focal point is unable to conduct the program or need further training /assistance: o Assistance may be obtained from the national level or under the guidance from national IPC team from another nearby Atoll focal point o Explore the option of using existing epidemiological expertise from other	• IPC focal point and the IPC team (including health care facility public health unit/ epidemiologist if present), working with senior management/ chief executive officer	3-6 months	Low

	programmes where available (or experts in data management who could assist). o Explore availability of web-based courses to support training. • Consider starting with targeted prevalence surveys as an exercise for staff to practice diagnosis of HAI, collect and analyze data and recognize HAI epidemiology and problems in their setting (see below)**			
Obtaining information on burden of HAI in the facility	• Ideally, conduct a point prevalence survey (PPS) to identify the most frequent HAIs in your facility and to orient future surveillance approaches. • Explore whether a PPS protocol, data collection forms and a data entry database are available from the national IPC or surveillance programme, or develop these by referring to international standards*. • Pilot PPS in several units including the intensive care unit and surgical wards. • Informed by the pilot, undertake PPS across the entire health care facility. • Feedback results to heads of units and the IPC committee and focus on securing support for the identification of priority areas for continuous surveillance. • Use results to support the ongoing need for an IPC programme.	IPC focal point and IPC team	3-6 months	Moderate
Case definitions	• Use the definitions provided in the national HAI surveillance guideline (section---) • If the required definition is not available or using a different case definition then would need to inform the National IPC committee and get advise	IPC focal point and IPC team	1-2 months	Low

Integrate standardized surveillance into IPC program	Using trained IPC staff, use national definitions, methods and data collection forms as a reference and host an expert meeting with heads of units, doctors and nurses (especially high risk units, for example, intensive care unit, surgery, neonatology, obstetric and gynecology, etc.) to discuss a careful locally-adapted approach to establish regular surveillance in priority areas and what methods should be used	IPC focal point and IPC team	3 months	Moder ate
Increase awareness across the facility on the value of surveillance and assign surveillance activities as a priority for the health care facility	• Use the advocacy materials obtained from central IPC team or develop own IPC materials (please share with the national IPC team before using these materials). • IEC materials should highlight the advantages of HAI surveillance - focus on how surveillance information can help reduce HAI across the facility and how to effectively utilize surveillance information to improve patient care practice and early detection of HAI outbreaks. Include cost-effectiveness data from studies demonstrating the economic benefit of detecting and preventing HAIs. • Where available, use PPS data to support advocacy and training. • Informed by meetings with heads of departments and discussions in the IPC committee, make a list of priorities and evaluate surveillance plans according to these current priorities - plans and resources for surveillance should be firmly established as a key part of the general IPC program including addressing data collection, analysis and reporting requirements	IPC focal point and IPC team		
Microbiological lab capacity for	In facilities where adequate microbiological laboratory facilities are not available consult with	IPC focal point IPC team with public health team,	3 months	High

supporting HAI surveillance	central IPC team/ QA MOH on upgrading the laboratory or if no laboratory is present – explore the possibilities to send microbiological samples to another laboratory, for example, to a nearly hospital with sufficient laboratory facilities	working with senior management/chief executive officer		

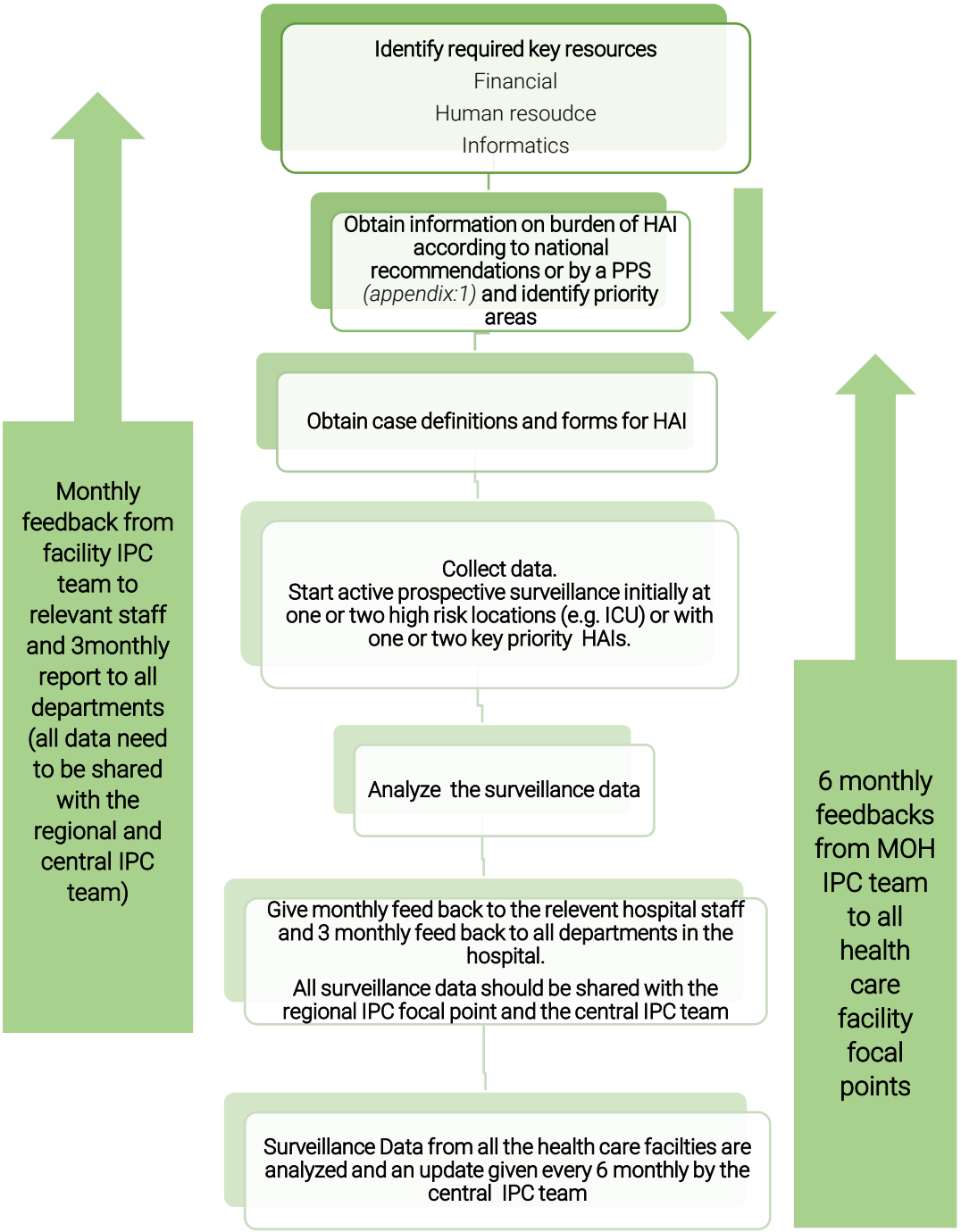


Figure 6: Process of HAI surveillance and reporting

2.3 METHODOLOGY:

Surveillance of device-associated infections in intensive care units (CAUTI, CLABSI, VAP) and SSI should be active, selective, prospective, and patient-based.

Case-finding:

A properly trained health care professional infection prevention and control professional will identify patients suspected of having a device-associated infection and collect the corresponding denominator data.

According to the health care facility, initially, one or two priority HAI maybe taken for surveillance. Suggested HAIs for Active surveillance are given below;

- SSI in cesarean section (occurring within 30 days of cesarean section)
- ICU device associated infection
- CAUTI
- CLABSI
- VAP
- AMR surveillance should be done and reported to MOH from all the hospitals with microbiological culture facilities.

Definitions and Terms

Table 2: Important Terms and Definitions

Key words	Comments
Types of surveillance	*Device associated:* Only from ICU during the patient's stay (infections occurring after the patient's discharge from the ICU will not be counted, even if they are related to the patient's stay in the intensive care unit). Microbiology data are compiled separately for each intensive care unit identified *(AMR surveillance).* *Procedure associated: (SSI for surgeries)* • Surveillance of all **selected surgical** procedures or • In case the facility does not have the capacity to follow all selected procedures choose 1 or 2 days of the week with at least one being the day for elective surgeries (e.g. cesarean sections) and follow up for the 30/90 days periods as specified. *AMR surveillance:* Laboratory based surveillance with
Denominator data (patients days and device days):	Note daily how many patients are on a device and tally at the end of the month to obtain: Mechanical ventilation days; indwelling urinary; central venous catheter days; and total patient days per month and per intensive care unit. Collect at the same time, every day, for each location under surveillance.
Numerator	Fill a separate form for all patients with a defined HAI. Data will be collected in the intensive care unit/defined locations daily through active surveillance under the responsibility of the infection prevention and control team. When reporting an HAI in prospective active surveillance; • All elements for HAI criterion must occur during the IWP of 7 days

	• Date or even (DOE) is the date that the first element (either culture, sign or symptom) used to meet an site-specific infection criterion occur for the first time within the seven-day IWP • Repeat infection time frame (RIT) is 14 days with DOE being day 1. • IWP, DOE, RIT not applicable for SSI and VAE
Data entry and analysis	Enter all data into a computer program for calculation of Incidence density for the HAIs = Number of cases of HAI in patients with the device/number of device days x 1000 or 100 (Ref section on calculation) SSI rates= Total number of patients developing and SSI after the procedure (e.g. cesarean section) within the defined period/ total number of patients who underwent the procedure during the surveillance period x 100 (may report as x 10 if fewer procedures performed during the period)
Reporting	Share the data with the Atoll/ Regional and the MOH IPC team monthly. MOH will consolidate the data from all facilities and give a report every 6 monthly

Key terms used in the surveillance process	Definitions	Short explanation
Infective window period*	7-days in which all site specific criteria must be met. Includes the collection date of the first positive diagnostic test that is used as an element to meet the site specific infection criterion, the 3 calendar day before and 3 calendar day after	First positive diagnostic test, 3 days before and 3 days after
Date of event (DOE)*	Date the first element used in meet the site specific criterion occurs for the first time within the seven-day infection window period	Date the first element occurs for the first time
Present on admission (POA)*	Period of POA is defined as the day of admission to inpatient location (admission day 1), the 2 days before admission and the next day of admission (admission day 2)	Event occur within the first 2 days of admission
HCAI*	If the date of event of the site-specific infection criterion occurs on or after the 3rd calendar day of admission to an inpatient location	Event occur on or after day 3 of admission
Repeat infection timeframe (RIT)*	The Repeat Infection Timeframe (RIT) is a 14-day timeframe during which no new infections of the same type are reported.	14 day timeframe after Date of event (date of event = day 1)
Secondary BSI attribution period*	The period in which a blood specimen must be collected for a secondary bloodstream infection to be attributed	Infective window period + RIT

	to a primary site infection. Include the infective window period combined with the repeat infection timeframe. It is 14-17 days in length depending upon date of event.	
Location of attribution (LOA)	The inpatient location where the patient was assigned on the date of event is the location of attribution	Location of the patient on the date of event
Transfer rule (exception to LOA)	If the date of event is on the date of transfer/discharge, or the next day, the infection is attributed to the transferring/discharging location.	

Table 3: Definition of HAI surveillance

Definition of HAI in active prospective surveillance		
Onset of HAI		Case definition
Admission > 2days	**AND**	Meets the case definition of survey (Ref to specific case definitions)

Resources:

Improving infection prevention and control at the health facility: Interim practical manual supporting implementation of the WHO Guidelines on Core Components of Infection Prevention and Control Programmes. Geneva: World Health Organization; 2018 (WHO/HIS/SDS/2018.10). https://apps.who.int/iris/bitstream/handle/10665/279788/WHO-HIS-SDS-2018.10-eng.pdf

World Health Organization. (2018). Infection prevention and control assessment framework at the facility level (No. WHO/HIS/SDS/2018.9). World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/330072/WHO-HIS-SDS-2018.9-eng.pdf

2.3.1 CA-UTI (Any Age)

(Any Age) https://www.cdc.gov/nhsn/pdfs/training/2019/cauti-508.pdf

Table 4: CAUTI definition

Patient must meet 1, 2, and 3 below:
1. Patient had an indwelling urinary catheter (IUC) that had been in place for > 2 consecutive days in an inpatient location on the date of event AND was either:
• Present for any portion of the calendar day on the date of event OR • Removed the day before the date of event
2. Patient has at least one of the following signs or symptoms:
• Fever (>38.0°C): To use fever in a patient > 65 years of age, the UC needs to be in place for > 2 consecutive days in an inpatient location on date of event and is either still in place or removed the day before the event • Suprapubic tenderness* • Costovertebral angle pain or tenderness* • Urinary urgency ^ • Urinary frequency^ • Dysuria ^
3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of ≥10^5CFU/ml

UC – urinary catheter
*no other recognized cause
^ These symptoms cannot be used when catheter is in place

Non CA-UTI (Any Age)

Patient must meet 1, 2, and 3 below:
1. One of the following is true:
• Patient has/had an indwelling urinary catheter but it has/had not been in place formore than 2 consecutive days in an inpatient location on the date of event OR • Patient did not have a urinary catheter in place on the date of event nor the day before the date of event
2. Patient has at least one of the following signs or symptoms:
• Fever (>38^0C) in a patient that is ≤ 65 years of age • Suprapubic tenderness* • Costovertebral angle pain or tenderness* • Urinary urgency ^ • Urinary frequency^ • Dysuria
3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of ≥10^5CFU/ml

*no other recognized cause
^ These symptoms cannot be used when catheter is in place

2.3.1.1.1 Symptomatic UTI: CA-UTI or Non CA-UTI in patient 1 year of age or less

Patient must meet 1, 2, and 3 below:
1. Patient is ≤1 year of age (with or without an indwelling urinary catheter)
2. Patient has at least one of the following signs or symptoms: • Fever (>38°C) • Hypothermia (<36.0°C) • Apnea* • Bradycardia* • Lethargy* • Vomiting* • Suprapubic tenderness*
3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of ≥10^5CFU/m

*no other recognized cause

Asymptomatic bacteremic UTI (Any Age)

Patient must meet 1, 2, and3 below:
1. Patient with or without an indwelling urinary catheter has no signs or symptoms of SUTI 1 or 2 according to age (Note: Patients > 65 years of age with a non-catheter-associated ABUTI may have a fever and still meet the ABUTI criterion)
2. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of ≥105 CFU/ml
3. Patient has organism identified from blood specimen with at least one matching bacterium to the bacterium identified in the urine specimen, OR meets LCBI criterion 2 (without fever) and matching common commensal(s) in the urine.(or 2 positive blood cultures with common commensal bacteria and a matching common commensal in the urine)

Urine cultures:

- Excluded organisms
  - Candidas pecies or yeast not otherwise specified,
  - mold,
  - dimorphic fungi or
  - parasites are excluded as organisms in the UTI definition
- Excluded organisms may be present in urine
  - Urine culture with yeast can be used as long as there is at least one bacterium with ≥105CFU/ml and no more than 2 organisms (for example, > 105CFU/ml of E. coli and > 105CFU/ml of C. albicans)

Unusable culture results

- Urine cultures with > 2 organisms are regarded as contaminated cultures and not used for UTI surveillance (for example, > 105CFU/ml E. coli, S. aureus and C. albicans= 3 organisms)
- Urine culture including “mixed flora*” or equivalent such as “perineal flora”, “vaginal flora”, “normal flora” cannot be used (for example, > 105CFU/ml of E. coli and perineal flora)
- *The bacteria and other microorganisms that normally inhabit a bodily organ or part such as

Asymptomatic CAUTI with Bacteremia Surveillance Definition AsymptomaticUTI with Bacteremia (ABUTI) requires the following threecriteria within a 7-day window period:1.Urine culture with no more than two species of organisms, at least one of which is a bacteria of >105CFU/ml 2.Positive blood culture with at least one matching bacteriato the urine or2 positive blood cultures with common commensal bacteria and a matching common commensal in the urine3.Noclinical signs or symptoms of CAUTI

Resources:

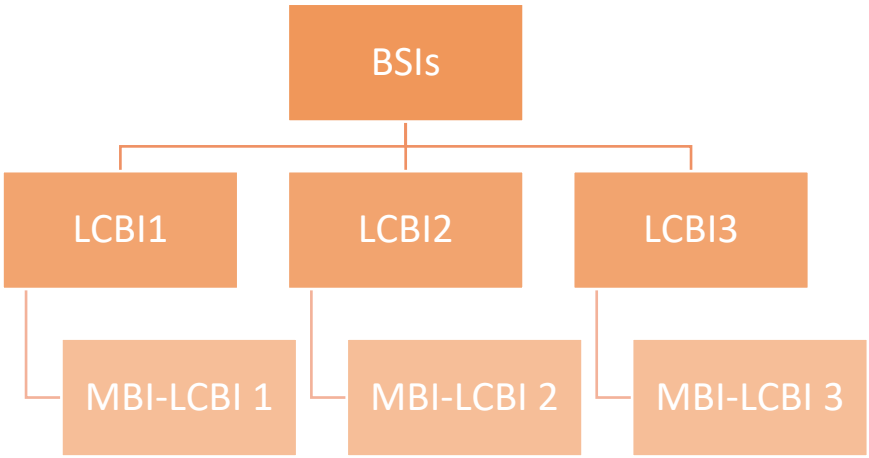
Norrick B., NHSN, CDC.Catheter-Associated Urinary Tract Infection Surveillance in 2019 https://www.cdc.gov/nhsn/pdfs/training/2019/cauti-508.pdf

2.3.2 Central Line Associated Blood Stream Infections (CLABSI)

Definitions specific to BSI/CLABSI surveillance:

Primary blood stream infection (BSI): A Laboratory Confirmed Bloodstream Infection (LCBI) that isnot secondary to an infection at another body site

Secondary BSI: A BSI that is thought to be seeded from a site-specific infection at another body site (e.g. UTI, pneumonia or SSI)



Secondary BSI Attribution Period (SBAP): the period in which a blood specimen must be collected for a secondary BSI to be attributed to a primary site of infection. This period includes the Infection Window Period (IWP) combined with the Repeat Infection Timeframe (RIT). It is 14-17 days in length depending upon the date of event

Infusion: The administration of any solution through the lumen of a catheter into a blood vessel. Infusions include continuous infusion (for example, nutritional fluids or medications), intermittent infusion (for example, IV flush), IV antimicrobial administration, and blood transfusion or hemodialysis treatment.

Access: The performance of any of the following activities during the current inpatient admission:

- Line placement
- Use of (entering the line with a needle or needless device) any central line for:
  - Infusion
  - Withdrawal of blood
- Use for hemodynamic monitoring.

Types of Central Lines for reporting purposes:

- Permanent central line: Includes:
  - Tunneled catheters, including tunneled dialysis catheters
  - Implanted catheters (including ports)
  - Temporary central line:
- A non-tunneled, non-implanted catheter
- Umbilical catheter: A vascular catheter inserted through the umbilical artery or vein in a neonate. All umbilical catheters are central lines.

Eligible Central Line: A CL that has been in place formore than two consecutive calendar days (on or after CL day 3), following the first access of the central line, in an inpatient location, during the current admission. Such lines are eligible for CLABSI events and remain eligible for CLABSI events until the day after removal from the body or patient discharge, whichever comes first.

Central line-associated BSI (CLABSI): A laboratory confirmed bloodstream infection where an eligible BSI organism is identified and an eligible central line is present on the LCBI DOE or the day before.

Central line days: the number of days a central line has been accessed to determine if a LCBI is a CLABSI Denominator device days: the count of central lines on an inpatient unit that is recorded in the monthly denominator summary data

Common commensal list: CDC (https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf)

Criterion	Once an LCBI determination is made, proceed to the MBI-LCBI definitions and determine if the corresponding MBI-LCBI criteria are also met(for example, after meeting LCBI 2, investigate for potential MBI-LCBI 2)
LCBI 1 If LCBI 1 criteria is met, consider MBI-LCBI 1	Patient of any age has a recognized bacterial or fungal pathogen not included on common commensal list, identified from one or more blood specimens obtained by a culture or non-culture based microbiologic testing methods AND Organism(s) identified in blood is not related to an infection at another site Notes: 1. If a patient meets both LCBI 1 and LCBI 2 criteria, report LCBI 1 with the recognized pathogen entered as pathogen #1 and the common commensal as pathogen #2. 2. No additional elements (in other words, no sign or symptom such as fever) are needed to meet LCBI 1 criteria; therefore, the LCBI 1 DOE will always be the collection date of the first positive blood specimen used to set the BSI IWP

LCBI 2 If LCBI 2 criteria is met, consider MBI-LCBI 2	Patient of any age has **at least one** of the following signs or symptoms: fever (>38.0 °C), chills, or hypotension **AND** Organism(s) identified in blood is not related to an infection at another site **AND** The same common commensal organisms include, but not are not limited to, diphtheroids (Corynebacterium spp. not C. diphtheria), Bacillus spp. (not B. anthracis), Propionibacterium spp., coagulase-negative staphylococci (including S. epidermidis), viridans group streptococci, Aerococcus spp. Micrococcus spp. and Rhodococcus spp. **Notes:** 1. Criterion elements must occur within the 7-day IWP. Which includes the collection date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after. 2. The two matching common commensal specimens represent a single element for use in meeting LCBI 2 criteria and the collection date of the first specimen is used to determine the BSI IWP. 3. At least one element (specifically, a sign or symptom of fever, chills or hypotension) is required to meet LCBI 2 criteria; the LCBI 2 DOE will always be the date the first element occurs for the first time during the BSI IWP, whether that be a sign or symptom or the positive blood specimen.
LCBI 3 If LCBI 3 criteria is met, consider MBI-LCBI 3	Patient ≤ 1 year of age has at least one of the following signs or symptoms: fever (>38.0oC), hypothermia (<36.0oC), apnea, or bradycardia **AND** Organism(s) identified in blood is not related to an infection at another site **AND** The same NHSN common commensal is identified by a culture or non-culture based microbiologic testing method, from two or more blood specimens collected on separate occasions Common Commensal organisms include, but not are not limited to, diphtheroids (Corynebacterium spp. not C. diphtheria), Bacillus spp. (not B. anthracis), Propionibacterium spp., coagulase-negative staphylococci (including S. epidermidis), viridans group streptococci, Aerococcus spp. Micrococcus spp, and Rhodococcus spp. **Notes:** 1.Criterion elements must occur within the 7-day IWP (as defined in Chapter 2)which includes the collection date of the positive blood specimen, the 3 calendardays before and the 3 calendar days after. 2.The two matching common commensal specimens represent a single element foruse in meeting LCBI 2 criteria and the date of the first is used to determine the BSI IWP. 3.At least one element (specifically, a sign or symptom of fever, hypothermia, apnea or bradycardia) is required to meet LCBI 3 criteria; the LCBI 3 DOE will always be the date the first element occurs for the first time during the BSI IWP whether that be a sign or symptom or the positive blood specimen.

After establishment of CLABSI proper surveillance, institutions may include other blood stream infections surveillance

Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infection (MBI-LCBI) Must meet one of the following MBI-LCBI criteria

This maybe added once basic surveillance starts

<table>
<tr><td colspan="3">An MBI-LCBI is a subset of the LCBI criteria; therefore, a BSI event must fully meet an LCBI criterion before evaluating for the corresponding MBI-LCBI criteria.
The MBI-LCBI DOE will always be the date the prerequisite LCBI criteria was met. Abnormal ANC and WBC values reflect risk factors for acquiring an MBI-LCBI, not symptoms of infection and therefore are not used in DOE determinations.</td></tr>
<tr><td>MBI-LCBI 1</td><td>MBI-LCBI 2</td><td>MBI-LCBI 3</td></tr>
<tr><td>Patient of any age fully meets LCBI 1 criteria</td><td>Patient of any age fully meets LCBI 2 criteria</td><td>Patient <1 year of age fully meets LCBI 3 criteria</td></tr>
<tr><td>with at least one blood specimen</td><td colspan="2">with at least two blood specimens</td></tr>
<tr><td colspan="3">Identified by culture or non-culture based microbiologic testing method</td></tr>
<tr><td>with ONLY intestinal organisms from the MBI organism list</td><td colspan="2">with ONLY Viridans Group Streptococcus or Rothia spp. but no other organisms</td></tr>
<tr><td colspan="3">AND
Patient meets at least one of the following:
1.Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood specimen:
a.Grade III or IV gastrointestinal graft versus host disease [GI GVHD]
b.≥1-liter diarrhea in a 24-hour period (or ≥20 mL/kg in a 24-hour period for patients <18years of age)
with onset on or within the 7 calendar days before the date the positive blood specimen was collected.

2.Is neutropenic, defined as at least two separate days with ANC and/or WBC values <500cells/mm3 collected within a 7-day time period which includes the collection date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after (See Table 6).

Note:
1.If a patient meets both MBI-LCBI 1 and MBI-LCBI 2 criteria (specifically has Viridans Group Streptococcus or Rothia spp. plus only other MBI organisms in the blood specimen), report organisms as MBI-LCBI 1 with the recognized pathogen as pathogen #1 and the common commensal as pathogen #2.
2.Any combination of ANC and/or WBC values can be used to meet neutropenic criteria provided they are collected on separate days within the 7-day period that includes the date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after.
3. When a blood specimen positive for an organism not included on the NHSN MBI organism listis collected during the BSI RIT of an MBI-LCBI, the initial MBI-LCBI event is edited to anLCBI and the identified non-MBI organism is added.</td></tr>
</table>

Notes on reporting

Absolute neutrophil count (ANC) calculations:

ANC = WBC x (%Segments s + %Bands) / 100

Group B Streptococcus identified from blood, with a date of event during the first 6 days oflife, will not be reported as a CLABSI. A BSI RIT will be set but no central line association is made.

In LCBI criteria 2 and 3, the phrase "two or more blood specimens drawn on separate occasions" means:

- Blood from at least two separate blood draws was collected on the same or consecutive calendar days, and
- Two separate site preparations (decontamination steps) were performed during specimen collection
- Reporting of the central lines:
- Only one central line per patient is counted per calendar day regardless of the number of central lines present.
- All central lines on inpatient units should be included in device day counts regardless of access.
- If a patient has both a temporary and a permanent central line, only report the temporary line because it is associated with a higher risk of bloodstream infection.

Measure	Calculation	Application
CLABSI Rates	The number of CLABSIs for a location x 1000 The number of Central Line Days for that location	Location specific measure only
MBI-LCBI Rates	The number MBI-LCBIs for a location x 1000 The number of Central Line Days for that location	Location specific measure only
DUR	The Central Line Days for a location The Patient Days for that location	Location specific measure only

Secondary BSI

Information maybe collected for secondary BSI- depending on the burden in the institution and available resources.

In order for a bloodstream infection to be determined secondary to another site of infection the following requirements must be met:

Secondary BSI:
Definitions for Specific Types of Infections (defined in Chapter 17), or UTI, PNEU or SSI definitions.
AND
One of the following scenarios must be met: Scenario 1: At least one organism from the blood specimen matches an organism identified from the site-specific specimen that is used as an element to meet the NHSN site-specific infection criterion AND the blood specimen is collected during the secondary BSI attribution period (infection window period + repeat infection timeframe) OR Scenario 2: An organism identified in the blood specimen is an element that is used to meet the NHSN site-specific infection criterion, and therefore is collected during the site-specific infection window period.
Note: Exceptions maybe found for NEC criteria and Endo criteria (Criteria will be updated once surveillance is broadened)

Partial list of MBI-LCBI Organisms (Ref CDC NHSN-2019) if doing MBI-LCBI surveillance	
Abiotrophia	*Klebsiella (E)*
Alistipes	*Kluyvera (E)*
Alloscardovia	*Kluyveromyces*
Anaerobiospirillum	*Leclercia (E)*
Anaerococcus	*Leminorella (E)*
Anaerorhabdus	*Leptotrichia*
Arcobacter	*Leuconostoc*
Atopobium	*Megamonas*
Averyella (+E)	*Megasphaera*
Bacteroides	*Mitsuokella*
Bifidobacterium	*Moellerella (E)*
Bilophila	*Mogibacterium*
Blautia	*Morganella (E)*
Buttiauxella (E)	*Obesumbacterium (+E)*
Campylobacter	*Odoribacter*
Candida	*Pantoea (+E)*
Capnocytophaga	*Parabacteroides*
CDC Enteric Group 58 (+E)	*Peptostreptococcus*
Cedecea (E)	*Pichia*
Citrobacter (E)	*Porphyromonas*
Clostridium	*Prevotella*
Collinsella	*Proteus (E)*
Cronobacter (+E)	*Providencia (E)*
Dialister	*Pseudoflavonifractor*
Dichelobacter	*Pseudoramibacter*
Edwardsiella (E)	*Rahnella (E)*
Eggerthella	*Raoultella (+E)*
Eggerthia	*Rothia*
Enterobacter (E)	*Ruminococcus*
Enterococcus	*Saccharomyces*
Escherichia (E)	*Sarcina*
Eubacterium	*Serratia (E)*
Ewingella (E)	*Shigella (E)*
Faecalibacterium	*Slackia*
Filifactor	*Streptococcus (VGS subset)*
Finegoldia	*Tannerella*
Flavonifractor	*Tatumella (E)*
Fusobacterium	*Tetragenococcus*
Gemella	*Tissierella*
Geotrichum	*Trabulsiella (E)*
Granulicatella	*Veillonella*
Hafnia (E)	*Weissella*
Helcococcus	*Yersinia (E)*
Helicobacter	*Yokenella (E)*

Resources:

NHSN 2019. Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central Line Associated Bloodstream Infection) https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf)

2.3.3 Ventilator-Associated Event (VAE) surveillance

The Ventilator Associated Event (VAE) definition algorithm is for use in surveillance; it is not a clinical definition algorithm and is not intended for use in the clinical management of patients. VAE surveillance should be done in adults. Initially VAE surveillance to be started in ICU setting and extended to (high dependency unit) HDU and other places where ventilator is used (VAE surveillance is not done in long term care home).

Patients must be mechanically ventilated for at least 4 calendar days to fulfill VAE criteria (where the day of intubation and initiation of mechanical ventilation is day 1). The earliest date of event for VAE (the date of onset of worsening oxygenation) is day 3 of mechanical ventilation.

2.3.3.1 VAE surveillance Algorithm

Ventilator Associated Events (VAE)
Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum* FiO2 or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO2. *Daily minimum defined by lowest value of FiO2 or PEEP during a calendar day that is maintained for > 1 hour
After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation: 1. Increase in daily minimum* FiO2 of ≥ 0.20 (20 points) over the daily minimum FiO2 of the first day in the baseline period, sustained for ≥ 2 calendar days. 2. Increase in daily minimum* PEEP values of≥ 3 cmH2O over the daily minimum PEEP of the first day in the baseline period†, sustained for ≥ 2 calendar days.
↓ Ventilator Associated Condition (VAC) ↓
On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, the patient meets both of the following criteria: 1. Temperature > 38 °C or < 36°C, OR white blood cell count ≥ 12,000 cells/mm3 or ≤ 4,000 cells/mm3 AND 2. A new antimicrobial agent(s) (see Appendix for eligible antimicrobial agents) is started, and is continued for ≥ 4 qualifying antimicrobial days (QAD)
↓ Infection-related Ventilator-Associated Condition (IVAC) ↓
On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met **(taking into account organism exclusions specified in the protocol)**: Possible Ventilator Associated Pneumonia (PVAP) criteria; **Criterion 1**: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds as outlined in protocol, <u>without</u> requirement for purulent respiratory secretions: • Endotracheal aspirate, ≥ 10^5 CFU/ml or corresponding semi-quantitative result • Bronchoalveolar lavage, ≥ 10^4 CFU/ml or corresponding semi-quantitative result • Lung tissue, ≥ 10^4 CFU/g or corresponding semi-quantitative result • Protected specimen brush, ≥ 10^3 CFU/ml or corresponding semi-quantitative result

Criterion 2: Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field [lpf, x100])† PLUS organism identified from one of the following specimens (to include qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet criterion #1):

- Sputum
- Endotracheal aspirate
- Bronchoalveolar lavage
- Lung tissue
- Protected specimen brush

† If the laboratory reports semi-quantitative results, those results must correspond to the quantitative thresholds. See additional instructions for using the purulent respiratory secretions criterion in the VAE Protocol (ref table).

Criterion 3: One of the following positive tests:

- Organism identified from pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
- Lung histopathology, defined as:
  - abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli;
  - evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms);
  - evidence of infection with the viral pathogens listed below based on results of immunohistochemical assays, cytology, or microscopy performed on lung tissue
- Diagnostic test for Legionella species
- Diagnostic test on respiratory secretions for; influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

Possible Ventilator Associated Pneumonia (PVAP)

Notes:

Data entry:

- It is recommended to organize the necessary data elements in a table or spreadsheet to assist in identifying VAEs. There are a number of different ways in which to organize the data
- One may include daily minimum PEEP and FiO2 values, and then, if a VAC event is identified, utilize other data sources to gather information on the data elements included in the IVAC and PVAP definitions.
- Or you may choose to include columns for all data elements (from VAC through PVAP) in a single spreadsheet.
- For most patients under surveillance for VAE, the only data elements you will need to record are the
  - ventilator days,

- minimum daily PEEP, and
- minimum daily FiO2.

- The maximum and minimum daily temperatures and white blood cell counts only need to be recorded for those patients who are identified as having met criteria for VAC.
- The antimicrobial criterion only needs to be assessed for those patients with VAC and with an abnormal temperature or white blood cell count that meets the criteria within the IVAC definition.
- Microbiology and related data elements included as criteria in the PVAP definition only need to be assessed for those patients who have met the IVAC definition.
- Keep in mind that the baseline period of stability or improvement on the ventilator is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO2, and must be characterized by≥ 2 calendar days of stable or decreasing daily minimum FiO2 or PEEP values (specifically the daily minimum PEEP or FiO2 on the second day of the baseline period of stability or improvement must be equal to or less than the daily minimum PEEP or FiO2 on the first day of the baseline period of stability or improvement).
- Keep in mind, too, that PEEP values of 0 to 5 cmH2O are considered equivalent for the purposes of VAE surveillance. This means that any daily minimum value of 0 to 5 cmH2O will be evaluated as if it were 5 cmH2O when determining whether a VAC has occurred or not. Also, the daily minimum PEEP or FiO2 is defined as the lowest setting during a calendar day that is maintained for > 1 hour

Definitions and key words:

- VAE Window Period: This is the period of days around the event date (specifically the day of onset of worsening oxygenation) within which other VAE criteria must be met. It is usually a 5-day period and includes the 2 days before, the day of, and the 2 days after the VAE event date (specifically the first day of worsening oxygenation,

the day of VAE onset). There is an exception, however, in which the VAE Window Period is only 3 or 4 days, as follows:

- New antimicrobial agent: Defined as any agent listed in the Appendix that is initiated on or after the third calendar day of mechanical ventilation AND in the VAE Window Period (specifically,the period typically defined by the 2 calendar days before, the day of, and the 2 calendar days after the onset date of the VAE). The agent is considered new for the purposes of this definition if it was NOT given to the patient on either of the 2 days preceding the current start date.
    - The antimicrobial agent(s) must have been given by one of the routes of administration outlined below (table---), and therapy with one or more new antimicrobial agents must be continued for at least 4 calendar days (referred to as 4 "qualifying antimicrobial days" or "QADs").
    - Qualifying Antimicrobial Day (QAD): A day on which the patient was administered an antimicrobial agent that was determined to be "new" within the VAE Window Period. Four consecutive QADs are needed to meet the IVAC antimicrobial criterion—starting within the VAE Window Period. Days on which a new antimicrobial agent is administered count as QADs. Days between administrations of a new antimicrobial agent also count as QADs as long as there is a gap of no more than 1 calendar day between administrations.

Route of Administration[a]	Definition
Intravenous	An intravascular route that begins with a vein.
Intramuscular	A route that begins within a muscle.
Digestive Tract	A route that begins anywhere in the digestive tract extending from the mouth through rectum.
Respiratory Tract	A route that begins within the respiratory tract, including the oropharynx and nasopharynx.

a. Other routes of administration are excluded (for example, antibiotic locks, intraperitoneal, intraventricular, irrigation, topical).

Excluded organisms and culture or non-culture based microbiologic testing method results that cannot be used to meet the PVAP definition are as follows:

- "Normal respiratory flora," "normal oral flora," "mixed respiratory flora," "mixed oral flora," "altered oral flora" or other similar results indicating isolation of commensal flora of the oral cavity or upper respiratory tract
- Any Candida species or yeast not otherwise specified; any coagulase-negative Staphylococcus species; and any Enterococcus species, when identified from sputum, endotracheal aspirates, bronchoalveolar lavage, or protected specimen brushings specimens. These organisms can be reported as PVAP pathogens if identified from lung tissue or pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
- Typically community acquired respiratory infections: These organisms rarely or are not known to be causes of healthcare-associated infections, they are also excluded, and cannot be used to meet the PVAP definition when isolated from any eligible specimen type (to include lung and pleural fluid): Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis.

Additional instructions for using the purulent respiratory secretions criterion, based on laboratory reporting of respiratory secretion direct examination results

How do I use the purulent respiratory secretions criterion if ..	Instruction
My laboratory reports counts of "white blood cells" or "polymorphonuclear leukocytes" or "leukocytes" rather than counts of "neutrophils"?	Assume that counts of cells identified by these other descriptors (for example, "white blood cells") are equivalent to counts of neutrophils, unless the laboratory tells you this is not the case.
My laboratory reports semi-quantitative results (not quantitative results) for numbers of neutrophils and squamous epithelial cells?	Check with the laboratory to get information about what quantitative ranges the semi-quantitative reports correspond to.
My laboratory cannot provide additional information on how its semi-quantitative reporting corresponds to quantitative reporting ranges for neutrophils and squamous epithelial cells?	Use the following direct examination results to meet the purulent respiratory secretions criterion: heavy, 4+, or ≥25 neutrophils perlow power field (lpf) [x100], AND rare, occasional, few, 1+ or 2+, or ≤10 squamous epithelial cells per lpf [x100]
My laboratory reports only the numbers of neutrophils present, without reporting the number of squamous epithelial cells?	In this situation, the purulent secretions criterion may be met using the specified quantitative and semi-quantitative thresholds for neutrophils alone (specifically heavy, 4+, or ≥25 neutrophils per lpf [x100]).

My laboratory uses different reporting thresholds for neutrophils and squamous epithelial cells (for example, maximum report of ≥ 20 neutrophils per low power field [x100], or minimum report of ≤ 15 squamous epithelial cells per low power field [x100])?	In this situation, the purulent secretions criterion may be met using the laboratory's specified maximum quantitative threshold for neutrophils, and/or minimum quantitative threshold for squamous epithelial cells.
My laboratory processes respiratory specimens such as bronchoalveolar lavage fluid using a centrifugation procedure (for example, "cytospin"), and there is no quantitation or semi-quantitation of neutrophils or white blood cells in the direct examination report?	In this situation, a report indicating the presence of white blood cells, without quantitation, is sufficient to meet the purulent secretions criterion

When hospitals start HAI surveillance for pneumonia it is recommended to start with ventilator associated pneumonia (VAP) surveillance in ICU setting:

- For ventilated adults use the definitions for VAE surveillance
- For ventilated pediatric patients (including neonates) use the PNEU definitions given in Appendix: 3.

Resources:

NHSN 2019. Ventilator-Associated Event (VAE).
https://www.cdc.gov/nhsn/PDFs/pscManual/10-VAE_FINAL.pdf

2.3.4 Surgical Site Infection (SSI)

SSI monitoring requires active, patient-based, prospective surveillance. Concurrent and post-discharge surveillance methods should be used to detect SSIs following inpatient operative procedures and post-discharge surveillance for outpatient operative procedures

Operative procedure:

Takes place during an operation where at least one incision (including laparoscopic approach and cranial Burrholes) is made through the skin or mucous membrane, or reoperation via an incision that was left open during a prior operative procedure

AND

Takes place in an operating theater (OT), defined as a patient care area that met the National Standards for OT construction.

This may include an operating theater, C-section room, interventional radiology room, or a cardiac catheterization lab.

Note: Any SSIs attributable to either primarily closed or non-primarily closed procedures should be reported.

Surgical Site Infection (SSI)	
Criterion	Superficial incisional SSI Must meet the following criteria:
	Date of event occurs within 30 days after any NHSN operative procedure (where day 1 = the procedure date) AND involves only skin and subcutaneous tissue of the incision AND Patient has at least ***one*** of the following: • Purulent drainage from the superficial incision. • Organism(s) identified from an aseptically-obtained specimen from the superficial incision or subcutaneous tissue by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example, not Active Surveillance Culture/Testing (ASC/AST)). • Superficial incision that is deliberately opened by a surgeon, attending physician* or other designee and culture or non-culture based testing of the superficial incision or subcutaneous tissue is not performed AND Patient has at least one of the following signs or symptoms: localized pain or tenderness; localized swelling; erythema; or heat. • Diagnosis of a superficial incisional SSI by the surgeon, attending physician.
Comments	Superficial Incisional SSI: There are two specific types of superficial incisional SSIs: • Superficial Incisional Primary (SIP) – a superficial incisional SSI that is identified in the primary incision in a patient that has had an operation with one or more incisions (for example, C-section incision or chest incision for CBGB) • Superficial Incisional Secondary (SIS) – a superficial incisional SSI that is identified in the secondary incision in a patient that has had an operation with more than one incision (for example, donor site incision for CBGB)
Reporting Instructions for Superficial SSI	The following do not qualify as criteria for meeting the NHSN definition of superficial incisional SSI: • Diagnosis/treatment of cellulitis (redness/warmth/swelling), by itself, does not meet criterion for superficial incisional SSI. Conversely, an incision that is draining or that has organisms identified by culture or non-culture based testing is not considered a cellulitis. • A stitch abscess alone (minimal inflammation and discharge confined to the points of suture penetration). • Circumcision is not an operative procedure. An infected circumcision site in newborns is not an SSI. • An infected burn wound is classified as BURN and is not an SSI. • For an operative procedure, a laparoscopic trocar site is considered a surgical incision and not a stab wound. • A localized stab wound or pin site infection is not considered an SSI; depending on the depth, these infections might be considered either a skin (SKIN) or soft tissue (ST) infection.

Criterion	**Deep incisional SSI:** Must meet the following criteria:
	The date of event for infection occurs within 30 or 90 days after the operative procedure (where day 1 = the procedure date) **AND** Involves deep soft tissues of the incision (for example, fascial and muscle layers) **AND** patient has at least ***one*** of the following: • Purulent drainage from the deep incision. • A deep incision that spontaneously dehisces, or is deliberately opened or aspirated by a surgeon, attending physician **AND** Organism is identified by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example, not Active Surveillance Culture/Testing (ASC/AST) or culture or non-culture based microbiologic testing method is not performed. A culture or non-culture based test from the deep soft tissues of the incision that has a negative finding does not meet this criterion. **AND** Patient has at least ***one*** of the following signs or symptoms: fever (>38°C); localized pain or tenderness. A culture or non-culture based test that has a negative finding does not meet this criterion. • An abscess or other evidence of infection involving the deepincision that is detected on gross anatomical or histopathologic exam, or imaging test.
Comments	There are two specific types of deep incisional SSIs: • **Deep Incisional Primary (DIP)** – a deep incisional SSI that is identified in a primary incision in a patient that has had an operation with one or more incisions (for example, C-section incision or chest incision for CBGB) • **Deep Incisional Secondary (DIS)** – a deep incisional SSI that is identified in the secondary incision in a patient that has had an operation with more than one incision (for example, donor site incision for CBGB)
	Other organ space SSI Must meet the following criteria:
	Date of event for infection occurs within 30 or 90 days after the operative procedure (where day 1 = the procedure date) according to the list in Table ---(below :- for reporting) **AND** Infection involves any part of the body deeper than the fascial/muscle layers, that is opened or manipulated during the operative procedure **AND**

	Patient has at least one of the following: • Purulent drainage from a drain that is placed into the organ/space(for example, closed suction drainage system, open drain, T-tubedrain, CT guided drainage) • Organisms are identified from fluid or tissue in the organ/space bya culture or non-culture based microbiologic testing method whichis performed for purposes of clinical diagnosis or treatment (forexample, not Active Surveillance Culture/Testing (ASC/AST). • An abscess or other evidence of infection involving theorgan/space that is detected on gross anatomical or histopathologicexam, or imaging test evidence suggestive of infection. **AND** meets at least one criterion for a specific organ/space infection site listed in Table –(organ space SSI)

Surveillance Periods for SSI Following Selected NHSN Operative Procedure Categories. Day 1 = the date of the procedure.			
30-day Surveillance			
Category	Operative Procedure	Category	Operative Procedure
AAA	Abdominal aortic aneurysm repair	LAM	Laminectomy
AMP	Limb amputation	LTP	Liver transplant
APPY	Appendix surgery	NECK	Neck surgery
AVSD	Shunt for dialysis	NEPH	Kidney surgery
BILI	Bile duct, liver or pancreatic surgery	OVRY	Ovarian surgery
CEA	Carotid endarterectomy	PRST	Prostate surgery
CHOL	Gallbladder surgery	REC	Rectal surgery
COLO	Colon surgery	SB	Small bowel surgery
CSEC	Cesarean section	SPLE	Spleen surgery
GAST	Gastric surgery	THOR	Thoracic surgery
HTP	Heart transplant	THYR	Thyroid and/or parathyroid surgery
HYST	Abdominal hysterectomy	VHYS	Vaginal hysterectomy
KTP	Kidney transplant	XLAP	Exploratory laparotomy
90 day surveillance			
BRST	Breast surgery	HER	Herniorrhaphy
CARD	Cardiac surgery	HPRO	Hip prosthesis
CBGB	Coronary artery bypass graft with both chest and donor site incisions	KPRO	Knee prosthesis
CBGC	Coronary artery bypass graft with chest incision only	PACE	Pacemaker surgery
CRAN	Craniotomy	PVBY	Peripheral vascular bypass surgery
FUSN	Spinal fusion	VSHN	Ventricular shunt
FX	Open reduction of fracture		

Notes:

Superficial incisional SSIs are only followed for a 30-day period for all procedure types. Secondary incisional SSIs are only followed for a 30-day period regardless of the surveillance period for the primary site.

Other organ space SSI

Specific Sites of an Organ/Space SSI			
Category	Specific Site	Category	Specific Site
BONE	Osteomyelitis	MED	Mediastinitis
BRST	Breast abscess or mastitis	MEN	Meningitis or ventriculitis
CARD	Myocarditis or pericarditis	ORAL	Oral cavity infection (mouth, tongue, or gums)
DISC	Disc space infection	OREP	Deep pelvic tissue infection or other infection of the male or female reproductive tract
EAR	Ear, mastoid infection	PJI	Periprosthetic joint infection
EMET	Endometritis	SA	Spinal abscess/infection
ENDO	Endocarditis	SINU	Sinusitis
GIT	Gastrointestinal (GI) tract infection	UR	Upper respiratory tract, pharyngitis, laryngitis, epiglottitis
IAB	Intraabdominal infection, not specified elsewhere	USI	Urinary System Infection
IC	Intracranial infection	VASC	Arterial or venous infection
JNT	Joint or bursa infection	VCUF	Vaginal cuff infection
LUNG	Other infection of the lower respiratory tract (LUNG)		

Criteria for these sites can be found in the Surveillance Definitions for Specific Types of Infections Specific Sites of an Organ/Space SSI according to CDC/NHSN surveillance definitions for specific types of infection:
https://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf

Data collection:

Review of medical records or surgery clinic patient records

- Admission, readmission, ED, and OR logs
- Patient charts for signs and symptoms of SSI
- Lab, imaging, other diagnostic test reports
- Clinician notes
- Electronic records to prompt further review
- Visit the ICU and wards – talk to primary care staff
    - Surgeon surveys by mail or telephone
    - Patient surveys by mail or telephone (though patients may have a difficult time assessing their infections).
- Date of event (DOE): For an SSI, the date of event is the date when the first element used to meet the SSI infection criterion occurs for the first time during the SSI surveillance period. The date of event must fall within the SSI surveillance period to meet SSI criteria.
- The type of SSI (superficial incisional, deep incisional, or organ/space) reported and the date of event assigned must reflect the deepest tissue level where SSI criteria are met during the surveillance period.
- All elements required to meet an SSI criterion usually occur within a 7-10 day timeframe with no more than 2-3 days between elements. The elements must be relational to each other, meaning you should ensure the elements all associate to the SSI, and this can only happen if elements occur in a relatively tight timeframe. Each case differs based on the individual elements occurring and the type of SSI.
- Secondary BSI Attribution Period for SSI: The secondary BSI attribution period for SSI is a 17-day period that includes the date of event, 3 days prior, and 13 days after. For detailed instructions on determining whether identification of organisms from a

blood specimen represents a secondary BSI, refer to the Secondary BSI Guide remove for now?

- ASA physical status: Assessment by the anesthesiologist of the patient's preoperative physical condition using the American Society of Anesthesiologists' (ASA) Classification of Physical Status. Patient is assigned an ASA score of 1-6 at time of surgery

Diabetes: The NHSN SSI surveillance definition of diabetes indicates that the patient has a diagnosis of diabetes requiring management with insulin or a non-insulin anti-diabetic agent. This includes:

- Patients with "insulin resistance" who are on management with anti-diabetic agents.
- Patients with gestational diabetes.
- Patients who are noncompliant with their diabetes medications.

Duration of operative procedure: The interval in hours and minutes between the Procedure/Surgery Start Time and the Procedure/Surgery Finish Time,

Procedure/Surgery Start Time (PST): Time when the procedure is begun (for example, incision for a surgical procedure).

Procedure/Surgery Finish (PF): Time when all instrument and sponge counts are completed and verified as correct, all postoperative radiologic studies to be done in the OR are completed, all dressings and drains are secured, and the physicians/surgeons have completed all procedure-related activities on the patient. 1.

Emergency operative procedure: A procedure that is documented per the facility'sprotocol to be an Emergency or Urgent procedure.

General anesthesia: The administration of drugs or gases that enter the general circulation and affect the central nervous system to render the patient pain free, amnesic, unconscious, and often paralyzed with relaxed muscles. This does not include conscious sedation.

Non-primary Closure: The closure of the surgical wound in a way which leaves the skin level completely open following the surgery. Closure of any portion of the skin

represents primary closure (see Primary Closure definition below). For surgeries with non-primary closure, the deep tissue layers may be closed by some means (with the skin level left open), or the deep and superficial layers may both be left completely open. Wounds with non-primary closure may or may not be described as "packed" with gauze or other material, and may or may not be covered with plastic, "wound vacs," or other synthetic devices or materials.

Primary Closure: The closure of the skin level during the original surgery, regardless of the presence of wires, wicks, drains, or other devices or objects extruding through the incision. This category includes surgeries where the skin is closed by some means. Thus, if any portion of the incision is closed at the skin level, by any manner, a designation of primary closure should be assigned to the surgery. Note: If a procedure has multiple incision/laparoscopic trocar sites and any of the incisions are closed primarily then the procedure technique is recorded as primary closed.

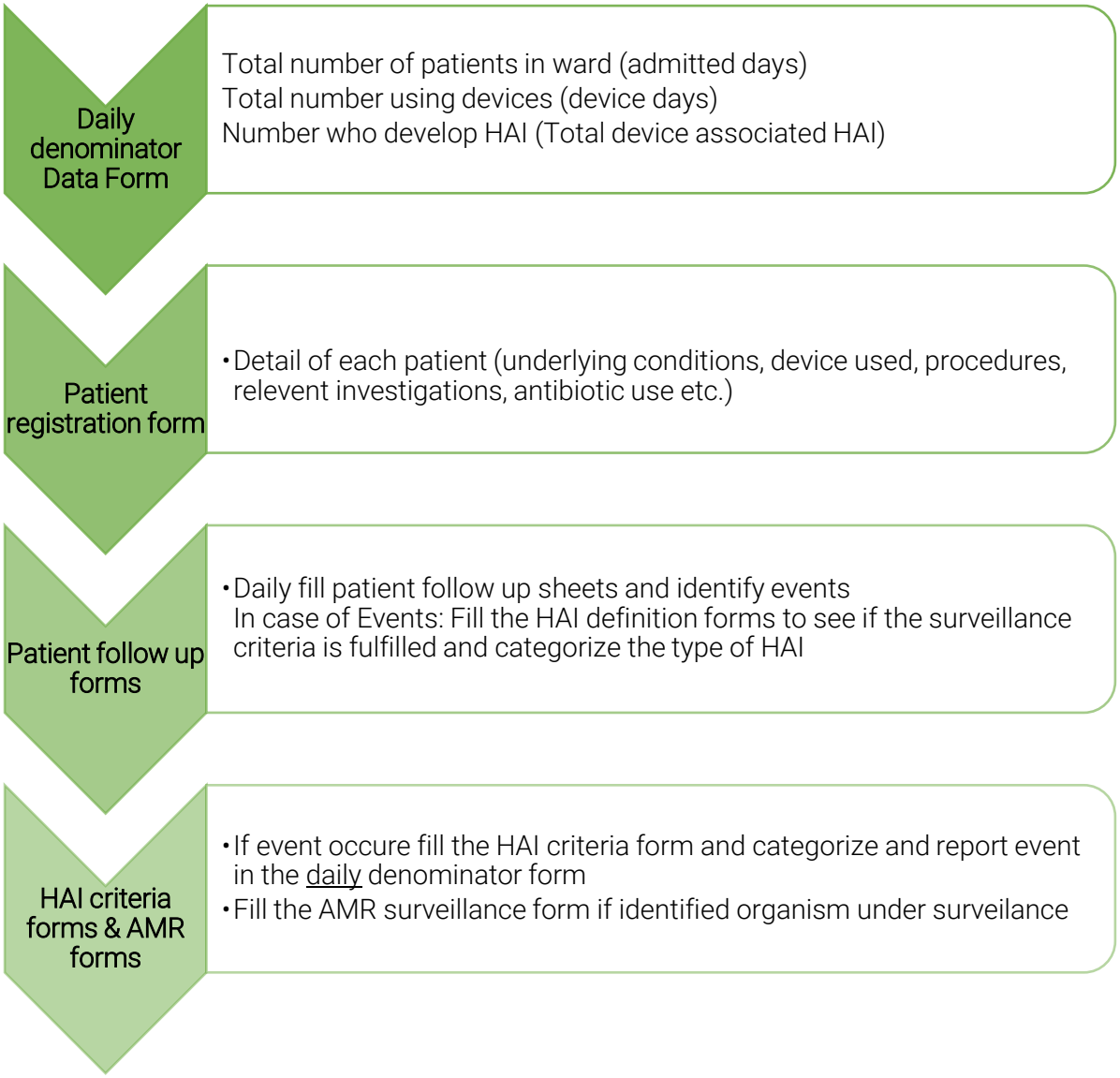
Wound class: An assessment of the degree of contamination of a surgical wound at the time of the operation. Wound class should be assigned by a person involved in the surgical procedure (for example, surgeon, circulating nurse, etc.). The four wound classifications available include Clean, Clean-Contaminated, Contaminated, and Dirty/Infected.

Excluded organisms: Well-known community associated organisms (organisms belonging to the following genera: Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis) and/or organisms associated with latent infections (for example, herpes, shingles, syphilis, or tuberculosis) are excluded from meeting SSI criteria.

Resources:

NHSA 2019. NHSN Surgical Site Infection (SSI) Checklist https://www.cdc.gov/nhsn/pdfs/checklists/ssi-checklist-508.pdf

2.4 PROCESS FLOW FOR HAI SURVEILLANCE IN WARD



Calculate and Analyse

- At the end of the month collect the total number of specific HAI that occurred (numerator) and collect the number of days people have used the devices (denominator-risk population) to calculate the HAI rate
- Rate of AMR can be calculated separately for different organism (either by the laboratory or by location by filling the AMR forms for organisms under surveillance.
- Antibiotic consumption rate can be calculated per patient or per ward/location depending on amount of antibiotic used during the period (numerator) divided by the patient days (denominator) x 100 (refer worked example in DDD calculation section.

2.4.1 Form for adult HAI surveillance

Patient data form- A1 (baseline information and HAI events)

Healthcare associated infection Surveillance: **Form A**: Page 1					
Patient Name:	Hospital no:		Age:	Sex: M/F	ICU/Ward
Department:	Admitting Unit:	DOA:	DOA to ICU:	If transferred from other hospital: name & DOA there: ☐	Admission abroad within 3months prior to DOA ☐ location name & country:
Provisional diagnosis:		Final Diagnosis		Any culture positivity abroad and (SIR) ☐ Not available ☐	
Outcome	Transfer out to ward/unit name & Date:	Discharge on date:	LAMA on:	Expired on:	Referred Abroad location & date:
Underlying disorder:	DM☐	HTN☐	CKD☐	CLD☐	TB☐ Transplantation☐ Immunosuppression ☐
Other underlying disorder:		Severity score: Rapidly fatal ☐ Ultimately fatal (1-4y) ☐ Non-fatal (≥5y) ☐		Neonate: birth weight:__ If PT (<37 wks) GA:____	

Type of surgery: if within 30/90 days	Date of surgery	SP 1	SP 2	SP 3	SSI & Date	SSI Type
					☐	
					☐	
					☐	

Type of device /Intervention	Date of insertion:	Date of removal:	Device days:	Device associated HAI & Date	Criteria fulfilled (ref to HAI diagnostic criteria page)
UC ☐				☐	
CVC ☐ Subclavian☐ Jugular☐ Brachial☐ Femoral☐ Umbilical ☐				☐	
Invasive ventilation				☐	
Tracheostomy				☐	
Intercostal ☐ or surgical site drainage tube ☐				☐ ☐	
Dialysis Sheath				☐	
Other:				☐	

	HAI1	HAI2	HAI3
Type of HAI			
Relevant device used before HAI[1]	Yes ☐ No☐ UK ☐	Yes ☐ No☐ UK ☐	Yes ☐ No☐ UK ☐
Present on admission	Yes ☐ No☐	Yes ☐ No☐	Yes ☐ No☐
Date of onset	--/--/----	--/--/----	--/--/----
Origin of infection	☐ Current hospital ☐ Other hospital ☐Other /UK	☐ Current hospital ☐ Other hospital ☐Other /UK	☐ Current hospital ☐ Other hospital ☐Other /UK
BSI source[2]			
Comment			

Culture site	Sample date	Organism	SIR[3]	SIR[3]	SIR[3]	GP7 :Amikacin	PDR[3]
HAI1:			GP1	GP3	GP5		
			GP2	GP4	GP6		
HAI2:			GP1	GP3	GP5		
			GP2	GP4	GP6		
HAI3			GP1	GP3	GP5		
			GP2	GP4	GP6		

Patient data Form- A2 (antibiotic consumption)

Form A (Page2). HAI surveillance form: Antimicrobial Prescription Weight if available (<15 years): ____

Antibiotic name	Route	Indication	Diagnosis (Site)	Reasons in notes	Started dates	Change? (+reason)	If changed date start first AM	No. of doses per day	Strength /dose	Unit (mg/g/IU/ MU/U)

Route: P: Parenteral, O: oral, R: rectal, I: Inhalation; BSI=blood stream infection
CVC: intravascular catheter that terminates at or close to the heart or in one of the great vessels (Aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common iliac veins, femoral veins, and in neonates, the umbilical artery/vein), which is used for infusion, withdrawal of blood, or hemodynamic monitoring
Indication: Community acquired (CI), Long term care (LI) or acute hospital (HI >48hrs of admission), surgical prophylaxis: SP1: Single dose, SP2: one day, SP3: >1 day: Medical prophylaxis: MP; O: other; Unknown Indication: UI.
Diagnosis see site; only for CI-LI-HI **;** (LI – if such facility available):
Reason in notes: Y/N; changed? (+reason): N=No change; E=escalation; D = De-escalation: S=Switch IV to oral; A= adverse effects, OU=changed due to other /unknown reasons; IF changed, date start first AM (AM = antibiotics) given for the indication: Dose/day e.g. 3 x1; g=grams, mg=milligrams; IU=international units, MU= million IU; **Underlying disease:**
Severity Rapidly fatal: < one year: End-stage haematological malignancies (unsuitable for transplant, or relapsed), heart failure (EF<25%)and end-stage liver disease (unsuitable for transplant with recalcitrant ascites, encephalopathy or varices)**;** Multiple organ failure on intensive care unit –APACHE II score > 30, SAPS II score > 70; Pulmonary disease with cor pulmonale
Ultimately fatal: one year to four years : Chronic leukaemias, myelomas, lymphomas, metastatic carcinoma, end-stage kidney disease (without transplant)**;** Motor neuron disease, multiple sclerosis non-responsive to treatment, Alzheimer's disease/dementia, Diabetes requiring amputation or post amputation
Non-fatal: > five years: Diabetes, Chronic GI, GU conditions, Obstetrics, Infections (including HIV, HCV, HBV –unless in above categories), Carcinoma/haematological malignancy with > 80% five-year survival, Inflammatory disorders, all other diseases

Daily Follow up sheet: Patient daily data form B

Daily FUP-Form B	Name:						Age/sex		Hospital No:				HAI code:		
DOA:	D 1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
Temperature >38°C- < 36°C (only for <1y)															
Hypotension(SBP <90 mmHg adult)															
Age <1 yr Hypothermia1 Apnea2 Bradycardia:3 Lethergy4 Vomiting5															
Adult >70 altered mental status w/o other known cause															
F1O2 minimum maintained >1 hr															
PEEP minimum >1 hr															
FiO2≥0.2) or PEEP ≥3cm H2O(adult)															
Cough 1 (only PNUE) Dyspnea 2 Tachypnea 3															
Suprapubic tenderness-1 Costovertebral angle tenderness-2															
SSI: Discharge 1; Redness2, tender-3 Abscess in site-4															
Others															
TLC enter only if in the range below ≥12000-1 or ≤4000-2 **Age<1yr** ≥15000-3 or 4000-2 with 10% bands-4															
CXR infiltrates:(PNUE)															
Culture specimen sent /received tick															
Urine															
Blood															
Sputum															
Tracheal aspirate															
Pus															
BAL, Tissue, brush specimen															
Purulent sputum (≥25Neu & ≤ 10 sq epi cell)															
other															

2.4.1.1 Denominator Data Collection form for each location

Enter the data for each location in a spread sheet as below:

Daily denominator data form (FORM D)

Ward/ Location: ……Month: …… Year: …… Page no:……

Total bed capacity: …… Comment: Surveyor name:

Note: Date format = dd/mm/yy (enter year only if different years overlap); DOA= Date of admission; DOD=Date of discharge /death; Mark X in comment if death/mention other major event

HAI code	ID no	Name	DOA	DOD	Admitted days	Date of UC	Date of removal UC	Date of CAUTI	# of days UC	Date of CVC insertion	Date of CVC removal	Date of CLABSI	# of days CVC	Date Pt went on	Date pt was taken off ventilator	Date onset of	# of days on
0001																	
0002																	
0003																	
0004																	

Calculated columns:

Denominator: Device days or Bed days Numerator: Number of HAI events

Worked out example

Patient ID	Date of UC	Date of removal UC	Date of CAUTI	# of days UC	Date of CVC insertion	Date of CVC removal	Date of CLABSI	# of days CVC	Date Pt went on ventilator	Date pt was taken off ventilator	Date onset of pneumonia	# of days on ventilator
0001	Jan02	Jan20	20Jan	18	-	-			Jan02	Jan30	Jan 15	28
0002	-	-	-	-	Jan03	Jan08	Jan08	5	-	-	-	
0003	-	-	-	-	Jan 04	Jan 30	Non	26	-	-	-	
0004	Jan05	Jan10	Jan 10	5	-	-	-		Jan 03	Jan 07	non	04
-												
-												
0008	-	-	-		-	-	-		Jan 10	Jan 15	non	5
			02	290			01	310			01	370

To calculate the rates of HAI the columns giving the total number of specific HAI is divided by the total number of device days. No of events/no of device days x 1000

Infection Outcome	Number of events (numerator data)	Population at risk (denominator)	Rate of infection
CAUTI	02	290	2 x 1000= 6.9 per 1000 UC days 290
CLABSI	01	310	01 X 1000 = 3.2 per CVC days 310
VAP	01	370	1 X 1000=2.7 per 1000 ventilator days 370

2.4.1.2 Calculation of surgical site infection rate (SSI)

The numerator is obtained by totaling the number of surgical site infections following a particular operative procedure. The denominator is obtained by totaling the number of patients having undergone that particular procedure over the surveillance period, obtained from the hospital's surgical database.

Denominator data:

Surgical Procedure: (e.g. Cesarean sections)		
Patient ID no:	Date performed	Date of SSI (follow up for 30 or 90 days depending on procedure)
0001		
0002		
0012		
Total	Total number =	Total number of SSI =

Date of Procedure: SSI event date					
Criterion	Criterion met	Date of event	Procedure of Attribution	PATOS	
SIP	☐				
SIS	☐				
DIP	☐				
DIS	☐				
O/S	☐				

SIP= Superficial Incisional Primary; SIS= Superficial incisional Secondary; DIP= Deep Incisional Primary; DIS= Deep Incisional Secondary; O/S= Organ Space; PATOS= Present at the time of surgery

Note:

SSI Event Details: The Infection Window Period (IWP), Present on Admission (POA), Hospital Associated Infection (HAI), and Repeat Infection Time frame (RIT) definitions do not apply to the SSI protocol.

Rates of surgical site infection are presented per 100 procedures in the table below.

SSI rate= _____total SSI following a procedure_____ x 1000
Total number of patients who underwent the same procedure

Type of surgery	Number of SSI following surgery	Number of patients undergoing the	Rate of SSI per 100 procedures
Cesarean section	2	30	2/30 x 100 = 6.7 per 100
Knee replacement	1	10	1/10 x 100 = 10 per 100

Resources:

NHSN (2019). Patient Safety Component Manual Hospital acquired infection surveillance guidelines
https://www.cdc.gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf

3. AMR SURVEILLANCE

Objective: Identify colonization or infections caused by multidrug-resistant organisms (MDROs) according to local epidemiology

3.1 KEY ORGANISMS UNDER SURVEILLANCE AND THE RESISTANT MARKER

For each antimicrobial marker, indicate whether microorganism is susceptible (S), intermediate (I), resistant (R) or susceptibility unknown (UNK):

Gram stain	Organism	Resistant markers/antibiotic class	Antimicrobial (AM)
Gram positive	Staphylococcus Aureus	MRSA VRSA VISA	OXA (Others FOX, CLO, FLC) GLY : VAN, TEC GLY*: VAN, TEC (intermediate)
	Enterococcus species (E. Faecalis & E. Faecium)	VRE	GLY: VAN, TEC
Gram negative	Enterobacteriaceae	C3G CAR (CRE Carbapenem resistant Enterobacteriaceae)	CTX, CRO, CAZ, IMP, MEM, DOR
	Pseudomonas	CAR COL	IMP, MEM, DOR COL
	Acinetobacter	CAR COL	IMP, MEM, DOR COL

Acronym			
Microorganism		Antibiotic	
MRSA	Methicillin Resistant Staphylococcus Aureus	OXA	Oxacillin
VRSA	Vancomycin Resistant Staphylococcus Aureus	VAN TEC	Vancomycin Teicoplanin
VISA	Vancomycin Intermediate Staphylococcus Aureus		
Enterococcus species (VRE)	Enterococcus. Faecium Enterococcus Faecalis	VAN TEC	Vancomycin Teicoplanin
Enterobacteriaceae CRE	Escherichia coli, Klebsiella spp., Enterobacter spp., Proteus pp., Citrobacter spp., Serratia spp., Carbapenem resistant Enterobacteriaceae	C3G CTX CRO CAZ CAR IMP MEM DOR	Cephalosporin Cefotaxime Ceftriaxone Ceftazidime Carbapenems Imipenem Meropenem Doripenem
Pseudomonas spp & Acinetobacter spp.		CAR COL	Carbapenem Colistin

Definition of terms:

Multi drug resistant (MDR): was defined as acquired non-susceptibility to at least one agent in three or more antimicrobial categories,

Extensively drug resistant (XDR): was defined as non-susceptibility to at least one agent in all but two or fewer antimicrobial categories (i.e. bacterial isolates remain susceptible to only one or two categories)

Pan drug resistant (PDR): was defined as non-susceptibility to all agents in all antimicrobial categories

Resistance Unknown (UKN): Resistance data is not available

3.2 CALCULATION OF INCIDENCE DENSITY OF ANTIBIOTIC-RESISTANT ORGANISMS (AROS)

For the numerator, collect total the number of persons both colonized and infected with MRSA and/or VRE or CRE?

As all patients are at risk for colonization or infection with MRSA and/or VRE, the denominator for this rate is the total number of patient days among those admitted to hospital during the surveillance period

Monthly rates of colonization and infection are calculated in addition to quarterly rates, in order to detect increases that will require immediate intervention. The number of days that all patients spent in hospital are collected from the hospital's administrative database and totals this to obtain the denominator for both the monthly and quarterly surveillance rates and can be further analyzed to check for the location of the samples from the hospital data base. Remove any repeat sample of the same patient with the same organism from the analysis.

Worked example AMR surveillance for the month of January.

Patient ID	Date of admission (DOA)	Date of discharge (DOD)	CAR Klebsiella spp	CAR E.coli	CAR Pseudomo-nas spp.	Acinetobact-er spp (CAR)	MRSA cultures	No. of days in hospital
0001	1.1.2007	5.1.07	NEG	NEG	NEG	NEG	NEG	4
0002	1.1.2007	10.02.07	POS	NEG	POS	POS	NEG	9
0003	2.1.2007	20.01.07	NEG	NEG	NEG	POS	POS	18
4500	20.01.07		POS	NEG	NEG	NEG	NEG	10
Total			35					45, 000

Calculate monthly data and quarterly data

Calculated example

Klebsiella spp CAR	No. of laboratory confirmed cases of CAR klebsiella spp.	Total no. of patients days in hospital (for whole hospital or for specific locations)	Rate of colonization/infection
January	35	45, 000	35 x 10, 000 45,000 = 7.8 per 10, 000 patient days
February	40	48, 500	8.3 per 10, 000 patient days
March	37	46, 500	8.0 per 10, 000 patient days
Total	112	140, 000	8.0 per 10, 000 patient days

Diagnosis (site). Diagnosis group by anatomical site: see diagnosis (site) code list for antimicrobial use. Should only be recorded when the indication is 'intention to treat an infection'; not recorded for prophylaxis or other indications (use code NA=not applicable).

Reason in notes: yes/no. Yes if the reason for antimicrobial use was documented in the patient chart/notes.

Date start antimicrobial. Day on which the first dose of the current antimicrobial was administered. If the patient received the antimicrobial on admission, record the date of admission.

Antimicrobial changed? (+ reason). Was the antimicrobial (or the route of administration) changed for this infection episode, and if so, what was the reason? If the antimicrobial was changed more than once for the current infection episode, report the reason of the last change. Changes should be considered for the entire treatment regimen for one infection episode.

- N=no change, antimicrobial was not changed.

- E=escalation: antimicrobial was escalated (or another antimicrobial was added) on microbiological and/or clinical grounds, i.e. the isolated microorganism was not susceptible to the previous antimicrobial and/or lack of clinical effect of previous antimicrobial; includes switch from oral to parenteral for the same antimicrobial.
- D=De-escalation: antimicrobial was de-escalated on microbiological and/or clinical grounds, i.e. the isolated microorganism was susceptible to more narrow-spectrum or first-line antimicrobials than the previous antimicrobial and/or the clinical situation of the patient allows changing to a more narrow-spectrum or to a first-line antimicrobial. If other antimicrobials given for the same indication were stopped at the time of the survey, report de-escalation for the remaining antimicrobial(s).
- S=switch IV to oral; route of administration of same antimicrobial was changed from parenteral to oral. A switch can also occur between antimicrobials belonging to the same antimicrobial class, e.g. IV ampicillin/sulbactam to oral amoxicillin/clavulanate or IV ceftriaxone to oral cefuroxime axetil.
- A=adverse effects; antimicrobial was changed because of observed or expected side or adverse effects of the antimicrobial.
- OU=change for other or unknown reason: the antimicrobial for that indication was changed for another reason, or the antimicrobial was changed but the reason could not be determined by the surveyor.
- U=unknown: no information on whether the antimicrobial was changed or not.

3.3 SURVEILLANCE OF ANTIBIOTIC USE IN HOSPITAL

Most antimicrobial consumption occurs in outpatient and community care. However, in the hospital setting, the density of antimicrobial use is much higher, and highly vulnerable patients are in close spatial proximity, contributing to the increased risk of development and spread of resistant microbial pathogens. The prevalence of antimicrobial treatment varies substantially between hospitals and countries, but it is reported that up to 50% of use is inappropriate or unnecessary. Antimicrobial stewardship represents a key strategy for promoting responsible antimicrobial use. It aims to enhance patient safety and care by improving prescribing practices and providing appropriate antimicrobial treatment. Monitoring of hospital antimicrobial consumption, as an integral part of antimicrobial stewardship programmes

The objectives of surveillance of antimicrobial consumption at facility level are:

- assess the volume and pattern of antimicrobial consumption;
- detect trends and perform comparisons both within and between facilities (e.g. between hospital units or between hospitals);
- identify areas in which remedial actions are needed;
- plan, focus, monitor and evaluate interventions;
- support antimicrobial stewardship activities and provide the basis for setting targets for improving antimicrobial use;

- raise awareness of responsible antimicrobial use;

Prerequisites

Establishing a functional surveillance system in a facility requires:

- commitment of administrative and senior medical leadership; and
- appointment of a person or team to manage and coordinate the local surveillance system; and, if applicable, to act as the contact point for the subnational/national surveillance system.

Tasks

To establish and manage a functional surveillance system, the tasks and responsibilities of the appointed person or team are to:

- define the surveillance objectives;
- determine the surveillance framework;
- create and maintain a register (or procurement catalogue) of the antimicrobial products used in the facility;
- collect consumption and hospital activity (denominator) data;
- validate and analyse data;
- report the data to the relevant staff (e.g. prescribers, antimicrobial stewardship and infection control team, pharmacy and therapeutics committee, and microbiologic laboratory); and
- if applicable, submit the data to a national surveillance system.

Surveillance framework

- the organizational level of data collection (e.g. whole hospital or ward level);
- the hospital sectors to be included (e.g. the whole hospital including inpatient and outpatient, or only inpatients);
- the time intervals and frequency of data collection and analysis (e.g. yearly or quarterly); and
- the antimicrobials to be monitored.

Method

The anatomical therapeutic chemical (ATC)/defined daily dose (DDD) system is used as the basis for the classification of medicines and the calculation of medicines consumption estimates.

ATC system:

- Rrepresents a hierarchy in which medicinal substances are categorized into different groups according to the organ or system on which they act, and their therapeutic, pharmacological and chemical properties.

Defined Daily Dosing (DDD):

- Is used to quantify medicines consumption; it is assigned to each medicinal substance, taking into account the route of administration.
- It represents the average maintenance dose per day of a medicine used for its main indication in adults.
- The DDD is a purely technical unit; it serves as a standard measure for quantification, but does not necessarily reflect the recommended or actual use of the substance in an individual patient.

Note:

The ATC/DDD system is maintained by the WHO Collaborating Centre for Drug Statistics Methodology (WHO CC) and is updated at yearly intervals (15). Since changes in ATC codes or DDD values are possible, it is important that the ATC/DDD version that has been used for the calculations is noted and reported with the data. In particular, the ATC/DDD version must be taken into consideration when comparing data from different time periods (e.g. for the assessment of trends) and from different hospitals or countries. In addition, the surveillance system should be able to accommodate any changes to the ATC/DDD system; for example, by providing the possibility for recalculation of historical data according to the new DDD version.

3.3.1 Measures for the quantification of antimicrobial consumption

Consumption volume is expressed as the number of DDD consumed, and is calculated by dividing the amount of the antimicrobial substance (measured in grams) by the DDD value (in grams) that has been assigned to the respective antimicrobial substance by the WHO CC.

$$\text{Number of DDD} = \frac{\text{Total number of grams of the substance consumed in a defined period of time}}{\text{DDD value of the substance in grams assigned by WHO CC}}$$

The total amount in grams can be obtained in two ways:

- by multiplying the strength of each tablet or vial by the number of items per package and the number of packages consumed; or
- by multiplying the strength of each tablet or vial by the total number of items consumed.

A. Calculation based on the number of packages

$$\text{Number of DDD} = \frac{\text{(number of packages)} \times \text{(package size)} \times \text{(strength per item)}}{\text{DDD assigned by WHO collaborating centre}}$$

Example:

$$\text{Number of DDD} = \frac{50 \text{ packages} \times 20 \text{ tablets} \times 0.5 \text{ g}}{1.5 \text{ g}} = 333.3 \text{ DDD}$$

B. Calculation based on the number of items

$$\text{Number of DDD} = \frac{\text{(number of items)} \times \text{(strength per single item)}}{\text{DDD assigned by WHO collaborating centre}}$$

Example:

$$\text{Number of DDD} = \frac{1000 \text{ tablets} \times 0.5 \text{ g}}{1.5 \text{ g}} = 333.3 \text{ DDD}$$

It is not necessary to provide data on the number and size of packages if data on the number of items (e.g. tablets) is available.

Special cases Combination products

For combinations of antibiotics, the DDD value is specified as unit dose (UD). One tablet or vial of a combination product with a specific strength of each component is defined as a specific number of UDs, representing the DDD. For a specific combination product, to obtain the DDD consumed, the total number of UDs is divided by the assigned UD value. A list of combination products with specified strengths and their assigned DDD values is provided by the WHO Collaborating Centre for Drug Statistics Methodology. For combination products that contain one active and one inactive ingredient, the DDD is ordinarily assigned only to the active ingredient. For example, for amoxicillin/clavulanic acid, the DDD is only assigned to amoxicillin, because clavulanic acid does not have any intrinsic anti-infective activity (the DDD is identical to the DDD of amoxicillin without a beta-lactamase inhibitor). As a result, for the calculation of the number of DDD for amoxicillin/clavulanic acid, the total volume of grams consumed should refer only to the amoxicillin component.

Liquid preparations for oral use The calculation of the consumption volume in DDD of liquid preparations for oral use (e.g. syrups) requires special attention. Because the respective medicinal products are not offered as single doses, the content of the antimicrobial substance of the whole container (e.g. bottle) must be calculated.

3.3.1.1 Worked example for DDD calculation:

Monthly Report of antibiotic use

Medical ward antibiotic consumption for the month of January

Drug description	Units Dispensed	DDD value of substance as per WHO CC	Calculation	DDD
Cefazolin 1 gram vial	300	3.0	1 x 300 / 3	100
Cefuroxime 750 mg vial	128	3.0	0.75 x128 / 3	32
Ciprofloxacin 500 mg tablet	96	1.0	0.5x 96 / 1 = 48	48

$$\text{DDD} = \frac{\text{Total number of grams of substance consumed in a defined period of time}}{\text{DDD value of substance in grams assigned by WHO CC}}$$

Rates:

Obtain the number of days each patient was admitted. By convention, the discharge day for each patient is not counted to avoid the inflation of the denominator by partial days (admission day and discharge day) being counted as full days.

Calculate according to DDD/100 bed days

Obtain the number of admitted days for each patient and get the total e.g. for the month of January in medical ward

Number of patients admitted	Date of admission	Date of Discharge	No. of admitted days
001	1.01.07	20.01.07	19
002	5.01.07	25.01.07	20
003			
005			
080	20.01.07		11
Total			400

Antimicrobial	DDD	Total bed days	Calculations for $\frac{\text{DDD}}{\text{Total Number of bed days}} \times 100$	DDD / 100 bed days
Cefazolin	100	400	100 / 400 x 100	25
Cefuroxime	32	400	32 / 400 x 100	8
Ciprofloxacin	48	400	48 / 400 x 100	12

Calculation of the consumption volume based on the number of packages and the number of items

Example:

The consumption volume of orally administered amoxicillin (medicinal product A) consumed in a surgical ward in 2018 should be calculated as number of defined daily doses (DDD):

- medicinal product A consumed in 2018: 50 packages
- size of the package: 20 tablets
- strength of the single tablet: 0.5 g amoxicillin
- anatomical therapeutic chemical (ATC) code: J01CA04
- route of administration: oral
- WHO DDD (2019): 1.5 g
- number of items: 1000 pieces (50 packages x 20 tablets).

A. Calculation based on the number of packages

$$\text{Number of DDD} = \frac{\text{(number of packages)} \times \text{(package size)} \times \text{(strength per item)}}{\text{DDD assigned by WHO collaborating centre}}$$

Example:

$$\text{Number of DDD} = \frac{50 \text{ packages} \times 20 \text{ tablets} \times 0.5 \text{ g}}{1.5 \text{ g}} = 333.3 \text{ DDD}$$

B. Calculation based on the number of items

$$\text{Number of DDD} = \frac{\text{(number of items)} \times \text{(strength per single item)}}{\text{DDD assigned by WHO collaborating centre}}$$

Example:

$$\text{Number of DDD} = \frac{1000 \text{ tablets} \times 0.5 \text{ g}}{1.5 \text{ g}} = 333.3 \text{ DDD}$$

Example for the calculation of the consumption density

Example: In the hospital intensive care unit (ICU) a total of 2000 DDD of the substance amoxicillin/ clavulanic acid (ATC code J01CR02) have been consumed in 2017 and the total number of patient days for this ICU and year accounts for 10 000 patient days. The consumption density of amoxicillin/clavulanic acid of the ICU for the year 2017 is calculated as follows:

$$\text{Consumption density} = \frac{\text{Number of DDD for time period P multiplied by 100 (1000)}}{\text{Quantity (number) of hospital activity indicator for time period P}}$$

$$\text{Number of DDD} = \frac{2000\ \text{DDD} \times 100}{10\ 000\ \text{patient days}} = 20\ \text{DDD/100 patient days}$$

The scale and level of detail in a data set (granularity of data), which in the context of consumption surveillance relates to the time period of surveillance and hospital units (e.g. whole hospital or single wards) covered. Examples:

1. If the consumption data have been collected for a whole year, the hospital activity data must be collected for the same whole year.
2. If the consumption data have been collected quarterly, the hospital activity data must be collected quarterly.
3. If the consumption data have been collected for the whole hospital, the hospital activity data must be collected for the whole hospital.
4. If the consumption data have been collected on the level of wards or medical specialities or departments, the hospital activity data must be collected accordingly.
5. If the consumption data have been collected confined to certain wards or specialities or departments (e.g. only for high-risk areas in the hospital), the hospital activity data must be collected accordingly.
6. If the consumption data have been collected for acute care wards only, the hospital activity data must be collected accordingly

Example for data entry and calculation of liquid preparations for oral use

Example The medicinal product amoxicillin is an oral liquid form (suspension) with a concentration of 125 mg amoxicillin/5 mL and a bottle content of 100 mL. A total of 70 packages containing five bottles or 350 bottles (items), respectively, have been consumed in the hospital in 2018. The DDD of amoxicillin assigned by WHO is 1.5 g for oral administration.

$$\text{Content of amoxicillin per bottle:} 125\ \text{mg} \times 20 = 2500\ \text{mg/(100 mL (1 bottle))}$$

$$\text{Consumption volume} = \frac{(70\ \text{packages} \times 5\ \text{bottles}) \times 2.5\ \text{g}}{1.5\ \text{g}} = 583\ \text{DDD}$$

Resources:

World Health Organization (2020). Global Antimicrobial Resistance and Use Surveillance System GLASS guide for national surveillance systems for monitoring antimicrobial consumption in hospitals. https://apps.who.int/iris/bitstream/handle/10665/336182/9789240000421-eng.pdf

WHO. Tools and toolkits: Anatomic Therapeutic Chemical (ATC) and Defined Daily Dose (DDD) methodology https://www.who.int/tools/atc-ddd-toolkit

Magiorakos, A. P., Srinivasan, A., Carey, R. B., Carmeli, Y., Falagas, M. E., Giske, C. G., ... & Monnet, D. L. (2012). Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. Clinical microbiology and infection, 18(3), 268-281. https://www.ncbi.nlm.nih.gov/pubmed/21793988)

World Health Organization. (2017). Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, Acinetobacter baumannii and Pseudomonas aeruginosa in health care facilities. World Health Organization. https://apps.who.int/iris/handle/10665/259462. License: CC BY-NC-SA 3.0 IGO

4. APPENDICES

4.1 EXPLANATION OF TERMS AND WORKED OUT EXAMPLES OFOT HAI SURVEILLANCE

Infection window period, Date of Event, POA, HAI, and RIT, Secondary BSI Attribution Period definitions as defined in this chapter do not applyto SSI, VAE, or Lab based Events (Table 1).

Infections occurring in newborns with date of event on hospital day 1 or day 2 are considered POA. Those with date of event on day 3 or later are HAI. This includes infections acquired trans-placentally (for example but not limited to herpes simplex, toxoplasmosis, rubella, cytomegalovirus, or syphilis) or as a result from passage through the birth canal. Exception: See guidance about non-reporting of CLABSIs with Group B Streptococcus during a neonate's first 6 days of life found in the Comments and Reporting Instuctions section of the Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central line-associated Bloodstream Infection) protocol.

If an observation patient is admitted to an inpatient location, the patient must be included in all surveillance events designated in the monthly reporting plan and included in patient and device day counts. The patient is being housed, monitored, and cared for in an inpatient location and therefore is at risk for acquisition of an HAI.

Terms	Definitions	Short explanation
Infective window period*	7-days in which all site specific criteria must be met. Includes the collection date of the first positive diagnostic test that is used as an element to meet the site specific infection criterion, the 3 calendar day before and 3 calendar day after	First positive diagnostic test, 3 days before and 3 days after
Date of event (DOE)*	Date the first element used in meet the site specific criterion occurs for the first time within the seven-day infection window period	Date the first element occurs for the first time
Present on admission (POA)*	Period of POA is defined as the day of admission to inpatient location (admission day 1), the 2 days before admission and the next day of admission (admission day 2)	Event occur within the first 2 days of admission
HCAI*	If the date of event of the site-specific infection criterion occurs on or after	Event occur on or after day 3 of admission

	the 3rd calendar day of admission to an inpatient location	
Repeat infection timeframe (RIT)*	The Repeat Infection Timeframe (RIT) is a 14-day timeframe during which no new infections of the same type are reported.	14 day timeframe after Date of event (date of event = day 1)
Secondary BSI attribution period*	The period in which a blood specimen must be collected for a secondary bloodstream infection to be attributed to a primary site infection. Include the infective window period combined with the repeat infection timeframe. It is 14-17 days in length depending upon date of event.	Infective window period + RIT
Location of attribution (LOA)	The inpatient location where the patient was assigned on the date of event is the location of attribution	Location of the patient on the date of event
Transfer rule (exception to LOA)	If the date of event is on the date of transfer/discharge, or the next day, the infection is attributed to the transferring/discharging location	

Note:

Accurate determination of DOE is critical because DOE is used to determine:

- if an event is HAI or POA
- location of attribution
- device association
- day 1 of the Repeat Infection Timeframe

The Infection Window Period (IWP) is defined as the 7-days during which all site-specific infection criteria must be met. It includes the collection date of the first positive diagnostic test that is used as an element to meet the site-specific infection criterion, the 3 calendar days before and the 3 calendar days after. For purposes of defining the Infection Window Period the following examples are considered diagnostic tests:

Infection Window Period		**3 days before**
	Date of first positive diagnostic test that is used as an element of the site-specific criterion **OR** **In the absence of a diagnostic test, use the date of the first documented localized sign or symptom that is used as an element of the site-specific criterion**	
		3 days after

Date of Event (Event Date):

The Date of Event (DOE) is the date the first element used to meet the site-specific infection criterion occurs for the first time within the seven-day infection window period. An infection is considered Present on Admission (POA) if the date of event of the site-specific infection criterion occurs during the POA time period, which is defined as the day of admission to an inpatient location (calendar day 1), the 2 days before admission, and the calendar day after admission.

For purposes of surveillance and determination of the Repeat Infection Timeframe (as defined below) if the date of event is determined to be either of the two days prior to inpatient admission, then the date of event will be hospital day 1.

Table 3: Date of Event and Classification Determination

Hospital Day	Date of Event Assignment for RIT	Classification
2 days before admit	Hospital Day 1	POA
1 day before admit	Hospital Day 1	
1	Hospital Day 1	
2	Hospital Day 2	
3	Hospital Day 3	HAI
4	Hospital Day 4	
5	Hospital Day 5	

An infection is considered a Healthcare-associated Infection (HAI) if the date of event of the site-specific infection criterion occurs on or after the 3rd calendar day of admission to an inpatient location where day of admission is calendar day 1.

Note: Accurate determination of DOE is critical because DOE is used to determine: if an event is HAI or POA

Location of attribution device association day 1 of the Repeat Infection Timeframe

Table 3: Date of Event and Classification Determination

Hospital Day	Date of Event Assignment for RIT	Classification
2 days before admit	Hospital Day 1	**POA**
1 day before admit	Hospital Day 1	
1	Hospital Day 1	
2	Hospital Day 2	
3	Hospital Day 3	**HAI**
4	Hospital Day 4	
5	Hospital Day 5	

Table 4: Infection Window Period and Date of Event

(Patient age ≤ 65)

Note the date of event is the date the **first** element used to meet the site-specific infection criterion occurs for the **first** time in the infection window period. In the first example, it is day 2, the date the fever occurs for the first time in the infection window period and this results in a POA determination. In the second example it is day 4, the date of the diagnostic test, which is the first element in the infection window period and this results in an HAI determination. Date of event may be, but is not always, the date of the diagnostic test which is used to set the infection window period.

Example 1

HOSPITAL DAY	INFECTION WINDOW PERIOD
1	
2 Date of Event	Fever > 38.0 C
3	
4	**Urine culture:** >100,000 CFU/ ml *E. coli*
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
	SUTI-POA Date of Event = 2 Pathogen = *E. coli*

Example 2

HOSPITAL DAY	INFECTION WINDOW PERIOD
1	
2	
3	
4 Date of Event	**Urine culture**: >100,000 CFU/ml *E. coli*
5	Fever > 38.0 C
6	Fever > 38.0 C
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
	SUTI-HAI Date of Event = 4 Pathogen = *E. coli*

Repeat Infection Timeframe:

The Repeat Infection Timeframe (RIT) is a 14-day timeframe during which no new infections of the same type are reported.

- The RIT applies to both POA and HAI determinations.
- The date of event is Day 1 of the 14-day RIT.
- If criteria for the same type of infection are met and the date of event is within the 14-day RIT, a new event is not identified or reported.
- Additional pathogens recovered during the RIT from the same type of infection are added to the event.
- Note the original date of event is maintained as is the original 14-day RIT.
- Device association determination and location of attribution are not to be amended.

HOSPITAL DAY	RIT	INFECTION WINDOW PERIOD
1		
2		
3		
4	1	**Urine culture:** >100,000 cfu /ml *E. coli*
5	2	Fever > 38.0 C
6	3	Fever > 38.0 C
7	4	
8	5	
9	6	Urine culture: No growth
10	7	
11	8	
12	9	Urine culture: > 100,000 cfu/ml *S. aureus*
13	10	
14	11	
15	12	
16	13	
17	14	
18		
19		
		SUTI-HAI **Date of Event = 4** **Pathogens = *E. coli, S. aureus***

Date of Event is hospital day 4. The 14-day RIT is hospital day 4 through day 17. On hospital day 12, within the RIT, a urine culture with > 100,000 CFU/ml S. aureus is identified. The urine pathogen identified from the hospital day 12 culture is added to the originally identified infection on hospital day 4. Determination of a new infection or continuation of ongoing infection is not required. The original date of event and the RIT are maintained

Notes:

- A patient may have negative cultures during the RIT without impact on the RIT.
- Do not change the device-association determination during the RIT.

- Do not change location of attribution determination during the RIT.

The Secondary BSI Attribution Period*(SBAP) is the period in which a blood specimen must be collected for a secondary bloodstream infection to be attributed to a primary site infection. This period includes the Infection Window Period combined with the Repeat Infection Timeframe (RIT). It is 14-17 days in length depending upon the date of event.

Infection should meet the surveillance definition and

One of the following scenarios must be met:

Scenario 1:

At least one organism from the blood specimen matches an organism identified from the site-specific infection that is used as an element to meet the site-specific infection criterion and the blood specimen is collected in the secondary BSI attribution period.(infection window period + repeat infection timeframe).

OR

Scenario 2:

An organism identified in the blood specimen is an element that is used to meet the site-specific infection criterion, and therefore is collected during the site-specific infection window period.

HOSPITAL DAY	BSI	RIT	INFECTION WINDOW PERIOD
1			
2			
3			
4		1	**Urine culture:** >100,000 cfu/ml *E. coli*
5		2	Fever > 38.0 C
6		3	Fever > 38.0 C
7		4	
8		5	
9		6	
10		7	Blood culture : *E.coli*
11		8	
12		9	Urine culture: > 100,000 cfu/ml *S. aureus*
13		10	
14		11	
15		12	
16		13	
17		14	
18			
19			
			SUTI & Secondary BSI **Date of Event = 4** **Pathogens = *E. coli, S. aureus***

HOSPITAL DAY	BSI	RIT	INFECTION WINDOW PERIOD
1			
2			
3			
4		1	**Chest Imaging:** infiltrate
5		2	Blood Culture: *S. aureus*, Fever > 38.0 C, new onset cough
6		3	Fever > 38.0 C, rales
7		4	
8		5	
9		6	
10		7	
11		8	
12		9	
13		10	
14		11	
15		12	
16		13	
17		14	
18			
19			
			PNEU (PNU2) & Secondary BSI **Date of Event = 4** **Pathogens = *S. aureus***

In the example below (Table 8), the Date of Event is hospital day 4. The 14-day RIT is hospital day 4 through day 17. The secondary BSI Attribution Period is 17 days in length. The blood culture collected on hospital day 5 is used as an element to meet the PNU2 = HAP infection definition and therefore a secondary BSI is identified.

Exception:

Necrotizing enterocolitis (NEC) criteria include neither a site-specific specimen nor organism identified from blood specimen, however an exception for assigning a BSI secondary to NEC is provided.

A BSI is considered secondary to NEC if the patient meets one of the two NEC criteria AND an organism identified from blood specimen collected during the secondary BSI attribution period is an LCBI pathogen, or the same common commensal which is identified from two or more blood specimens drawn on separate occasions collected on the same or consecutive days

Example:

Example 1:

K. pneumoniae is identified in a blood culture during the RIT of a SUTI with K. pneumoniae. The patient is also recovering from COLO surgery performed at your facility in the past week and now has:

Fever > 38.0° C,

Abdominal pain, and

CT showing abdominal abscess

These three elements, when combined with a positive blood culture, meet IAB criterion 3b. If a facility includes both UTI and SSI (for COLO) in their monthly reporting plan, a UTI and SSI will be reported, both with a secondary BSI and with pathogen K. pneumoniae.

Note: As per the SSI protocol, the SSI-IAB does not have an Infection Window Period or RIT. The secondary BSI attribution period is 17 days in duration including the date of event, 3 days prior and 13 days after the date of event.

Infection Window Period
(first positive diagnostic test, 3 days before and 3 days after)

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period
(Infection Window Period + RIT)

Secondary BSI Attribution Period for SSI

Date of Event
(date the first element occurs for the first time within the infection window period)

Hospital Day	BSI	RIT	Infection Window Period	Infection Window Period	BSI -SSI
1					
2					
3					
4		1	**Urine culture**: >100,000 cfu/ml *K. pneumoniae*		
5		2	Fever > 38.0 C		
6		3			
7		4			
8		5		Fever >38.0 C, Abdominal pain	
9		6		CT Scan : Abdominal abscess	
10		7	Blood culture: *K. pneumoniae*	Blood culture: *K. pneumoniae*	
11		8			
12		9			
13		10			
14		11			
15		12			
16		13			
17		14			
18					
19					
20					
21					
22					
23					
			SUTI & Secondary BSI Date of Event = 4 Pathogen: *K. pneumoniae*	**SSI-IAB & Secondary BSI Date of Event = 8 Pathogen: *K. pneumoniae***	

Example 2:

On day 4 of hospital admission, S. aureus is identified in a blood culture meeting the HAI, LCBI 1 criterion. On day 8 the patient has a fever > 38.0° C and E. coli is identified in a urine culture meeting the SUTI definition. On hospital day 13, a blood culture positive for E.coli is identified. Because the blood culture occurs within both the LCBI RIT and the SUTI secondary BSI attribution period, the pathogen, E.coli is assigned to both events.

Infection Window Period
(first positive diagnostic test, 3 days before and 3 days after)

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period
(Infection Window Period + RIT)

Date of Event
(date the first element occurs for the first time within the infection window period)

Hospital Day	RIT	Infection Window Period	Infection Window Period	RIT	BSI
1					
2					
3					
4	1	**Blood culture**: *S. aureus*			
5	2				
6	3				
7	4				
8	5		Fever >38.0 C,	1	
9	6		**Urine culture**: >100,000 cfu / ml *E.coli*	2	
10	7			3	
11	8			4	
12	9			5	
13	10			6	
14	11			7	
15	12			8	
16	13	Blood Culture: *E.coli*	Blood Culture: *E.coli*	9	
17	14			10	
18				11	
19				12	
20				13	
21				14	
22					
		LCBI Date of Event = 4 Pathogen: S. aureus and E.coli	**SUTI & Secondary BSI Date of Event = 8 Pathogen: E.coli**		

Location of attribution

The inpatient location where the patient was assigned on the date of event is the location of attribution. Non-bedded patient locations, (for example Operating Room (OR) or Interventional Radiology (IR) are not eligible for assignment of location of attribution for HAI events. Location of attribution must be assigned to a location where denominator data (for example, patient days, device days) can be collected

Exception to Location of Attribution:

Transfer Rule:

If the date of event is on the date of transfer or discharge, or the next day, the infection is attributed to the transferring/discharging location

Location Example:

Date	Patient Location	Location of Attribution
3/22	Unit A	
3/23	Unit A Unit B	
3/24 **Date of Event**	Unit B	**Unit A**
3/25	Unit B	

Facility Example:

Date	Patient Location	Location of Attribution
3/22	Facility 1	
3/23	Facility 1 Facility 2	
3/24 **Date of Event**	Facility 2	**Facility 1**
3/25	Facility 2	

Multiple Transfers Example:

In instances where a patient has been transferred to more than one location on the date of an infection, or the day before, attribute the infection to the first location in which the patient was housed the day before the infection's date of event.

Date	Patient Location	Location of Attribution
3/22	Unit A	
3/23	Unit A Unit B Unit C	
3/24 **Date of Event**	Unit C Unit D	**Unit A**
3/25	Unit D	

4.2 CAVEATS IN HAI SURVEILLANCE

Assignment of HAI to specific surveillance periods

Infections are typically associated with the date of onset of symptoms. However, in certain cases, infections identified in the current surveillance period may have resulted from an exposure that took place in the previous surveillance period. This is particularly true for SSIs related to joint surgery, where an infection can take up to one year to develop. Case definitions for health care-associated infections should take these factors into account.

How to organize data in electronic format for calculation of rates

The worked out examples in table---show the calculation of HAI rates from data compiled in an electronic spreadsheet/database. Recommended practice is that all health care settings have a computerized system to track and monitor patient/resident surveillance data. This system should also allow for the analysis of infection data or, at a minimum, allow the data to be exported to a statistical analysis program. Where electronic systems are used to store and analyze data, HCAI rates can be calculated with greater ease and efficiency and are less prone to error, provided that the IPC team members have received training in the use of such programs.

Health care settings that do not use specific infection control computer programs should track infections using a spreadsheet or database program (EXCEL). Several simple statistical software packages are available and are compatible with most spreadsheet/database programs. The national AMR committee would give assistance and training regarding data analysis, including use of specific software packages.

How to handle missing data

Occasionally a hospital or long-term care home will encounter missing data in the calculation of their HAI rates. Missing data are common when doing post-discharge surveillance for SSIs, as many patients are lost to follow-up and their infection status will be unknown. There are several ways to deal with surveillance results when some of the data are not available:

If it is unknown whether a patient/resident developed an infection then this person should be excluded from both the numerator and the denominator in rate calculations.

As a general rule, if the number of patients at risk for an infection excluded from a rate exceeds 20 percent because of missing data, then the validity of the rate may be jeopardized.

The rate should be reported with the caveat that “over Xper centof patients at risk were excluded from the rate due to missing observations”.

Hospitals and long-term care homes should keep track of the type of data that is most frequently missing and enhance efforts to ensure the completeness of the data.

Effects of sample size

While HAI rates may be accurately and consistently calculated over time, they may not be very meaningful if the number of events (i.e.,numerator) is small. For example, if there were only two reported SSIs following laminectomy over the course of a year. An increase in the number of laminectomy-associated SSIs (e.g, as few as two or three additional cases)would result in a 50% in the SSI rate (assuming the denominator, or number of procedures, remained constant).ICPs should consider the number of events on which a rate is based when interpreting surveillance rates. A low number of events results in instability in rates of HAI. An epidemiologist/biostatistician can assist in confirming whether there are too few infection events for clinically meaningful differences to be detected.

4.2.1.1 Interpret Infection Rates

IPC team must be able to interpret HAI rates so that they can identify areas where improvements to IPC practices are needed to lower the rate of infection, or to evaluate where preventive interventions have been effective in reducing the risk of infection

As a first step in interpretation of an infection rate, the ICP should ask:

Have the rates been accurately calculated?

It is recommended that all HAI rate calculations be pre-programmed into your computerized system or spreadsheet/database. Calculation of surveillance rates through a computerized system will eliminate some of the potential for the miscalculation of rates and save valuable time.

It is also recommended that another member of the Infection Control Team review, and if necessary re-calculate, the rates using your infection data. If discrepancies in the rates are found, then identification of the area of miscalculation can serve to reinforce methods and provide additional practice in calculation of rates.

Are there any major deviations from previous data? Do the rates make sense?

At this point, the IPC team will notice if a rate deviates substantially from previous surveillance periods. The team may substantiate this statistically through the use of a standard deviation.

- Using standard deviation to assess data
  The standard deviation (SD) of a rate of infection indicates the average spread or dispersion around the mean rate, i.e.,data values will lie somewhere above or below the average that has been calculated from all of the values.
  A rate that is farther than +2 SDs from the mean rate of infection represents an unusual occurrence. The Infection Control Team could seek the assistance of a biostatistician/epidemiologist in calculating the mean rate and standard deviation

to assist them in interpreting whether a difference is substantial, especially when numbers are small, data are not normally distributed or to evaluate changes in processes.

Standard deviation should never be used alone to determine outbreaks. The calculation of the SD should be done using non-outbreak periods of time when HAI rates are within normal limits. Outbreak data should never be used to calculate the standard deviation.

> Example:
>
> After generating monthly rates for MRSA colonization in HOSPITAL A, at the end of a year the IPC team calculates a mean rate of 2 cases per 1,000 resident days. Using the rates from the previous 12 months to calculate the standard deviation results in a standard deviation of 1.
>
> This means that, in any given month, 68.2%of the time the MRSA colonization rate will fall between1 and 3 cases per 1,000 resident days (mean ±1 SD) and 95.5%of the time the MRSA colonization rate will fall between 0 and 4 cases per 1,000 resident days (mean ±2 SD). If ±2 SDis considered acceptable, then only months where the rate was above 4 cases per 1,000 resident days would require investigation.

- Using critical thinking to assess data:
- If no errors are detected in the calculation of a rate and the rate is substantially higher or lower than expected, then the IPC team should ask: do these rates make sense?
  The IPC team members day-to-day activities in case finding provide them with a general idea of the range of frequencies of various types of infections that can be expected in their facility.
  The members can apply this working knowledge to assess whether a particular rate of infection seems reasonable, based on what they have observed in their facility over the surveillance period. Unusually high HAI rates that signify a cluster or outbreak would normally come to the attention of the IPC team members before HAI rates are calculated. If an unusually high rate of infection indicates an outbreak, then the IPC team member should bring this to the immediate attention of the Infection Control Team and implement their outbreak management protocols if required. Substantial deviations in HAI rate from previous surveillance periods that are not explained by an outbreak situation should be investigated by the ICP and Infection Control Team. These differences could indicate:
- changes in hospital practices
- changes in surveillance methodology
- changes to case definitions.

Temporal variations impacting on data

Rates of infection may vary from previous surveillance periods due to changes related to time:

- Seasonal variations -for example, Dengue infections have a low frequency in the dry months but may increase over the rainy months
- Weekly variations -for example, onset of infection over the weekend may not be recognized or confirmed until Monday when patient/resident care and laboratory staffing levels increase, which may result in a higher number of infections being recorded on that day.

These contextual factors should also be considered in interpretation of a surveillance rate. If a health care setting is doing seasonal surveillance (e.g.,influenza surveillance), the same time period must be used each year when doing trend comparisons.

Rate comparison to benchmarks:

Internal rate comparison of the facility should be done routinely and the national IPC committee would be doing external comparison i.e between different Health facilities and with established benchmark such as from NHSN/CDC.

Once the IPC analyze and interpret the data the relevant information should be communicated to the

- Concerned departments in the health care facilities
- Regional and central IPC team according to the protocol

4.2.1.2 Evaluate the Surveillance

Evaluation of the surveillance system is important, and includes review of:

- How efficiently and effectively the surveillance system works (process evaluation)
  - Periodic review of surveillance methods should be done as part of regular Infection Control Committee meetings. These review sessions will provide an opportunity for the Infection Control Team to review case definitions, case finding methods (including number of potential cases missed) and other surveillance procedures to ensure consistency in application.
- How the information produced by a surveillance system is used to reduce the risk of health care-associated infection (outcome evaluation).
- Use the following questions to evaluate how the surveillance system is impacting IPC program and how the information produced from surveillance is used to reduce HAIs in their health care setting
  - Did the surveillance system detect clusters or outbreaks?
  - Which patient/resident care practices were changed based on surveillance data?

- Were data used to assess the efficacy of interventions?
- Were data used to make procedural changes to decrease the endemic rate of infection?
- Is surveillance of this infection still of value (if the number of cases or rate of infection is exceptionally low, then surveillance for the infection may not be warranted)?

Where surveillance data are not used as effectively as they could be to effect changes to practice, the Infection Control Team should examine the underlying reasons for this and if necessary make changes to its surveillance system.

4.2.1.3 Ongoing surveillance system improvement

A surveillance system will undergo continual modification or re-alignment to ensure that it is working towards improved infection prevention and control. Modifications to a surveillance system might include:

Re-assessment of the infections monitored

Changes to the approach to case finding

Ways in which information generated by the system is communicated to other health care providers and decision-makers

At the level of health care facility and national level IPC team should continually monitor and evaluate and improve the surveillance program.

4.3 PERFORMING A BASELINE ASSESSMENT: POINT PREVALENCE SURVEY OF HAI AND ANTIMICROBIAL USE

*https://www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/PPS-HAI-antimicrobial-use-EU-acute-care-hospitals-V5-3.pdf

Point prevalence study on HAI and Antimicrobial use can be done initially in all health care facilities to estimate the priority areas.

4.3.1.1 Objectives

- To estimate the total burden (prevalence) of HAIs and antimicrobial use in a hospital
- To describe patients, invasive procedures, infections and antimicrobials prescribed by type of patients, specialties

- To describe key structures and processes for the prevention of HAIs and antimicrobial resistance at the hospital and ward level
- To disseminate results to those who need to know at local, regional, national level
  - to raise awareness
  - to enhance surveillance structures and skills
  - to identify common problems and set up priorities accordingly
  - to evaluate the effect of strategies and guide policies for the future at the local/regional/ national level (repeated PPS)
- To provide a standardised tool for hospitals to identify targets for quality improvement

4.3.1.2 Inclusion criteria

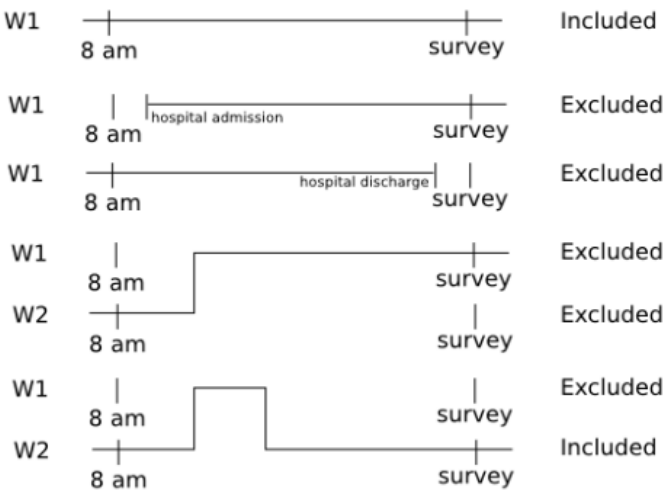
From all the wards in the hospitals /health facilities where inpatients are admitted for more than 48 hours

4.3.1.3 Exclude day cases:

- Patients undergoing same day treatment or surgery;
- Patients seen at outpatient department;
- Patients in the emergency room;
- Dialysis patients (outpatients).

Patients

Include all patients admitted to the ward before or at a particular time (e.g. 8 am) and not discharged from the ward at the time of the survey, in practice, this means that patients transferred in/out after 8 a.m. from/to another ward should not be included (see Figure ----). Include neonates on maternity and paediatric wards if born before/at 8 a.m.



Examples of included and excluded patients in the point prevalence survey

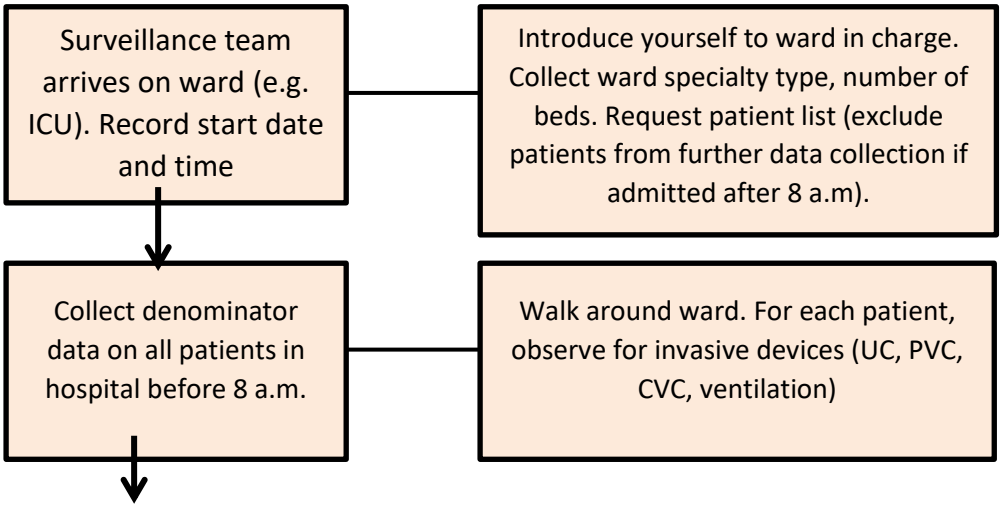
Note: Include patients who are temporarily off from the ward for diagnostic investigations, procedures; if patient does not return to the ward before the end of the PPS day and information about patient is not available at 8 a.m., please revisit ward. Include patients who are on the patient administration system but at home for a number of hours.

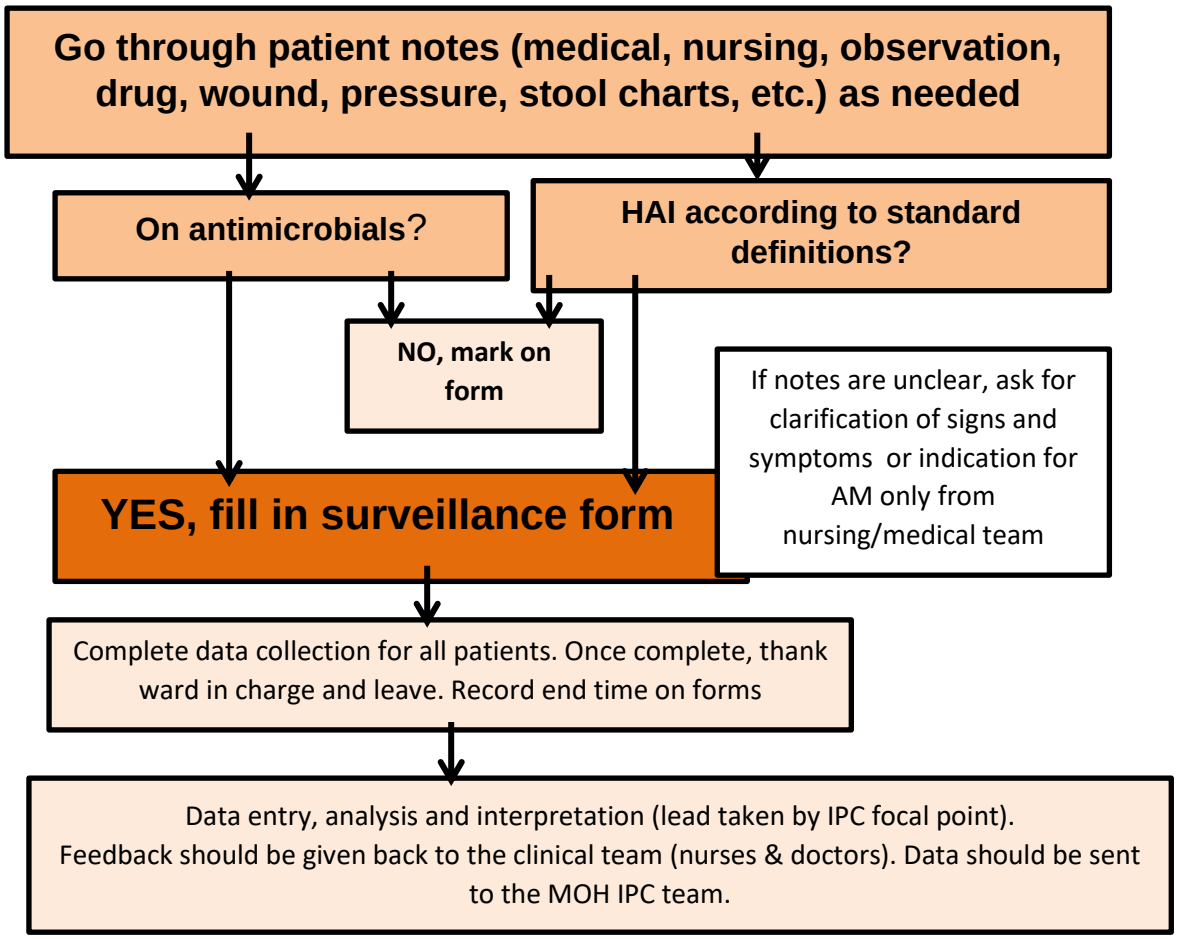
When should the data be collected?

Data should be collected in a single day for each ward/unit. The total time frame for data collection for all wards of a single hospital should not exceed two to three weeks. It is practice in some hospital units to admit additional patients on Sundays for elective procedures; it is therefore recommended to conduct the survey in these units between Monday and Thursdays.

Who will collect the data?

Designated members from Hospital Infection control team.





UC=urinary catheter; PVC=peripheral vascular catheter; CVC=central vascular catheter; AM=antimicrobial

Flow diagram for Point Prevalence Study

4.3.1.4 Case definitions for an active HIA for PPS

Onset of HAI[1]		Case definition
Admission > 2days	AND	Meets the case definition of survey
OR		
Day 1 (day of admission) or Day 2: SSI criteria met at any time after admission (including previous surgery 30 days/90 days).		
OR		
Day 1 or Day 2 AND patient discharged from acute care hospital in preceding 48 hours.		
OR		OR

Day 1 or Day 2 AND patient discharged from acute care hospital in preceding 28 days if CDI[2]present		Patient is receiving treatment AND HAI has previously met the case definition between Day 1 of treatment and survey day.
OR		
Day 1 or Day 2 AND patient has relevant device inserted on this admission prior to onset.		

1. Date of onset of HAI: date of first signs or symptoms of the infection; if unknown, record the date when treatment was started for this infection or the date the first diagnostic sample was taken. If no treatment or sample, please estimate. Not to be recorded if signs/symptoms are present at admission.

2. CDI: Clostridium difficile infection 3Any kind of treatment, not necessarily antimicrobial.

Overview of data collection

Patient based survey

From PPS- D: Denominator data: Data on all patients present in the ward at 8 a.m. and not discharged at the time of the survey

PPS survey date:-----/----/20---- Name of surveyor:

Ward	**Total patients in ward**	**No. on UC**	**No. on CVC**	**No. intubated**	**Post - surgical**	**On systemic AM**	**No. of HCW in ward at the time of PPS**	**Start and end time**
ICU								____ to ____
NICU								
Surgical ward								
Ortho Ward								
Obstetric ward								

Time in 24 hours format.
UC=urinary catheter; PVC=peripheral vascular catheter; CVC=central vascular catheter; AM=antimicrobial; HCW= health care workers; ICU= intensive care unit; NICU=neonatal intensive care unit

PPS survey form:

PART 1 Ward: Date of survey: Start time:

End time: Main Specialty: Surveyor:

S.no	ID no	B.no	Diagnosis & underlying	UC	Date of UC	No. of days UC	CA-UTI	CVC	Date of CVC	No. of days CVC	CLABSI	Intuba-ted	Date of intubation	No. of days intubated	Post sx	Type of Sx	No of days post Sx	SSI n type

Form PPSA: one form per patient (for all patients present in the ward at 8 a.m. and not discharged at the time of the survey) collecting risk factors for each eligible patient, with or without an HAI or antimicrobial; healthcare-associated infection data (to be collected for all patients with an infection that matches the definition of active healthcare-associated infection) and/or antimicrobial use data (to be collected for all patients receiving an antimicrobial agent) are collected on the same form.

Patient form Numerator-A1

Hospital number_____ Ward/Unit_____
Survey date __/___/20__ *(dd/mm/yy)* Surveyor name: _____-
Defined patient survey number_____ Date of hospital admission__/__/20
Age in years___ yrs: Age < 2 years old: _____months: Sex: M / F
Consultant /specialty in charge _____
Surgery since admission:_____
□ No surgery □ Minimally invasive surgery (_____)
□ Other surgery (name_____)
Underlying disorder: _____
Underlying Condition severity:
□ Rapidly fatal (<1 year) □Ultimately fatal (1-4 years) □ non fatal >5 years
If neonate, birth weight (_____) grams

Central vascular catheter	□ No	□ Yes	□ Unk
Peripheral vascular catheter	□ No	□ Yes	□ Unk
Urinary catheter	□ No	□ Yes	□ Unk
Intubation	□ No	□ Yes	□ Unk
Patient on antimicrobials	□ No	□ Yes	If yes go to AMR form
Patient has active HAI	□ No	□ Yes	If yes go to HAI form

Antibiotic name	Route	Indication	Diagnosis (site)	Reason in notes	Start date	Change? (+reason)	If changed (date started first AM)	Number of doses/ day	Strength /dose	Mg/g/IU/MIU
					--/--/--					

Route: P: Parenteral, O: oral, R: rectal, I: Inhalation; **Indication:** Community acquired (CI), Long term care (LI) or acute hospital (HI >48hrs of admission), surgical prophylaxis: single dose SP1, SP2 one day, SP3: >1day: Medical prophylaxis: MP; O: other; Unknown Indication: UI. **Diagnosis** see site list; only for CI-LI-HI **Reason in notes:** Y/N; changed? (+reason): No change: N: E=escalation; D= De-escalation: S=Switch IV to oral; A= adverse effects, OU=changed due to other /unknown reasons; IF changed, date start first AM(AM = antibiotics) given for the indication: Dose/day e.g. 3 x1 g=grams, mg=milligrams; IU=international units, MU= million IU

	HAI 1	HAI2	
Type of HAI			
Relevant device [3]	O Yes O No O UK	O Yes O No O UK	
Present on admission	O Yes O No	O Yes O No O UK	
Date of onset[4]	-- /---/----	-- /---/----	
Origin of infection	O Current hospital O Other hospital O Other origin/UK	O Current hospital O Other hospital O Other origin/UK	
If BSI source[5]			
Lab result (name of microorganism)	AM [6]	SIR	PDR
1.			
2.			
3.			

(3) Relevant device used before onset of infection (intubation for pneumonia (PN), CVC=central vascular catheter/PVC=peripheral vascular catheter for BSI (BSI=Blood stream infection)
(4) Only for infections not present on admission (POA)(dd/mm/year)
(5) C-CVC, C-PVC, S-PUL, S-UTI, S-DIG, S-SSI (surgical site, S-OTH (other) , BSI of (confirmed)unknown origin (UO)
(6) Antibiotics tested : staph aureus OXA (oxacillin) & GLY (glycopyrollate e.g.vancomycin), Enterococcus : AMP= GLY (vancomycin); Enterobactericiae (Klebsiella, Ecoli, Serratia, Enterobacter, Proteus?): C3G (third generation cephalosporin) & CAR (carbapenem meropenem/imepenenam), P. aeruginosa and Acinetobacter spp; CAR,
SIR= susceptibility: S=Susceptible, I=intermediate, R= Resistance, U=Unknown; ESBL=extended spectrum beta lactamase: N=NO, P=possible, C=Confirmed, U=Unknown; PDR=pan drug resistance (resistance to all antimicrobial categories); N, P, C or UK.
If several antibiotics within the group were tested (e.g. carbapenems (CAR)), report the least susceptible result for the group (e.g. meropenem R + imipenem I = CAR R).

Ward specialty: Main ward specialty (≥ 80% of patients requiring this specialty). If fewer than 80%, choose mixed ward (MIX).

Consultant/patient specialty. Specialty of physician in charge of the patient or main specialty for which the patient was admitted to the hospital. If the consultant specialty differs from the patient specialty, give priority to the patient specialty.

Surgery since admission. Patient has undergone surgery during current hospitalisation. Surgery is defined as a procedure performed primarily for therapeutic reasons where an incision is made (not just a needle puncture), with breach of mucosa and/or skin – not necessarily in the operating theatre

Examples of diseases for different underlying condition categories:

Rapidly fatal: < one year

- End-stage haematological malignancies (unsuitable for transplant, or relapsed), heart failure (EF<25%)and end-stage liver disease (unsuitable for transplant with recalcitrant ascites, encephalopathy or varices)
- Multiple organ failure on intensive care unit –APACHE II score > 30, SAPS II score > 70
- Pulmonary disease with cor pulmonale

Ultimately fatal: one year to four years

- Chronic leukaemias, myelomas, lymphomas, metastatic carcinoma, end-stage kidney disease (without transplant)
- Motor neuron disease, multiple sclerosis non-responsive to treatment
- Alzheimer's disease/dementia
- Diabetes requiring amputation or post amputation

Non-fatal: > five years

- Diabetes
- Carcinoma/haematological malignancy with > 80% five-year survival
- Inflammatory disorders
- Chronic GI, GU conditions
- Obstetrics
- Infections (including HIV, HCV, HBV –unless in above categories)
- All other diseases

Patient receives antimicrobial(s). Patient receives at least one systemic antimicrobial agent at the date of the survey (given or planned treatment, including intermittent treatments, e.g. alternate day; or medical prophylaxis); for surgical antimicrobial prophylaxis, check whether any surgical prophylaxis was given in the 24 hours prior to 8 a.m. on the day of the survey; yes/no. If yes, collect antimicrobial use data.

Patient has active HAI. Patient has an active healthcare-associated infection on survey date; yes/no. If yes, collect HAI data.

Notes:

Patient data have to be collected for each patient admitted to the ward at 8 a.m. on the survey date, infected or not, only excluding day cases (see inclusion criteria).

Maternity: both mother and neonate are counted if present at 8 a.m. on the day of the survey.

Neonates: Count all infections after their birth.

Obstetrics: in the case of natural birth with no interventions/procedures/devices, a maternal infection is only considered as an HAI if the date of onset is on day 3 or later.

AM use survey

Diagnosis (site). Diagnosis group by anatomical site: see diagnosis (site) code list for antimicrobial use. Should only be recorded when the indication is 'intention to treat an infection; not recorded for prophylaxis or other indications (use code NA=not applicable).

Reason in notes: yes/no. Yes if the reason for antimicrobial use was documented in the patient chart/notes.

Date start antimicrobial. Day on which the first dose of the current antimicrobial was administered. If the patient received the antimicrobial on admission, record the date of admission.

Antimicrobial changed? (+ reason). Was the antimicrobial (or the route of administration) changed for this infection episode, and if so, what was the reason? If the antimicrobial was changed more than once for the current infection episode, report the reason of the last change. Changes should be considered for the entire treatment regimen for one infection episode.

- N=no change, antimicrobial was not changed.
- E=escalation: antimicrobial was escalated (or another antimicrobial was added) on microbiological and/or clinical grounds, i.e. the isolated microorganism was not susceptible to the previous antimicrobial and/or lack of clinical effect of previous antimicrobial; includes switch from oral to parenteral for the same antimicrobial.
- D=De-escalation: antimicrobial was de-escalated on microbiological and/or clinical grounds, i.e. the isolated microorganism was susceptible to more narrow-spectrum or first-line antimicrobials than the previous antimicrobial and/or the clinical situation of the patient allows changing to a more narrow-spectrum or to a first-line antimicrobial. If other antimicrobials given for the same indication were stopped at the time of the survey, report de-escalation for the remaining antimicrobial(s).
- S=switch IV to oral; route of administration of same antimicrobial was changed from parenteral to oral. Aswitch can also occur between antimicrobials belonging to the

same antimicrobial class, e.g. IVampicillin/sulbactam to oral amoxicillin/clavulanate or IV ceftriaxone to oral cefuroxime axetil.

- A=adverse effects; antimicrobial was changed because of observed or expected side or adverse effects of the antimicrobial.
- OU=change for other or unknown reason: the antimicrobial for that indication was changed for another reason,or the antimicrobial was changed but the reason could not be determined by the surveyor.
- U=unknown: no information on whether the antimicrobial was changed or not.

For each antimicrobial marker, indicate whether microorganism is susceptible (S), intermediate (I), resistant (R) or susceptibility unknown (UNK):

Gram stain	Organism	Resistant markers/antibiotic class	Antimicrobial (AM)
Gram positive	Staphylococcus Aureus	MRSA VRSA VISA	OXA (Others FOX, CLO, FLC) GLY : VAN, TEC GLY*: VAN, TEN (intermediate)
	Enterococcus species (E. Faecalis & E. Faecium)	VRE	GLY: VAN, TEC
Gram negative	Enterobacteriaceae	C3G CAR (CRE Carbapenem resistant Enterobacteriaceae)	CTX, CRO, CAZ, IMP, MEM, DOR
	Pseudomonas	CAR COL	IMP, MEM, DOR COL
	Acinetobacter	CAR COL	IMP, MEM, DOR COL

Acronym			
Microorganism		Antibiotic	
MRSA	Methicillin Resistant Staphyloccocal Aureus	OXA FOX CLO FLC	Oxacillin Cefoxitin Cloxacillin Flucloxacillin
VRSA	Vancomycin Resistant Staphyloccocal Aureus	VAN TEC	Vancomycin Teicoplanin
VISA	Vancomycin Intermediate Staphyloccocal Aureus		
Enterococcus species	Entercoccus. Faecium Entercococcus Faecalis	VAN TEC	Vancomycin Teicoplanin
Enterobateriaceae	Escherichia coli, Klebsiella spp., Enterobacter spp.,	C3G CTX	Cephalosporin Cefotaxime

CRE	Proteuss pp., Citrobacter spp., Serratia spp., Carbapenem resistant enterobacteriaceae	CRO CAZ CAR IMP MEM DOR	Ceftriaxone Ceftazidime Carbapenems Imipenem Meropenem Doripenem
Pseudomonas spp & ,Acinetobacter spp.		CAR COL	Carbapenem Colistin

Note:

Multi drug resistant (MDR): was defined as acquired non-susceptibility to at least one agent in three or more antimicrobial categories,

Extensively drug resistant (XDR): was defined as non-susceptibility to at least one agent in all but two or fewer antimicrobial categories (i.e. bacterial isolates remain susceptible to only one or two categories)

Pan drug resistant (PDR): was defined as non-susceptibility to all agents in all antimicrobial categories

4.4 PAEDIATRIC PATIENTS VENTILATOR ASSOCIATED PNEUMONIA (VAP) SURVEILLANCE

Pneumonia (Ventilator-associated [VAP] and non-ventilator-associated Pneumonia [PNEU]) Event

The PNEU definitions maybe used for both ventilated and non-ventilated neonatal and pediatric patients and for non-ventilated adults patients. For ventilated adults it is recommended to use the VAE definitions.

Settings: Surveillance may occur in any inpatient pediatric location where denominator data can be collected, such as critical/intensive care units (pedICUs), specialty care areas (SCA), step-down units, wards, and long term care unit.

Definitions specific to PNUE surveillance section

Pneumonia (PNEU): is identified by using a combination of imaging, clinical and laboratory criteria. The following section outlines the various criteria that may be used for meeting the surveillance definition of healthcare-associated pneumonia, general comments applicable to all site-specific criteria, and reporting instructions.

Date of event: For a PNEU/VAP the date of event is the date when the first element used to meet the PNEU infection criterion occurred for the first time within the 7-day Infection Window Period.

Ventilator: Any device used to support, assist or control respiration (inclusive of the weaning period) through the application of positive pressure to the airway when delivered via an artificial airway, specifically an oral/nasal endotracheal or tracheostomy tube.

Note: Ventilation and lung expansion devices that deliver positive pressure to the airway (for example: CPAP, Bipap, bi-level, IPPB and PEEP) via non-invasive means (for example: nasal prongs, nasal mask, full face mask, total mask, etc.) are not considered ventilators unless positive pressure is delivered via an artificial airway (oral/nasal endotracheal or tracheostomy tube).

Ventilator-associated pneumonia (VAP): A pneumonia where the patient is on mechanical ventilation for >2 calendar days on the date of event, with day of ventilator placement being Day 1,* AND the ventilator was in place on the date of event or the day before.

*If the ventilator was in place prior to inpatient admission, the ventilator day count begins with the admission date to the first inpatient location.

Guidance for Determination of Eligible Imaging Test Evidence

- If only one imaging test is available, it is acceptable for this to satisfy the imaging requirement for PNEU/VAP-POA determinations regardless of whether the patient has underlying pulmonary or cardiac disease.
- When multiple imaging test results are available, persistence of imaging test evidence of pneumonia is a requirement for all patients not just those with underlying cardiac or pulmonary disease.
- When identifying persistence of imaging test evidence of pneumonia, the second imaging test must occur within seven days of the first but is not required to occur within the Infection Window Period.
- The date of the first eligible imaging test will be utilized when determining if the PNEU/VAP criteria are met within the infection window period. All other elements of PNEU/VAP definition must be present within the infection window period. General Comments

Applicable to All Pneumonia Specific Site Criteria

- Physician’s diagnosis of pneumonia alone is not an acceptable criterion for POA (present on admission) or HAI (healthcare-associated) pneumonia.
- Although specific criteria are included for infants and children and immunocompromised patients, all patients may meet any of the other pneumonia site specific criteria.
- Pneumonia due to gross aspiration (for example, in the setting of intubation in the field, emergency department, or operating room) that meets the PNEU/VAP definition with a date of event during the HAI timeframe is considered healthcare-associated (HAI).
- Multiple episodes of healthcare-associated pneumonia may occur in critically ill patients with lengthy hospital stays. When determining whether to report multiple

episodes of healthcare-associated pneumonia in a single patient, follow the Repeat Infection Timeframe (RIT) guidance i.e. If criteria for the same type of infection are met and the date of event is within the 14-day RIT, a new event is not identified or reported.

- Excluded organisms that cannot be used to meet the PNEU/VAP definition are as follows:
  - "Normal respiratory flora," "normal oral flora," "mixed respiratory flora," "mixed oral flora," "altered oral flora" or other similar results indicating isolation of commensal flora of the oral cavity or upper respiratory tract
  - The following organisms unless identified from lung tissue or pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube):
    - Any Candida species as well as a report of "yeast" that is not otherwise specified
    - Any coagulase-negative Staphylococcus species
    - Any Enterococcus species
- If the excluded pathogens, any Candida species*or yeast not otherwise specified, any coagulase-negative Staphylococcus species, and any Enterococcus species are identified from blood they can only be attributed as a secondary BSI to PNEU if PNU2 or PNU3 is met with a matching organism identified from pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube) or lung tissue and the blood specimen collection date is within the Secondary BSI Attribution Period (SBAP). *The exception to this is any Candida species or yeast not otherwise specified identified from blood can be attributed as a secondary BSI to PNEU if PNU3 is met using the blood and a sputum, endotracheal aspirate, BAL or protected specimen brushing with matching Candida species and both specimens have a collection date in the Infection Window Period.
- Additionally, because organisms belonging to the following genera are typically causes of community-associated infections and are rarely or are not known to be causes of healthcare-associated infections, they are also excluded, and cannot be used to meet definition:
  - Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus, and Pneumocystis.
- Abbreviations used in the PNEU laboratory criteria:
  - BAL–bronchoalveolar lavage
  - EIA–enzyme immunoassay
  - IFA–immunofluorescent antibody
  - LRT–lower respiratory tract
  - PMN–polymorphonuclear leukocyte
  - RIA–radioimmunoassay Reporting Instructions
- There is a hierarchy of specific categories within the major site pneumonia. If the patient meets criteria for more than one specific site during the infection window period or the RIT, report only one:
  - If a patient meets criteria for both PNU1 and PNU2, report PNU2.

- If a patient meets criteria for both PNU2 and PNU3, report PNU3.
- If a patient meets criteria for both PNU1 and PNU3, report PNU3.
- Pathogens and secondary bloodstream infections can only be reported for PNU2 and PNU3 specific events.
- Report concurrent LUNG and PNEU with at least one matching organism(s) as PNEU.

Specific Site Algorithms for Clinically Defined Pneumonia (PNU1)

<table>
<tr><th>Imaging Test Evidence</th><th>Signs/Symptoms/Laboratory</th></tr>
<tr><td rowspan="3">Two or more serial chest imaging test results with at least one of the following:
New and persistent
or
Progressive and persistent
• Infiltrate
• Consolidation
• Cavitation
• Pneumatoceles, in infants ≤1 year old

Note: In patients without underlying pulmonary or cardiac disease (for example: respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive imaging test result is acceptable</td><td>For ANY PATIENT, at least one of the following:
• Fever (>38.0°C or >100.4°F)
• Leukopenia (≤4000 WBC/mm3) or leukocytosis (>12,000 WBC/mm3)
• For adults >70 years old, altered mental status with no other recognized cause
And at least two of the following:
• New onset of purulent sputum or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements
• New onset or worsening cough, or dyspnea, or tachypnea
• Rales or bronchial breath sounds
• Worsening gas exchange (for example: O2 desaturations (for example: PaO2/FiO2<240), increased oxygen requirements, or increased ventilator demand)</td></tr>
<tr><td>ALTERNATE CRITERIA, for infants ≤1 year old:
Worsening gas exchange (for example:2desaturations [for example pulse oximetry <94%], increased oxygen requirements, or increased ventilator demand)
And at least three of the following:
• Temperature instability
• Leukopenia (≤4000 WBC/mm3) or leukocytosis (>15,000 WBC/mm3) and left shift(>10% band forms)
• New onset of purulent sputum3 or change in character of sputum4, or increased respiratory secretions or increased suctioning requirements
• Apnea, tachypnea , nasal flaring with retraction of chest wall or nasal flaring with grunting
• Wheezing, rales, or rhonchi
• Cough
• Bradycardia (<100 beats/min) or tachycardia (>170 beats/min)</td></tr>
<tr><td>ALTERNATE CRITERIA, for child >1 year old or ≤12 years old, at least three of the following:
• Fever (>38. 0°C or >100. 4°F) or hypothermia (<36. 0°C or <96. 8°F)
• Leukopenia (≤4000 WBC/mm3) or leukocytosis (≥15,000 WBC/mm3)
• New onset of purulent sputum or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements
• New onset or worsening cough, or dyspnea, apnea, or tachypnea.
• Rales or bronchial breath sounds
• Worsening gas exchange (for example: O2 desaturations [for example pulse oximetry <94%], increased oxygen requirements, or increased ventilator demand)</td></tr>
</table>

Specific Site Algorithms for Pneumonia with Common Bacterial or Filamentous Fungal Pathogens and Specific Laboratory Findings (PNU2)

Imaging Test Evidence	Signs/Symptoms	Laboratory

Two or more serial chest imaging test results with at least ***one*** of the following:
New and persistent
or
Progressive and persistent
• Infiltrate
• Consolidation
• Cavitation
• Pneumatoceles, in infants ≤1 year old
 	
Note: In patients ***without*** underlying pulmonary or cardiac disease (for example: respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable
	At least ***one*** of the following:
	• Fever (>38.0°C or >100.4°F)
	• Leukopenia (≤4000 WBC/mm3)or leukocytosis (>12,000WBC/mm3)
	• For adults >70 years old, altered mental status with no other recognized cause
	
	And at least ***one*** of the following:
	• New onset of purulent sputum or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements
	• New onset or worsening cough, or dyspnea or tachypnea
	• Rales or bronchial breath sounds
	• Worsening gas exchange (for example: O2 desaturations [for example: PaO2/FiO2 <240],increased oxygen requirements, or increased ventilator demand)
		At least ***one*** of the following:
		• Organism identified from blood
		• Organism identified from pleural fluid
		• Positive quantitative culture or corresponding semi-quantitative culture result from minimally-contaminated LRT specimen (specifically, BAL, protected specimen brushing or endotracheal aspirate)
		• ≥5% BAL-obtained cells contain intracellular bacteria on direct microscopic exam (for example: Gram's stain)
		• Positive quantitative culture or corresponding semi-quantitative culture result of lung tissue
		• Histopathologic exam shows at least ***one*** of the following evidences of pneumonia:
		  ○ Abscess formation or foci of consolidation with intense PMN accumulation in bronchioles and alveoli
		  ○ Evidence of lung parenchyma invasion by fungal hyphae or pseudohyphae

Specific Site Algorithms for Viral, Legionella, and other Bacterial Pneumonias with Definitive Laboratory Findings (PNU2)

Imaging Test Evidence	Signs/Symptoms	Laboratory
Two or more serial chest imaging test results with at least ***one*** of the following: New and persistent or Progressive and persistent • Infiltrate • Consolidation • Cavitation • Pneumatoceles, in infants ≤1 year old Note: In patients ***without*** underlying pulmonary or cardiac disease (for example: respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable.	At least ***one*** of the following: • Fever (>38.0°C or >100.4°F) • Leukopenia (≤4000 WBC/mm3) or leukocytosis (>12,000 WBC/mm3) • For adults >70 years old, altered mental status with no other recognized cause And at least ***one*** of the following: • New onset of purulent sputum or change in character of sputum4, or increased respiratory secretions, or increased suctioning requirements • New onset or worsening cough or dyspnea, or tachypnea • Rales or bronchial breath sounds • Worsening gas exchange (for example: O2 desaturations [for example: PaO2/FiO2 <240],increased oxygen requirements, or increased ventilator demand)	At least ***one*** of the following: • Virus, *Bordetella, Legionella, Chlamydia or Mycoplasma* identified from respiratory secretions or tissue by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example: not Active Surveillance Culture/Testing (ASC/AST). • Fourfold rise in paired sera (IgG) forpathogen (for example: influenza viruses, *Chlamydia*) • Fourfold rise in *Legionella pneumophila* serogroup 1 antibody titerto ≥1:128 in paired acute and convalescent sera by indirect IFA. • Detection of *L. pneumophila* serogroup1 antigens in urine by RIA or EIA

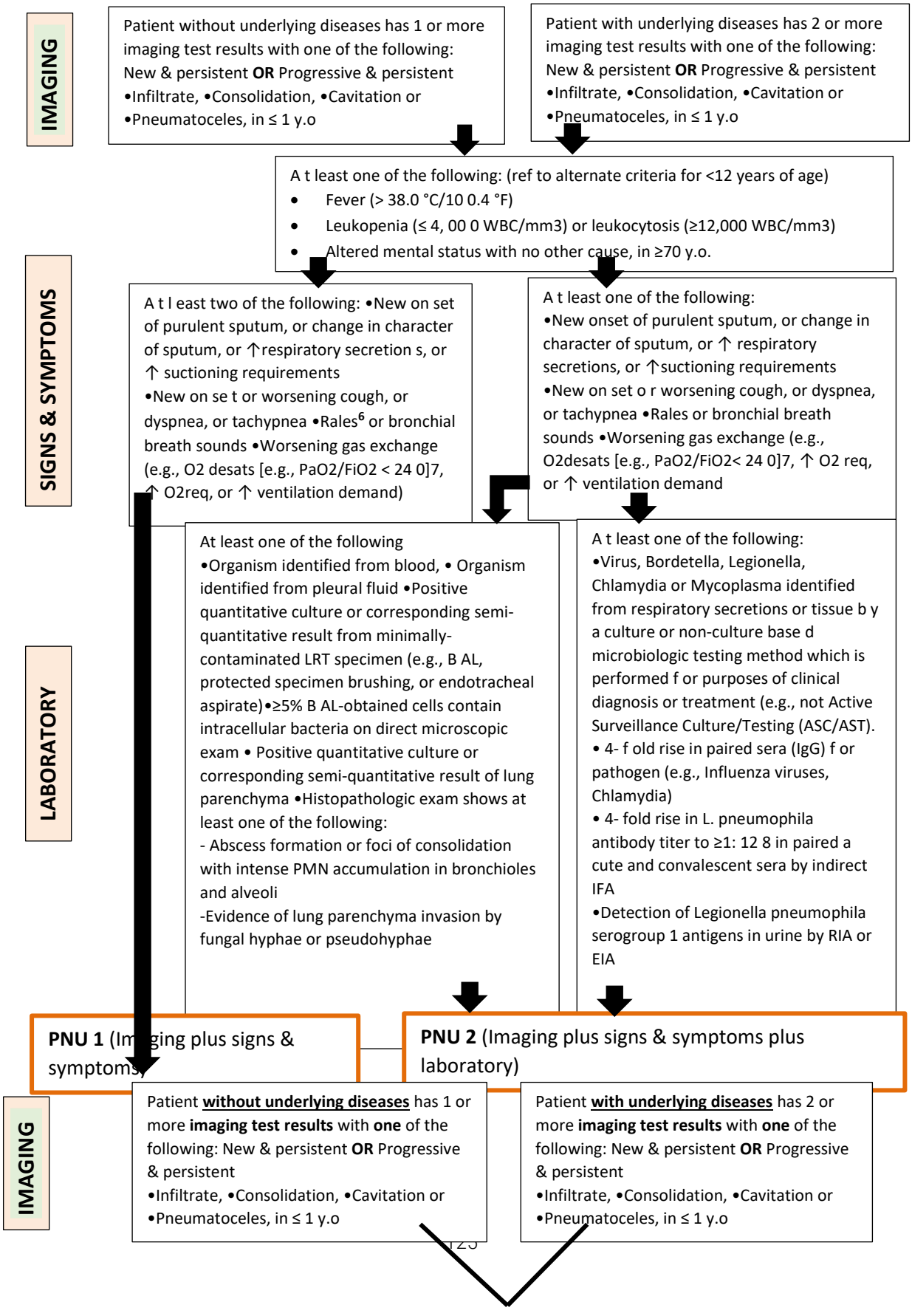
Specific Site Algorithm for Pneumonia in Immunocompromised Patients (PNU3)

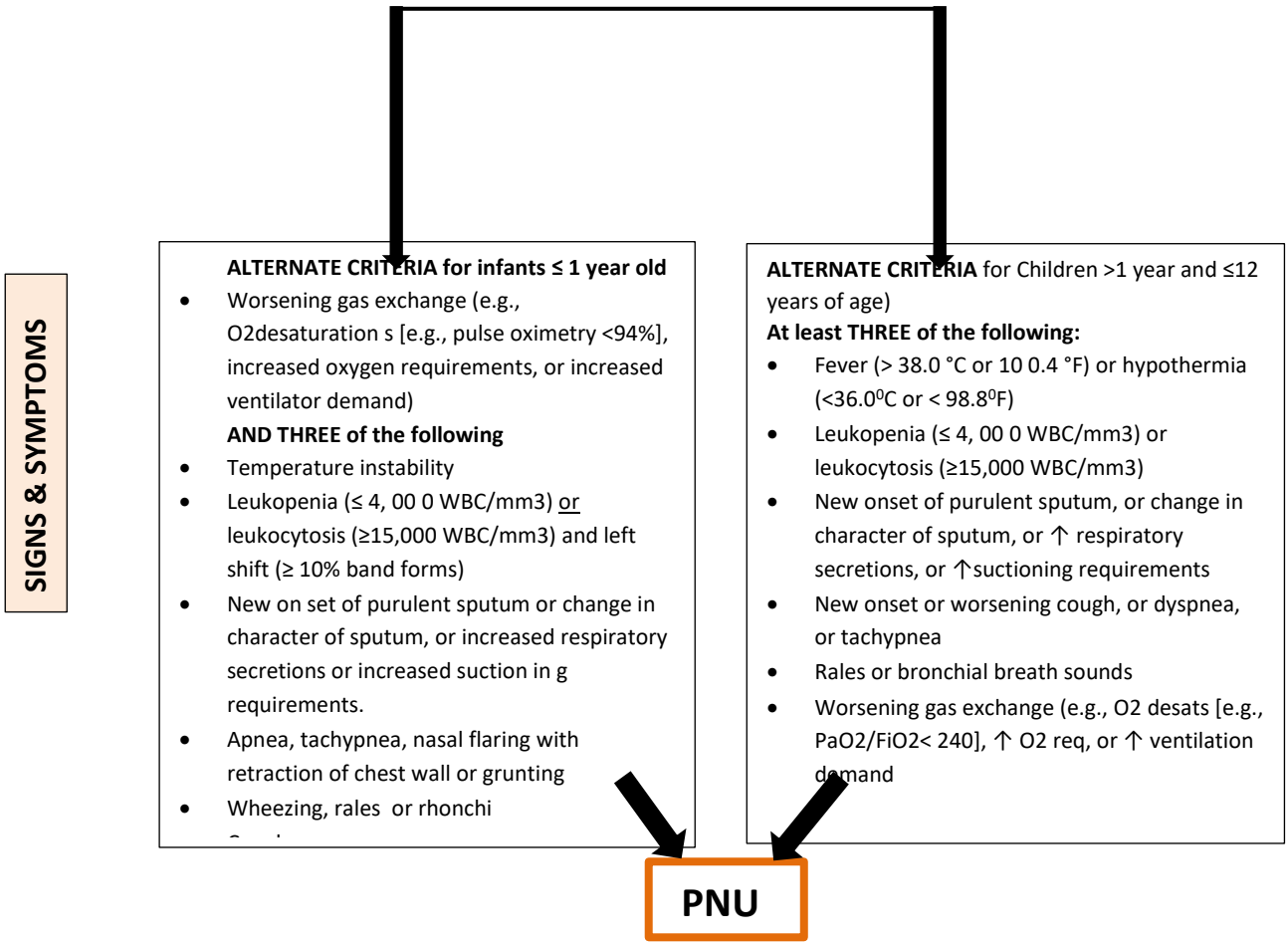
Imaging Test Evidence	Signs/Symptoms	Laboratory
Two or more serial chest imaging test results with at least ***one*** of the following: New and persistent or Progressive and persistent • Infiltrate • Consolidation • Cavitation • Pneumatoceles, in infants ≤1 year old Note: In patients ***without*** underlying pulmonary or	Patient who is immunocompromised (see definition in footnote) has at least ***one*** of the following: • Fever (>38.0°C or >100.4°F) • For adults >70 years old, altered mental status with no other recognized cause • New onset of purulent sputum, or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements	At least ***one*** of the following: • Identification of matching *Candida* spp. from blood and one of the following: sputum, endotracheal aspirate, BAL or protected specimen brushing. • Evidence of fungi from minimally-contaminated LRT specimen (specifically BAL, protected specimen brushing or endotracheal aspirate) from one of the following: ○ Direct microscopic exam

cardiac disease (for example: respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable.	• New onset or worsening cough, or dyspnea, or tachypnea • Rales or bronchial breath sounds • Worsening gas exchange (for example: O2 desaturations [for example: PaO2/FiO2 <240], increased oxygen requirements, or increased ventilator demand) • Hemoptysis • Pleuritic chest pain	○ Positive culture of fungi ○ Non-culture diagnostic laboratory test 1. OR Any of the following from: LABORATORY CRITERIA DEFINED UNDER PNU2

4.4.1.1Pneumonia Flow Diagram for Patients of Any Age for non-immunocompromised patient

(PNEU1 & PNEU2)





Notes:

IMAGING:

- To help confirm difficult cases, multiple imaging test results spanning over several calendar days must be considered when determining if there is imaging test evidence of pneumonia.. Pneumonia may have rapid onset and progression, but does not resolve quickly. Imaging test evidence of pneumonia will persist. Rapid imaging resolution suggests that the patient does not have pneumonia, but rather a non-infectious process such as atelectasis or congestive heart failure.
  - In non-ventilated patients, the diagnosis of healthcare-associated pneumonia may be quite clear on the basis of signs, symptoms and a single definitive chest imaging test result. Therefore, in a patient without underlying pulmonary or cardiac disease and when there is only one imaging test available, if it is an eligible finding, the imaging test evidence requirement can be met.
  - In patients without underlying disease if more than one imaging test is available serial imaging test results must also be evaluated and demonstrate persistence.
  - In patients with underlying disease, serial chest imaging test results must be examined to help separate infectious from non-infectious pulmonary processes. In patients with

pulmonary or cardiac disease (for example: interstitial lung disease or congestive heart failure), the diagnosis of pneumonia may be particularly difficult. For example: Pulmonary edema from decompensated congestive heart failure may simulate the presentation of pneumonia.

- Note that there are many ways of describing the imaging appearance of pneumonia. Examples include, but are not limited to, "air-space disease", "focal opacification", "patchy areas of increased density". Although perhaps not specifically delineated as pneumonia by the radiologist, in the appropriate clinical setting these alternative descriptive wordings should be seriously considered as potentially positive findings. If provided and the findings are not documented as attributed to another issue (for example pulmonary edema, chronic lung disease) they are eligible for meeting imaging test evidence of pneumonia.
- If the imaging test result is equivocal for pneumonia, check to see if subsequent imaging tests are definitive. For example, if a chest imaging test result states infiltrate vs. atelectasis and a subsequent imaging test result is definitive for infiltrate—the initial imaging test would be eligible for use. In the absence of finding a subsequent imaging result that clarifies the equivocal finding, if there is clinical correlation then the equivocal imaging test is eligible for use.

SPUTUM:

- Purulent sputum is defined as secretions from the lungs, bronchi, or trachea that contain >25 neutrophils and <10 squamous epithelial cells per low power field (x100). Refer to the table____(in VAE part) below if your laboratory reports these data semi-quantitatively or uses a different format for reporting Gram stain or direct examination results (for example: "many WBCs" or "few squamous epithelial cells"). This laboratory confirmation is required since written clinical descriptions of purulence are highly variable.
- Change in character of sputum refers to the color, consistency, odor and quantity.

SIGNS AND SYMPTOMS

- In adults, tachypnea is defined as respiration rate >25 breaths per minute. Tachypnea is defined as >75 breaths per minute in premature infants born at <37 weeks gestation and until the 40th week; >60 breaths per minute in patients <2 months old; >50 breaths per minute in patients 2-12 months old; and >30 breaths per minute in children >1 year old.
- Rales may be described as "crackles".
- The measure of arterial oxygenation is defined as the ratio of the arterial tension (PaO2) to the inspiratory fraction of oxygen (FiO2).

LABORATORY

- Coagulase-negative Staphylococcus species, Enterococcus species and Candida species or yeast not otherwise specified that are identified from blood cannot be deemed secondary to a PNEU, unless the organism was also identified from pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling

chest tube) or lung tissue. Identification of matching Candida spp. from blood and sputum, endotracheal aspirate, BAL or protected specimen brushing can be used to satisfy PNU3 definition for immunocompromised patients.

- Refer to threshold values for cultured specimens with growth of eligible pathogens. (Table) Ref to VAE section.
- A specimen that is not obtained through an artificial airway (specifically endotracheal tube or tracheostomy) from a ventilated patient is not considered minimally contaminated and is not eligible for use in meeting the laboratory criteria for PNU2. Sputum or tracheal secretions collected from a non-ventilated patient are not minimally-contaminated specimens.
- Because they are an indication of commensal flora of the oral cavity or upper respiratory tract, the following organisms can only be used to meet PNEU definitions when identified from pleural fluid obtained during thoracentesis or initial placement of chest tube (not from an indwelling chest tube) or lung tissue:
- Coagulase-negative Staphylococcus species
- Enterococcus species
- Candida species or yeast not otherwise specified. Exception: identification of matching Candida spp. from blood and sputum, endotracheal aspirate, BAL or protected specimen brushing can be used to satisfy PNU3 definition for immunocompromised patients.
- Blood specimen and sputum, endotracheal aspirate, BAL or protected specimen brushing specimens must have a collection date that occurs within the Infection Window Period.
- Semi-quantitative or non-quantitative cultures of sputum obtained by deep cough, induction, aspiration, or lavage are acceptable.
- Identification of organism by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example: not Active Surveillance Culture/Testing (ASC/AST).

4.4.2 Pneumonia (PNEU) Checklist

Pneumonia (PNEU) Summary		
Criterion	**Criterion Met**	**Date of Event (DOE)**
PNU1 (patients of any age)	☐	
PNU1 (infants ≤1 year old)	☐	
PNU1 (child >1 year old or ≤12 years old)	☐	
PNU2 (Pneumonia with Common Bacterial or Filamentous Fungal Pathogens and Specific Laboratory Findings)	☐	
PNU2 (Viral, Legionella, and other Bacterial Pneumonias with Definitive Laboratory Findings)	☐	
PNU3 (Immunocompromised Patients)	☐	

Documentation Review Checklist		
Pneumonia 1 (PNU1) **Must meet at least *one* of the following criteria:**		
PNU1: ANY PATIENT, any age group		
Element	**Element Met**	**Date**
Patient has ***one of the following*** found in two or more serial chest imaging test results[1, 2, 14]:		
Either new and persistent **OR** progressive and persistent		
• Infiltrate	☐	
• Consolidation	☐	
• Cavitation	☐	
• Pneumatoceles, in infants ≤1 year old	☐	
*NOTE: In patients **without** underlying pulmonary or cardiac disease (for example, respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable[1].*		
AND Patient has at least ***one*** of the following:		
• Fever (>38.0°C or >100.4°F)	☐	
• Leukopenia (≤4,000 WBC/mm^3)	☐	
• Leukocytosis (≥12,000 WBC/mm^3)	☐	
• Adults ≥70 years old, altered mental status with no other recognized cause	☐	
AND Patient has at least ***two*** of the following:		
• New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements	☐	
• New onset or worsening cough, or dyspnea, or tachypnea[5]	☐	
• Rales[6] or bronchial breath sounds	☐	
• Worsening gas exchange (for example: O_2 desaturations (for example, PaO_2/FiO_2 ≤240)[7], increased oxygen requirements, or increased ventilator demand)	☐	
PNU1: ALTERNATE CRITERIA, for infants ≤1 year old		
Element	**Element Met**	**Date**
Patient has ***one of the following*** found in two or more serial chest imaging test results[1, 2, 14]:		
Either new and persistent **OR** progressive and persistent		
• Infiltrate	☐	
• Consolidation	☐	
• Cavitation	☐	
• Pneumatoceles, in infants ≤1 year old	☐	
*NOTE: In patients **without** underlying pulmonary or cardiac disease (for example, respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable[1].*		
AND Patient has:		
Worsening gas exchange (for example: O_2 desaturations [for example pulse oximetry <94%], increased oxygen requirements, or increased ventilator demand)	☐	
AND Patient has at least ***three*** of the following:		

• Temperature instability	☐	
• Leukopenia (≤4000 WBC/mm3) or leukocytosis (≥15,000 WBC/mm3) and left shift (≥10% band forms)	☐	
• New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions or increased suctioning requirements	☐	
• Apnea, tachypnea[5], nasal flaring with retraction of chest wall or nasal flaring with grunting	☐	
• Wheezing, rales[6], or rhonchi	☐	
• Cough	☐	
• Bradycardia (<100 beats/min) or tachycardia (>170 beats/min)	☐	

PNU1: ALTERNATE CRITERIA, for child >1 year old or ≤12 years old		
Element	**Element Met**	**Date**
Patient has ***one of the following*** found in two or more serial chest imaging test results[1, 2, 14]:		
Either new and persistent **OR** progressive and persistent		
• Infiltrate	☐	
• Consolidation	☐	
• Cavitation	☐	
*NOTE: In patients **without** underlying pulmonary or cardiac disease (for example, respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable[1].*		
AND Patient has at least ***three*** of the following:		
• Fever (>38. 0°C or >100. 4°F) or hypothermia (<36. 0°C or <96. 8°F)	☐	
• Leukopenia (≤4000 WBC/mm^3) or leukocytosis (≥15,000 WBC/mm^3)	☐	
• New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements	☐	
• New onset or worsening cough, or dyspnea, apnea, or tachypnea[5]	☐	
• Rales[6] or bronchial breath sounds	☐	
• Worsening gas exchange (for example: O_2 desaturations [for example pulse oximetry <94%], increased oxygen requirements, or increased ventilator demand)	☐	
Notes/Comments:		

Documentation Review Checklist		
Pneumonia 2 (PNU2)		
PNU2: Specific Site Algorithms for Pneumonia with Common Bacterial or Filamentous Fungal Pathogens and Specific Laboratory Findings		
Element	**Element Met**	**Date**
Patient has ***one of the following*** found in two or more serial chest imaging test results[1, 2, 14]:		
Either new and persistent **OR** progressive and persistent		
• Infiltrate	☐	
• Consolidation	☐	
• Cavitation	☐	
• Pneumatoceles, in infants ≤1 year old	☐	
*NOTE: In patients **without** underlying pulmonary or cardiac disease (for example, respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable[1].*		
AND Patient has at least ***one*** of the following:		
• Fever (>38.0°C or >100.4°F)	☐	
• Leukopenia (≤4,000 WBC/mm^3)	☐	
• Leukocytosis (≥12,000 WBC/mm^3)	☐	
• Adults ≥70 years old, altered mental status with no other recognized cause	☐	
AND Patient has at least ***one*** of the following:		
• New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements	☐	
• New onset or worsening cough, or dyspnea, or tachypnea[5]	☐	
• Rales[6] or bronchial breath sounds	☐	
• Worsening gas exchange (for example: O_2 desaturations (for example, PaO_2/FiO_2 ≤240)[7], increased oxygen requirements, or increased ventilator demand)	☐	
AND Patient has at least ***one*** of the following:		
• Organism identified from blood[8,13]	☐	
• Organism identified from pleural fluid[9,13]	☐	
• Positive quantitative culture or corresponding semi-quantitative culture result[9] from minimally-contaminated LRT specimen (specifically BAL, protected specimen brushing, or endotracheal aspirate)	☐	
• ≥5% BAL-obtained cells contain intracellular bacteria on direct microscopic exam (for example: Gram's stain)	☐	
• Positive quantitative culture or corresponding semi-quantitative culture result[9] of lung tissue	☐	
• Histopathologic exam shows at least ***one*** of the following evidences of pneumonia:		
○ Abscess formation or foci of consolidation with intense PMN accumulation in bronchioles and alveoli	☐	
○ Evidence of lung parenchyma invasion by fungal hyphae or pseudohyphae	☐	
Notes/Comments:		

Documentation Review Checklist		
Pneumonia 2 (PNU2)		
PNU2: Specific Site Algorithms for Viral, Legionella, and other Bacterial Pneumonias with Definitive Laboratory Findings		
Element	**Element Met**	**Date**
Patient has ***one of the following*** found in two or more serial chest imaging test results[1, 2, 14]:		
Either new and persistent **OR** progressive and persistent		
• Infiltrate	☐	
• Consolidation	☐	
• Cavitation	☐	
• Pneumatoceles, in infants ≤1 year old	☐	
*NOTE: In patients **without** underlying pulmonary or cardiac disease (for example, respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable[1].*		
AND Patient has at least ***one*** of the following:		
• Fever (>38.0°C or >100.4°F)	☐	
• Leukopenia (≤4,000 WBC/mm^3)	☐	
• Leukocytosis (≥12,000 WBC/mm^3)	☐	
• Adults ≥70 years old, altered mental status with no other recognized cause	☐	
AND Patient has at least ***one*** of the following:		
• New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements	☐	
• New onset or worsening cough, or dyspnea, or tachypnea[5]	☐	
• Rales[6] or bronchial breath sounds	☐	
• Worsening gas exchange (for example: O_2 desaturations (for example, PaO_2/FiO_2 ≤240)[7], increased oxygen requirements, or increased ventilator demand)	☐	
AND Patient has at least ***one*** of the following:		
• Virus, *Bordetella, Legionella, Chlamydia,* or *Mycoplasma* identified from respiratory secretions or tissue by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example: not Active Surveillance Culture/Testing (ASC/AST))	☐	
• Fourfold rise in paired sera (IgG) for pathogen (for example: influenza viruses, *Chlamydia*)	☐	
• Fourfold rise in *Legionella pneumophila* serogroup 1 antibody titer to ≥1:128 in paired acute and convalescent sera by indirect IFA	☐	
• Detection of *L. pneumophila* serogroup 1 antigens in urine by RIA or EIA	☐	
Notes/Comments:		

Documentation Review Checklist		
Pneumonia 3 (PNU3)		
PNU3: Specific Site Algorithms for Pneumonia in Immunocompromised Patients		
Element	**Element Met**	**Date**
Patient has ***one of the following*** found in two or more serial chest imaging test results[1, 2, 14]:		
Either new and persistent **OR** progressive and persistent		
• Infiltrate	☐	
• Consolidation	☐	
• Cavitation	☐	
• Pneumatoceles, in infants ≤1 year old	☐	
*NOTE: In patients **without** underlying pulmonary or cardiac disease (for example, respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable[1].*		
AND Patient is immunocompromised[10]	☐	
AND Patient has at least ***one*** of the following:		
• Fever (>38.0°C or >100.4°F)	☐	
• Adults ≥70 years old, altered mental status with no other recognized cause	☐	
• New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements	☐	
• New onset or worsening cough, or dyspnea, or tachypnea[5]	☐	
• Rales[6] or bronchial breath sounds	☐	
• Worsening gas exchange (for example: O_2 desaturations [for example: PaO_2/FiO_2 ≤240][7], increased oxygen requirements, or increased ventilator demand)	☐	
• Hemoptysis	☐	
• Pleuritic chest pain	☐	
AND Patient has at least ***one*** of the following:		
• Identification of matching *Candida* spp. from blood and one of the following: sputum, endotracheal aspirate, BAL, or protected specimen brushing[11,12,13]	☐	
• Evidence of fungi (excluding any Candida and yeast not otherwise specified) from minimally-contaminated LRT specimen (specifically BAL, protected specimen brushing, or endotracheal aspirate) from one of the following: ○ Direct microscopic exam ○ Positive culture of fungi ○ Non-culture diagnostic laboratory test	☐	
OR Any of the following from:		
• **LABORATORY CRITERIA DEFINED UNDER PNU2**	☐	
Notes/Comments:		

Footnotes to Algorithms:

1. To help confirm difficult cases, multiple imaging test results spanning over several calendar days must be considered when determining if there is imaging test evidence of pneumonia. Pneumonia may have rapid onset and progression but does not resolve quickly. Imaging test evidence of pneumonia will persist. Rapid imaging resolution suggests that the patient does not have pneumonia, but rather a non-infectious process such as atelectasis or congestive heart failure.
    a. In non-ventilated patients, the diagnosis of healthcare-associated pneumonia may be quite clear on the basis of signs, symptoms and a single definitive chest imaging test result. Therefore, in a patient without underlying pulmonary or cardiac disease and when there is only one imaging test available, if it is an eligible finding, the imaging test evidence requirement can be met.
    b. In patients without underlying disease if more than one imaging test is available serial imaging test results must also be evaluated and demonstrate persistence.
    c. In patients with underlying disease, serial chest imaging test results must be examined to help separate infectious from non-infectious pulmonary processes. In patients with pulmonary or cardiac disease (for example, interstitial lung disease or congestive heart failure), the diagnosis of pneumonia may be particularly difficult. For example: Pulmonary edema from decompensated congestive heart failure may simulate the presentation of pneumonia.
2. Note that there are many ways of describing the imaging appearance of pneumonia. Examples include, but are not limited to, “air-space disease”, “focal opacification”, “patchy areas of increased density”. Although perhaps not specifically delineated as pneumonia by the radiologist, in the appropriate clinical setting these alternative descriptive wordings should be seriously considered as potentially positive findings. If provided and the findings are not documented as attributed to another issue (for example pulmonary edema, chronic lung disease) they are eligible for meeting imaging test evidence of pneumonia.
3. Purulent sputum is defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field (x100). Refer to the table below if your laboratory reports these data semi-quantitatively or uses a different format for reporting Gram stain or direct examination results (for example, “many WBCs” or “few squamous epithelial cells”). This laboratory confirmation is required since written clinical descriptions of purulence are highly variable.

How do I use the purulent respiratory secretions criterion if …	Instruction
My laboratory reports counts of "white blood cells" or "polymorphonuclear leukocytes" or "leukocytes" rather than counts of "neutrophils"?	Assume that counts of cells identified by these other descriptors (for example, "white blood cells") are equivalent to counts of neutrophils, unless the laboratory tells you this is not the case.
My laboratory reports semi-quantitative results (not quantitative results) for numbers of neutrophils and squamous epithelial cells?	Check with the laboratory to get information about what quantitative ranges the semi-quantitative reports correspond to.
My laboratory cannot provide additional information on how its semi-quantitative reporting corresponds to quantitative reporting ranges for neutrophils and squamous epithelial cells?	Use the following direct examination results to meet the purulent respiratory secretions criterion: many, heavy, numerous, 4+, or ≥ 25 neutrophils per low power field (lpf) [x100], AND no, rare, occasional, few, 1+ or 2+, or ≤ 10 squamous epithelial cells per lpf [x100].
My laboratory reports only the numbers of neutrophils present, without reporting the number of squamous epithelial cells?	In this situation, the purulent secretions criterion may be met using the specified quantitative and semi-quantitative thresholds for neutrophils alone (specifically many, heavy, numerous, 4+, or ≥ 25 neutrophils per lpf [x100]).
My laboratory uses different reporting thresholds for neutrophils and squamous epithelial cells (for example, maximum report of ≥ 20 neutrophils per low power field [x100], or minimum report of ≤ 15 squamous epithelial cells per low power field [x100])?	In this situation, the purulent secretions criterion may be met using the laboratory's specified maximum quantitative threshold for neutrophils, and/or minimum quantitative threshold for squamous epithelial cells.
My laboratory processes respiratory specimens such as bronchoalveolar lavage fluid using a centrifugation procedure (for example, "cytospin"), and there is no quantitation or semi-quantitation of neutrophils or white blood cells in the direct examination report?	In this situation, a report indicating the presence of white blood cells, without quantitation, is sufficient to meet the purulent secretions criterion.

4. Change in character of sputum refers to the color, consistency, odor and quantity.
5. In adults, tachypnea is defined as respiration rate >25 breaths per minute. Tachypnea is defined as >75 breaths per minute in premature infants born at 60 breaths per minute in patients 50 breaths per minute in patients 2-12 months old; and >30 breaths per minute in children >1 year old.
6. Rales may be described as "crackles".
7. This measure of arterial oxygenation is defined as the ratio of the arterial tension (PaO2) to the inspiratory fraction of oxygen (FiO2).
8. Any coagulase-negative Staphylococcus species, any Enterococcus species and any Candida species or yeast not otherwise specified that are identified from blood cannot be deemed secondary to a PNEU, unless the organism was also identified from pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube) or lung tissue. This applies when meeting PNU2 or when meeting PNU3 with the laboratory findings found in PNU2. Identification of matching Candida spp. from blood and sputum, endotracheal aspirate, BAL, or protected specimen brushing with specimen collection dates in the same IWP (see footnote 11) can be used to satisfy PNU3 definition for patients meeting the immunocompromised definition (see footnote 10).
9. Refer to threshold values for cultured specimens with growth of eligible pathogens as in table below. Notes:

a. A specimen that is not obtained through an artificial airway (specifically endotracheal tube or tracheostomy) is not considered minimally contaminated and is not eligible for use in meeting the laboratory criteria for PNU2. Sputum or tracheal secretions collected from a non-ventilated patient are not minimally contaminated specimens.
b. The following organisms can only be used to meet PNEU definitions when identified from pleural fluid obtained during thoracentesis or initial placement of chest tube (not from an indwelling chest tube) or lung tissue:
c. Any coagulase-negative Staphylococcus species
d. Any Enterococcus species
e. Any Candida species or yeast not otherwise specified. Exception: identification of matching Candida spp. from blood and sputum, endotracheal aspirate, BAL, or protected specimen brushing with specimen collection dates in the same IWP can be used to satisfy PNU3 definition for immunocompromised patients (see footnote 10).

Table 5: Threshold values for cultured specimens used in the diagnosis of pneumonia

Specimen collection/technique	Values*
Lung tissue†	≥10^4 CFU/g tissue
Bronchoscopically (B) obtained specimens	
Bronchoalveolar lavage (B-BAL)	≥10^4 CFU/ml
Protected BAL (B-PBAL)	≥10^4 CFU/ml
Protected specimen brushing (B-PSB)	≥10^3 CFU/ml
Nonbronchoscopically (NB) obtained (blind)specimens	
NB-BAL	≥10^4 CFU/ml
NB-PSB	≥10^3 CFU/ml
Endotracheal aspirate (ETA)	≥10^5 CFU/ml

CFU = colony forming units g = gram ml = milliliter *Consult with your laboratory to determine if reported semi-quantitative results match the quantitative thresholds. In the absence of additional information available from your laboratory, a semi-quantitative result of “moderate” or “heavy” or “many” or “numerous” growth, or 2+, 3+ or 4+ growth is considered to correspond. †Open-lung biopsy specimens and immediate post-mortem specimens obtained by transthoracic or transbronchial biopsy

- Immunocompromised patients include only
- those with neutropenia defined as absolute neutrophil count or total white blood cell count <500/mm3
- those with leukemia, lymphoma or who are HIV positive with CD4 count <200
- those who have undergone splenectomy
- those who have a history of solid organ or hematopoietic stem cell transplant
- those on cytotoxic chemotherapy

- those on enteral or parenteral administered steroids (exclude inhaled and topical steroids) daily for >2 weeks on the date of event
- Blood specimen and sputum, endotracheal aspirate, BAL, or protected specimen brushing specimens must have a collection date that occurs within the Infection Window Period.
- Semi-quantitative or non-quantitative cultures of sputum obtained by deep cough, induction, aspiration, or lavage are acceptable.
- Identification of organism by a culture or non-culture based microbiologic testing method, which is performed for purposes of clinical diagnosis or treatment (for example, not Active Surveillance Culture/Testing (ASC/AST)).
- If the imaging test result is equivocal for pneumonia, check to see if subsequent imaging tests are definitive. For example, if a chest imaging test result states infiltrate vs. atelectasis and a subsequent imaging test result is definitive for infiltrate — the initial imaging test would be eligible for use. In the absence of finding a subsequent imaging result that clarifies the equivocal finding, if there is clinical correlation then the equivocal imaging test is eligible for use.

Resources:

NHSN (2019). Patient Safety Component Manual Hospital acquired infection surveillance guidelines https://www.cdc.gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf

4.5 HAI DATA COLLECTION FORMS

4.5.1 Patient Registration form (A)

HAI Patient Registration Form-A **Page 1**

Patient Name:	Hospital no:	Age:	Sex: M/F	ICU/Ward

Department:	Admitting Unit:	DOA:	DOA to ICU:	If transferred from other hospital: name & DOA there: ☐	Admission abroad within 3months prior to DOA ☐ location name & country:

Provisional diagnosis:	Final Diagnosis	Any culture positivity abroad and (SIR) ☐ Not available ☐

Outcome	Transfer out to ward/unit name & Date:	Discharge on date:	LAMA on:	Expired on:	Referred Abroad location & date:

Underlying disorder:	DM☐	HTN☐	CKD☐	CLD☐	TB☐	Transplantation☐	Immunosuppression ☐

Other underlying disorder:	Severity score: Rapidly fatal ☐ Ultimately fatal (1-4y) ☐ Non-fatal (≥5y) ☐	Neonate: birth weight:__ If PT (<37 wks) GA:____

Type of surgery: if within 30/90 days	Date of surgery	SP 1	SP 2	SP 3	SSI & Date	SSI Type
					☐	
					☐	
					☐	

Type of device /Intervention	Date of insertion:	Date of removal:	Device days:	Device associated HAI & Date	Criteria fulfilled (ref to HAI diagnostic criteria page)
UC ☐				☐	
CVC ☐ Subclavian☐ Jugular☐ Brachial☐ Femoral☐ Umbilical ☐				☐	
Invasive ventilation				☐	
Tracheostomy				☐	
Intercostal ☐ or surgical site drainage tube ☐				☐ ☐	
Dialysis Sheath				☐	
Other:				☐	

	HAI1	**HAI2**	**HAI3**
Type of HAI			
Relevant device used before HAI[1]	Yes ☐ No☐ UK ☐	Yes ☐ No☐ UK ☐	Yes ☐ No☐ UK ☐
Present on admission	Yes ☐ No☐	Yes ☐ No☐	Yes ☐ No☐
Date of onset	--/--/----	--/--/----	--/--/----
Origin of infection	☐ Current hospital ☐ Other hospital ☐Other /UK	☐ Current hospital ☐ Other hospital ☐Other /UK	☐ Current hospital ☐ Other hospital ☐Other /UK
BSI source[2]			
Comment			

Culture site	Sample date	Organism	SIR[3]	SIR[3]	SIR[3]	GP7 :Amikacin	PDR[3]
HAI1:			GP1	GP3	GP5		
			GP2	GP4	GP6		
HAI2:			GP1	GP3	GP5		
			GP2	GP4	GP6		
HAI3			GP1	GP3	GP5		
			GP2	GP4	GP6		

Form A (Page2). HAI surveillance form: Antimicrobial Prescription Weight if available (required for all <15 years): ____ Kg Creatinine clearance if renal failure:

Antibiotic name	Route	Indication	Diagnosis (Site)	Reasons in notes	Started dates	Change? (+reason)	If changed date start first AM	No. of doses per day	Strength /dose	Unit (mg/g/IU/ Ml/U)

Route: P: Parenteral, O: oral, R: rectal, I: Inhalation; BSI=blood stream infection
CVC: intravascular catheter that terminates at or close to the heart or in one of the great vessels (Aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common iliac veins, femoral veins, and in neonates, the umbilical artery/vein), which is used for infusion, withdrawal of blood, or hemodynamic monitoring
Indication: Community acquired (CI), Long term care (LI) or acute hospital (HI >48hrs of admission), surgical prophylaxis: SP1: Single dose, SP2: one day, SP3: >1 day: Medical prophylaxis: MP; O: other; Unknown Indication: UI.
Diagnosis see site; only for CI-LI-HI **;** (LI – if such facility available):
Reason in notes: Y/N; changed? (+reason): N=No change; E=escalation; D = De-escalation: S=Switch IV to oral; A= adverse effects, OU=changed due to other /unknown reasons; IF changed, date start first AM (AM = antibiotics) given for the indication: Dose/day e.g. 3 x1; g=grams, mg=milligrams; IU=international units, MU= million IU; **Underlying disease:**
Severity Rapidly fatal: < one year: End-stage haematological malignancies (unsuitable for transplant, or relapsed), heart failure (EF<25%)and end-stage liver disease (unsuitable for transplant with recalcitrant ascites, encephalopathy or varices)**;** Multiple organ failure on intensive care unit –APACHE II score > 30, SAPS II score > 70; Pulmonary disease with cor pulmonale
Ultimately fatal: one year to four years : Chronic leukaemias, myelomas, lymphomas, metastatic carcinoma, end-stage kidney disease (without transplant)**;** Motor neuron disease, multiple sclerosis non-responsive to treatment, Alzheimer's disease/dementia, Diabetes requiring amputation or post amputation
Non-fatal: > five years: Diabetes, Chronic GI, GU conditions, Obstetrics, Infections (including HIV, HCV, HBV – unless in above categories), Carcinoma/haematological malignancy with > 80% five-year survival, Inflammatory disorders, all other diseases

4.5.2 Daily Event Monitoring form (B)

Daily Events: Form B Name:						Age/sex			Hospital No:			HAI code:			
DOA:															
Temperature >38°C- < 36°C (only for <1y)															
Hypotension(SBP <90 mmHg adult)															
Age <1 yr Hypothermia1 Apnea2 Bradycardia:3 Lethergy4 Vomiting5															
Adult >70 altered mental status w/o other known cause															
F1O2 minimum maintained >1 hr															
PEEP minimum >1 hr															
FiO2≥0.2) or PEEP ≥3cm H2O(adult)															
Cough 1 (only PNUE) Dyspnea 2 Tachypnea 3															
Suprapubic tenderness-1 Costovertebral angle tenderness-2															
SSI: Discharge 1; Redness2, tender-3 Abscess in site-4															
Others															
TLC enter only if in the range below ≥12000-1 or ≤4000-2 **Age<1yr** ≥15000-3 or 4000-2 with 10% bands-4															
CXR infiltrates:(PNUE)															
Culture specimen sent /received tick															
Urine															
Blood															
Sputum															
Tracheal aspirate															
Pus															
BAL, Tissue, brush specimen															
Purulent sputum (≥25Neu & ≤ 10 sq epi cell)															

other															

4.5.3 HAI criteria form (C)

HAI Criteria: Form C (Page 1) Patient name: Age/sex **Date of admission: Ward:**			
VAE	Intubated date: Base line FiO2: PEEP (Baseline ≥2 days daily minimum >1 hour maintained)	Yes (tick)	Tick event and Date with total vent days
ONE of: a. FiO2≥0.2 above baseline **or (Peds use FiO2 ≥ 0.25)** b. PEEP ≥3cm H2O (Peds MAP ≥ 4cmH2O) ‡		☐ ☐	**VAC** ☐
Temperature. >38oC or <36oC **AND** new antimicrobial agent x ≥ 4 **QAD*** (qualifying antimicrobial day)		☐ ☐	**IVAC** ☐
On or after D3 of ventilation & with 2 d before or after worsening oxygenation: **Criterion 1: Positive c/s** of **ONE** of: a. ET aspirate (≥10^5CFU/ml) b. BAL-2((≥10^4CFU/ml); c. Lung tissue(≥10^4CFU/ml d. Protected specimen brush(≥10^3CFU/ml)		☐ ☐ a ☐ b ☐ c ☐ d	**VAP** ☐ Criterion 1 ☐
Criterion 2: Purulent respiratory secretions (≥25neutrophils & ≤10 squamous epithelial cells) **PLUS one** of the above cultures without significant growth to meet the above criteria		☐ ☐ a,b,c,d (circle)	Criterion 2 ☐
Criterion 3: At least one a. Pleural fluid (thoracentesis or initial tube placement) b. Histopathology: I. Abscess formation or foci of consolidation with neutrophil accumulation II. Lung parenchyma invasion by fungi III. Evidence of infection by virus by immunohistochemistry/cytology/microscopy on lung tissue c. Diagnostic test for legionella species d. Diagnostic test on respiratory secretion (Flu, RSV, adeno, Paraflu, rhino, human metapneumo or coronavirus		☐ a ☐ b (I) ☐ b (II) ☐ b (III) ☐c ☐d	Criterion 3☐
Note:. **QAD*:** A day on which the patient was administered an antimicrobial agent that was determined to be "new" within the VAE Window Period. ‡For adults PEEP btw 0-5 cm H2O is taken as equal. Age <30 days MAP btw 0-8cm/ ≥30days 0-10cm cm of H2O is also taken as equal. **VAE Window Period:** This is the period of days around the event date within which other VAE criteria must be met. It is usually a 5-day period and includes the 2 days before, the day of, and the 2 days after the VAE event date			

CLABSI	**Date CVC insertion: Date of CLABSI:** **Date of CVC removal: Catheter days:**	MCB☐ tick if met	CLABSI
Central line in place > 2 days	CVC in place on day of event	☐LCBI1 +only intestinal organism + underlying#	☐
	CVC removed day before event		☐
LCBI1 (any age)	≥1 blood c/s positive for bacterial or fungal pathogen not in the common commensal list		☐
	Organism identified in blood is not related to an infection in another site		☐LCBI1
LCB2 (any age)	At least one: Fever (>38°C) ☐; Chills ☐; Hypotension ☐	☐LCB2 + only viridian gp streptococcus or Rothia spp + underlying#	☐
	Organism identified in blood is not related to an infection in another site		☐
	≥2blood specimens collected on separate occasions with same commensal		☐LCBI2
LCBI3 (age <1 year)	At least one fever (>38°C)☐; Hypothermia (<36°C)☐; apnea ☐, bradycardia☐	☐LCB2 + only viridian gp streptococcus or Rothia spp +underlying#	☐
	Organism identified in blood is not related to an infection in another site		☐
	≥2blood specimens collected on separate occasions with same commensal organism‡		☐LCBI3
‡Common commensal organisms include, , diphtheroids (Corynebacterium spp. not C. diphtheria), Bacillus spp. (not B. anthracis), Propionibacterium spp., coagulase-negative staphylococci (including S. epidermidis), viridans group streptococci, Aerococcus spp. Micrococcus spp. and Rhodococcus spp. #at least one of: **Hematopietic stem cell transplant** within 1y with one: GI GVHD(gr3-4), diarrhea (1lit or ≥20ml/kg in 24h) onset on/within 7 days of blood specimen **OR Neutropenia** (ANC on 2 separate days within the 7 day period (3d before and 3 day after blood specimen)			

Form C page 2: Patient name: Hospital number: Ward: HAI code: Date of UC insertion: Date of removal: Date of CAUTI: Catheter days:			
CAUTI	**Date UC**	Criteria met tick	Date
UC>2 days	UC in place on day of event		
	Removed day before		
AND At least one of	Fever >38°C □; Suprapubic tenderness* □; Costovertebral angle pain/tenderness* □; Urinary urgency^ □; Urinary frequency^ □; Dysuria^□		
OR _____ For **age ≤1** year	Fever >38°C □; hypothermia □; Apnea* □; Bradycardia* □; Lethargy* □; Vomiting □; Suprapubic tenderness□		
AND Urine culture	No more than two species of organisms identified, at least one of which is a bacterium of ≥10^5CFU/ml		
Note	No other recognized cause*; symptoms cannot be used when catheter is in place^ Exclude candida, mold, Dimorphic fungi, Parasite, mixed flora, normal flora or vaginal flora		

Form C: Patient name: Hospital number: Ward: **SSI** date: Procedure date: SSI date					
Type of SSI	**Day of event**	**with**	**And One of**	□ and Date	**SSI**
Superficial incisional	Within 30days □ (D1= procedure date)	Only skin & subcutaneous tissue □	• Purulent drainage from superficial incision • Organism identified by aseptically obtained specimen from superficial incisional or subcutaneous tissue • Superficial incision deliberately opened but lab investigation for organism detection is not performed **AND with one s/s in patient;** localized pain or tenderness; localized swelling; erythema; or heat. • Diagnosis of a superficial incisional SSI by surgeon	□ □ □ □	SIP □ SIS □
Deep incisional	Within 30days □ or 90 days□	Involves deep soft tissues of the incision □ (e.g. fascial and muscle layers)	• Purulent drainage from deep incision site • Deep incision that is deliberately opened or aspirated **AND** growth of an organism identified **AND** patient has *one* s/s: fever (>38°C), localized pain or tenderness • An abscess or other evidence of infection involving the deep incision that is detected on gross anatomical or histopathologic exam, or imaging test.	□ □ □	DIP □ DIS □
Organ space	30days 90 days	Any part deeper than the fascial/muscle layers, that is opened or manipulated during the operative procedure	• Purulent drainage from a drain placed in organ/space • Organism identified from fluid or tissue in the organ space • An abscess or other evidence of infection involving the organ/space that is detected on gross anatomical or histopathologic exam, or imaging test	□ □ □	O/S□
		□ With one specific criterion of specific organ/space *			
Note: Incisional SSI can be primary incisional (IP) if identified in the primary incision or it could be secondary incisional (IS)ie. SIP , SIS (for superficial incisional secondary or primary) or DIP, DIS (for deep incisional secondary or primary) https://www.cdc.gov/nhsn/pdfs/pscmanual/17pscnosinfdef_current.pdf					

4.5.4 SSI Surveillance: Perioperative form

PERIOPERATIVE FORM

ID	**Form P** Patient name:	Age: (<2 yrs in months) Date of birth: ……./……./……		SSI Code: ……	Date of admission: …./…./…….
	Hospital No:	Sex ☐M ☐F	Wt ……..kg	Height…….cm	
1	Surgical procedure…… Date of surgery:……./……./……..		Operation theater:…….. Lead surgeon name:…… Grade:……		
2	**CDC –Risk Index Variables**	ASA class ☐1. Normal healthy person ☐2. Mild systemic illness (e.g. HTN, well controlled DM) ☐3. Severe systemic disease not incapacitation (e.g. moderate COPD, DM, malignancy) ☐4. Incapacitating systemic disease that is a constant threat to life (e.g. pre-eclampsia, heavy bleeding) ☐5. Moribund patient, not expected to survive with or without operation (e.g. major trauma)			
3		Surgical wound class Clean ☐ = Sterile tissue with no resident bacteria e.g. neurosurgery Clean contaminated ☐ = CONTROLED entry to tissue with resident bacteria e.g. hysterectomy Contaminated ☐ = UNCONTROLLED entry to tissue with bacteria e.g. acute gastrointestinal perforation. Dirty/infected ☐ = Heavy contamination (e.g. soil in wound) or infection already established			
4		Start time ___:____(24 h format) End time ___:____(24 h format) Duration=_____hrs_____min	Urgency of operation ☐ Emergency: must be done immediately to save life (major bleeding) ☐ Urgent: Must be done within 24-48 hours (repair fracture) ☐ Semi-elective: must be done within days to weeks (tumour removal) ☐ Elective- no time constrains (cosmetic procedures)		
PERIOPERATIVE PROCEDURES					
5	**Patient preparation:** Pre-op bath/shower (full body): (Y/N) Date…./……/…….. Antimicrobial soap used (Y/N) Plain soap used (Y/ N) Hair removal(HR): ☐razor ☐clippers ☐none HR date……../……/…… ☐Home ☐ Ward ☐ Theatre		**Surgical skin preparation (under sterile condition)** ☐ CGH+ alc ☐ Iodine +alc ☐ CGH- Aq ☐ Iodine- Aq Appropriate skin preparation technique (Y/N) Allowed to fully dry (Y/N)		
	Surgical Antibiotic prophylaxis (SAP): ☐ No prophylaxis required ☐ Required but not given due to ☐ unavailable ☐ other…….. **Antibiotic given** ☐ Augmentin ☐ Cefazolin ☐Cloxacillin ☐ Vancomycin ☐ Ciprofloxacin ☐ Gentamicin ☐ Metronidazole ☐ Penicillin ☐ Other Dose ……(mg/ unit if other …….) Time given(……:…..) Time re-dosed (……:……)(24 format)		Surgical had preparation ☐ ABHR ☐ Antimicrobial soap + water ☐ Plain soap + water Time spent on procedure (……) min(……) sec Appropriate hand preparation technique Y/N Theater traffic: Head count at start of operation……total…… Number of entries during operation…… Doors opening during operation…… Total……		
	Post operative antibiotics Were antibiotics ceased at completion of surgery? Y/N If not, what antibiotics were prescribed? Drug……Dose……(mg/……) Doses /day……Duration (days)…… Reason given ☐Post-operative prophylaxis ☐Drain or implant inserted ☐Treating suspected or known infection ☐Other ……		Drain/implant Location…… Drain inserted? Y/N If YES type of drain : ☐ Open ☐ Closed Antibiotic given in presence of drain but no infection? (Y/N) Implant used? Y/N ☐ Metal (ortho) ☐ Skin graft ☐ Mesh ☐ Other……		
6	Comment:				
Date form completed…./…../….. Database entry Y/N Signature: Name:					

4.5.4.1 SSI Post Operative Data collection form and SSI definition

POST OPERATIVE DATA COLLECTION FORM: Form S -PROCEDURE NAME:……					
Patient name:……. H no			Age: (if <2 yrs give in months) DOB	Address: SSI code:	
Tel no 1			Whose no.		Checked ? □
Tel no 2			Whos no.		Checked ? □
Email address			Whos address:		Checked ? □
Procedure date:			Primary Discharge date:		
Day	Date	Event	Antibiotic	SSI symptoms and notes	HW initials
1		Surgical procedure			
2-3					
4-5					
6-7					
8-10					
11-14					
15-17					
18-21					
22-25					
26-29					
Day 30				End of 30day surveillance	

HAI definition for SSI from Form C : Patient name: Hospital number: Ward: **SSI** date: Procedure date: SSI date					
Type of SSI	**Day of event**	**with**	**And One of**	□ and Date	**SSI**
Superficial incisional	Within 30days □ (D1= procedure date)	Only skin & subcutaneous tissue □	• Purulent drainage from superficial incision • Organism identified by aseptically obtained specimen from superficial incisional or subcutaneous tissue • Superficial incision deliberately opened but lab investigation for organism detection is not performed **AND with one s/s in patient;** localized pain or tenderness; localized swelling; erythema; or heat. • Diagnosis of a superficial incisional SSI by surgeon	□ □ □ □	SIP □ SIS □
Deep incisional	Within 30days □ or 90 days□	Involves deep soft tissues of the incision □ (e.g. fascial and muscle layers)	• Purulent drainage from deep incision site • Deep incision that is deliberately opened or aspirated **AND** growth of an organism identified **AND** patient has *one* s/s: fever (>38°C), localized pain or tenderness • An abscess or other evidence of infection involving the deep incision that is detected on gross anatomical or histopathologic exam, or imaging test.	□ □ □	DIP □ DIS □
Organ space	30days 90 days	Any part deeper than the fascial/muscle layers, that is opened or manipulated during the operative procedure	• Purulent drainage from a drain placed in organ/space • Organism identified from fluid or tissue in the organ space • An abscess or other evidence of infection involving the organ/space that is detected on gross anatomical or histopathologic exam, or imaging test	□ □ □	o/s☐
		□ With one specific criterion of specific organ/space *			
Note: Incisional SSI can be primary incisional (IP) if identified in the primary incision or it could be secondary incisional (IS)i.e SIP , SIS (for superficial incisional secondary or primary) or DIP, DIS (for deep incisional secondary or primary) https://www.cdc.gov/nhsn/pdfs/pscmanual/17pscnosinfdef_current.pdf					

4.5.5 List of microorganisms and tested antibiotics susceptibility groups

Microorganism	Antimicrobial group		Antimicrobial agents
Enterobactericiae • E.coli (ESCCOL) • Klebsiella spp (KLEPNE) • Enterobacter spp. • Serratia spp. • Proteus spp.	GP1	Third Generation Cephalosporin	Ceftriaxone (CRO), Cefotaxime (CTX), Ceftazidime (CAZ)
	GP2	Fluoroquinolones	Ciprofloxacin (CIP), Ofloxacin (OFX), Levofloxacin (LVX)
	GP3	Aminoglycoside	Gentamicin (GEN), Tobramycin(TOB), Netilmicin (NET)
	GP4	Piperacillin +/- Tazobactam	Piperacillin +/-Tazobactam (TZP)
	GP5	Carbapenem	Imepenem (IPM), Meropenem (MEM), Dorepenam
	GP6	Polymixin	Colistin (CST)
	GP7	Amikacin	AMK
Pseudomonas spp (PSEAER) and Acinetobacter spp (ACISPP)	GP1	**Report only Ceftazidime**	CAZ
	GP2	Fluoroquinolones	Ciprofloxacin (CIP), Ofloxacin (OFX), Levofloxacin (LVX)
	GP3	Aminoglycoside	Gentamicin (GEN), Tobramycin(TOB), Netilmicin (NET)
	GP4	Piperacillin +/- Tazobactam	Piperacillin +/-Tazobactam (TZP)
	GP5	Carbapenem	Imepenem (IPM), Meropenem (MEM), Dorepenam (DOM)
	GP6	Polymixin	Colistin (CST)
	GP7	Amikacin	AMX
Staphylococcus aureus (STAAUR)	GP1	Oxacillin	OXA
	GP2	Glycopeptides (GLY)	Vancomycin (VAN), Teicoplanin (TEC)
	GP3	Aminoglycosides	GEN (high level aminoglycoside resistance)
	GP4	Trimethoprim-sulphamethoxazole	SXT
	GP5	Clindamycin	CLR
	GP6	Rifampicin	RIF
Enterococccus E. Faecium (ENCFAE) E. Faecalis (ENCFAI)	GP1	Aminopenicillin	AMP, AMP
	GP2	GLY	VAN, TEC
	GP3	Aminoglycoside	GEN (high level aminoglycoside resistance)

Antimicrobial abbreviations: http://www.bsacsurv.org/science/antimicrobials/
MRSA-Methicillin resistant Staphylococcus aureus
VRE -Vancomycin resistant Enterococci spp**.**
ESBL -Extended-spectrum beta (β)-lactamase producing Gram-negative organisms
CPO–Carbapenem Producing Organisms
CPE- Carbapenem Producing Enterobacteriaceae
CRE: Carbapenem Resistance Enterobacteriaceae
CRAB–Carbapenem Resistant Acinetobacter baumanni
http://www.wales.nhs.uk/sitesplus/documents/888/MDRO%20all%20Wales%20guidelines.pdf

Secondary BSI: Definitions for Specific Types of Infections or UTI, PNEU or SSI definitions. **AND** One of the following scenarios must be met:
Scenario 1: At least one organism from the blood specimen matches an organism identified from the site-specific specimen that is used as an element to meet the site-specific infection criterion **AND** the blood specimen is collected during the secondary BSI attribution period (infection window period + repeat infection time frame) (IWP =First positive diagnostic test, 3 days before and 3 days after)+ RIT (14 days).
OR Scenario 2: An organism identified in the blood specimen is an element that is used to meet the NHSN site-specific infection

4.5.7 AMR Data Collection Form

AMR surveillance form (FORM AMR) Ward/ Location: ……Month: ……Year: …… Page no: .....

Bed capacity: ..... Total no. Of patients admitted in the period ..... Comment: Surveyor name:

Note: Date format = dd/mm/yy (enter year only if different years overlap); DOA= Date of admission; DOD=Date of discharge /death; CAR= Carbapenem Resistant ; VER= Vancomycin Resistant Enterococcus spp.; MRSA= Methicillin Resistant Staph Aureus; Mark X in comment if death/mention other major event

S.No	Hospital number	HAI code	DOA	DOD	No. of days in hospital	CAR Klebsiella spp	CAR E.coli	CAR Pseudomo-nas spp.	CAR Acinetobact-er spp	MRSA	VER	Comment

Note: If required columns can be added for other important multi-drug resistant organisms depending on the institution; e.g. Colistin resistant A. Baumanii or colistin resistant Klebsiella spp. etc

4.5.8 Forms for care bundles :HAI prevention

HAI prevention

Patient name: Hospital number: Ward:
Date of insertion:
Indication for insertion:
1. Sterile items/equipments used during insertion
2. Inserted using strict aseptic techniques
3. Closed drainage system

Date	Bundle Criteria for Urinary Catheter							
	Daily documented assessment of need (Y/N)	Tamper evidence seal is intact	Catheter secured securement in place	Hand hygiene performed for patient contact	Hand hygiene after patient contact	Daily meatal hygiene with soap and water	Unobstructed flow maintained	Action: Remove (R) continue (✓)

Patient name: Hospital number: Ward:
Date of intubation:

1. Sterile items/equipment used during insertion
2. Inserted using strict aseptic techniques
(fill as Yes/No: Y/N)

Date	Bundle Criteria for ventilator					
	Head of bed elevated 30^0 (Y/N)	Sedative interruption and readiness of extubating	Catheter secured securement in place	Hand hygiene performed for patient contact	Brush twice a day	VAP (Y/N)

Procedure

- Perform hand hygiene - Moment 1, before touching the patient
- Check patient identification, inform patient of the procedure and its purpose
- Ensure that the relevant history and tests are stated on the blood culture request form as this may affect incubation requirements
- Collect all equipment required (including personal protection equipment) and place on a trolley cleaned with alcohol-based wipes and bring to the patient zone
    - Two blood culture sets (4 bottles) comprising two aerobic and two anaerobic bottles – depending on the requirement.

- Check expiry date for each bottle and mark 10mL above the broth for fill level
- Sterile gloves, small dressing pack, cotton balls, tape, tourniquet(s)
- Chlorhexidine gluconate (2%) with 70% alcohol solution, or chlorhexidine/ 10% povidine iodine and 70% alcohol and swabs (for those below
- Vacutainer and leash with winged infusion set designed to fit over the blood culture bottle - if unavailable, use a winged infusion set with luer adapter and syringe - once a blood sample has been obtained using a syringe, attach a blood transfer device to the syringe to enable safe innoculation of the blood culture bottles

- Remove the cap of each blood culture bottle and using a non-touch technique scrub the vial stoppers well using a 70% alcohol and/or chlorhexidine and allow to dry for 30 seconds. Do not use betadine to clean cap.
- Prepare winged infusion set and vacutainer, prepare other equipment
- Position patient appropriately, apply tourniquet to palpate and identify appropriate vein.
- Perform hand hygiene – Moment 2, before the procedure
- Put on sterile gloves (essential if re-palpation occurs post cleansing of the venepuncture site)
- Preparing site:
  - Using chlorhexidine with 70% alcohol swabs, disinfect the venepuncture site using a scrubbing motion, use a fresh swab for each scrub. Use 2-3 scrubs. Do this for a total of 1-2 minutes, allowing the site to dry (approximately 30 seconds). Do NOT wipe the site with gauze. Do NOT touch the venipuncture site with fingers.
  - OR
  - Vigorously cleanse the skin over the venipuncture site in a circle approximately 5 cm in diameter with 70% alcohol. Scrubbing should continue for 30 seconds. Allow to dry. Starting in the centre of the circle, apply chlorhexidine (2%) or 10% povidone iodine (betadine) in ever widening circles until the entire circle is saturated with iodine.
  - If the child is less than 2 months of age, use only 70% alcohol swabs. Using a spiral motion clean from the proposed puncture site outwards and use a fresh swab for each spiral. Do this for 1-2 minutes and allow to dry.

- Taking blood sample:
  - Butterfly needle procedure: (preferred method except for neonatal patients)
    - Remove butterfly needle and tubing from the package. [Be careful not to touch the rubber cover to prevent contamination].
    - Perform venipuncture by inserting the needle with the rubber cover directly into the Bactec bottle. The needle and vacutainer holder must be held down to keep the needle from popping out of the vial.
    - Remove the vial(s) when the blood flow has reached the mark that has been made on the vial indicating the appropriate fill level.
    - Remember to hold the vacutainer/needle assembly down onto the vial.

- After collection mix the bottles thoroughly by gentle inversion.

- For alternate syringe draw:
  - Perform venipuncture with needle and syringe and draw proper amounts of blood.
  - Inoculate the blood into the appropriate blood culture vial(s).
  - Do not change needles before injecting the blood into vial(s).
  - Be sure to inoculate the correct volume into each vial.
  - Do NOT recap the needles. After collection mix the bottles thoroughly by gentle inversion.

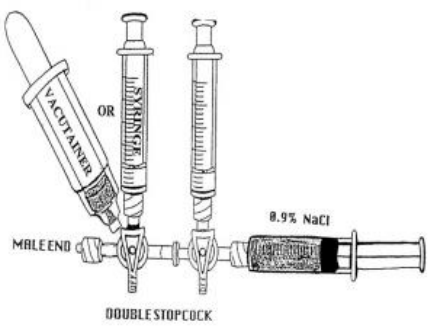
- Collection of Blood from Intravascular Catheters:
  - Mark volume and disinfect top of vial (see above for details).
  - Using 2 separate 70% alcohol swabs, scrub catheter hub connection for 15 seconds. Air dry.
  - While wearing gloves, disconnect the tubing or cap of catheter and attach syringe to collect discard blood (suggested amounts: 3ml for adults and 0.2ml for pediatric patients). For suspected CLABSI waste draw is not needed; refer to procedure for taking blood cultures for suspected CLABSI.
  - NOTE: Avoid drawing from lines within an hour of completion of antimicrobial agent administration.
  - Using a new syringe, collect blood for culture through the hub. Quickly reconnect tubing.
  - Connect filled syringe to safety system adapter.
  - Holding syringe plunger for control, inoculate the bottles with no more than the marked volume.
  - Mix the bottles thoroughly by gentle inversion.
  - Label vials (see above for details)
- https://www.albertahealthservices.ca/assets/wf/plab/wf-provlab-blood-culture-collection-guidelines.pdf

1. Volume of blood:
   a. Place 10mL blood per bottle (20mL/set, 40mL in total), keeping blood culture bottle upright and at/below the level of the venepuncture
   b. For Paediatric Blood Culture (infant/small child): use one paediatric aerobic bottle and fill with 0.5 mL to 4mL blood depending on the age and blood culture bottle used.
2. Always collect/innoculate the blood culture bottles FIRST (innoculating the aerobic bottle first) then, if required, collect additional blood pathology tubes at this point
3. Apply cotton ball and pressure to site (where possible obtain patient assistance to hold and apply pressure); repeat procedure for 2nd set of blood cultures at a

different peripheral site, maintaining aseptic technique, invert bottles gently several times to prevent clotting
4. Discard sharps, collect all rubbish/dirty items and dispose appropriately
5. Label each bottle with patient name, Hospital Number, date/time for collection of blood and location of site used for each set. Do not cover any bar codes or the bottom of the bottle
6. Place bottles into biohazard bag and arrange to send to the lab with request form, transport bottles at room temperature
7. Remove gloves and perform hand hygiene – Moment 3, after the procedure
8. Explain to patient that results may not be available for 48 hours, conclude procedure
9. Document that (a) two sets of blood cultures have been taken, (b) from which sites, (c) include reason for site choice if this differs from a peripheral site

Taking sample for suspected Central line associated infection

- Set up stopcock(s) with syringe, vacutainer and saline as shown below (FIG 1) .
- Do not flush central line. Do not draw a waste. No waste ensures that the blood sample contains that fill space of the central vascular access device. One stop cock setup per each set of blood cultures.
- Select lumen of central line from which sample will be obtained. Place sterile 4x4 under lumen
- Scrub needleless connector with 70% alcohol and/or 2% Chlorhexidine gluconate pad for 30 seconds. It is very important to allow the prepared site to dry unassisted (i.e., without blotting, blowing, fanning, or wiping dry); the chlorhexidine dries in about 30 seconds
- Connect stopcock to needle-free connector
- Withdraw 8-10ml, for adults, or appropriate volume for pediatric patients into empty syringe and transfer to the blood culture bottle with the stopcock turned off to the patient
- Flush line with saline post draw.



1. Attach vacutainer holder or syringe for drawing blood (sampling syringe) to stopcock port closest to patient-end of the stopcock. Turn valve off in direction of vacutainer OR sampling syringe.
2. Attach empty 10 mL syringe to next port. Turn valve off to syringe.
3. Attach syringe of 0.9% Sodium chloride to female end of stopcock and flush air out of stopcock. Turn valve off to 0.9% sodium chloride syringe.

Figure 1: Central Line Blood Collection procedures

If the patient has intravascular lines in place that are > 24-48 hours, draw cultures and request a "CLABSI" assessment as follows:

Note:

- Collect one set of blood cultures from a Peripheral site AND from EACH indwelling line (arterial, central line, PICC).
- Each set of blood cultures consists of one anaerobic and one aerobic bottle.
- Cultures from all sites should be drawn within 15 minutes.
- Dialysis lines should also be cultured, however, cultures must be drawn by a nurse approved for CRRT or hemodialysis.
- For multilumen central venous catheters, obtain blood culture from distal lumen whenever possible.
- If a patient has an implanted central venous catheter (e.g. Portacath for oncology), it must be accessed by a Vascular Access or Oncology nurse.
- If the patient has a previously established line that is being removed and obtain cultures from the line and at least one other site and send the tip for culture (done semiquantitatively).

Diagnosis of CLABSI:

(For further details please refer to appendix 4.6)

- Blood culture from indwelling line becomes positive more than 2 hours before the venipuncture culture first became positive, the blood stream infection (bacteremia) is labled as a CATHETER ASSOCIATED BLOOD STREAM INFECTION.
- If all blood cultures become positive within a 2 hour window, the infection is not considered to be catheter associated.
- All samples must go to the lab at the same time so that they can be setup together.
- A newly established line can be considered a "peripheral stab" ONLY if it is newly established and has not been previously used for blood drawing. If the sample is drawn at the time of insertion, identify this as a "consider as peripheral culture" in the lab orders.
- If a peripheral culture cannot be obtained, this has to be documented in the lab order form and patient records

Catheter tip culture

- Do only if the central line was removed for suspected CLABSI. Alert lab “write suspected CLABSI”.
- Remove aseptically and cut a ~4 cm segment from tip and place in sterile container and transport rapidly to prevent drying out.
- A positive catheter tip by itself is not diagnostic for a CLABSI; Do not routinely culture catheter tips on removal unless there are clinical signs and symptoms for infection.

Special tips

- Do not touch the vein after disinfection
- Do not use iodine on the rubber septa of the bottles
- Do not use expired blood culture bottles
- Do not overfill the blood culture bottles

4.6.2 Abscess/ Wound culture:

Label pus /wound cs

- Clean surface of abscess with 70% alcohol and allow to dry; aspirate pus or fluid if possible and either transport in syringe(preferred) or place in anaerobic transport vial (anaerobic transport tubes are appropriate for aerobic and anaerobic cultures) always request a gram stain for initial guidance and comparison
- Swabs should be discouraged since swabs usually have insufficient material for gram stain and culture; if swabs must be used be sure quantity is adequate for both culture and gram stain
- Do not culture chronic superficial wounds or sinus drainage since superficial cultures correlate poorly with deep cultures-try an obtain a deep culture or biopsy for culture whenever possible
- Swab culture: All wounds are contaminated so a positive culture does not automatically indicate an infection. This must be clinically determined based on wound characteristics, erythema, edema, pain, heat, increased exudate & odor. Proper technique for obtaining a specimen is crucial to avoid false negative or positive results. https://msqc.org/wp-content/uploads/2019/02/WOUND-CULTURE-PROTOCOL.pdf
- Method:
  - Wash hands, apply gloves, remove soiled dressing and place in biohazard bag.
  - Cleanse wound by removing excess debris from the wound base by irrigating with normal saline. Thoroughly flush wound.
  - Gently wipe excess saline with a sterile gauze pad
  - Remove soiled gloves and cleanse with hand sanitizer
  - Apply sterile gloves
  - Moisten the culture swab with the 0.9% sodium chloride (a moist swab provides more accurate results than a dry swab).
  - Identify a small area (1 cm) of clean viable tissue and rotate the swab on it for 5 seconds while applying enough pressure to produce exudate. Avoid necrotic tissue and wound edges. A wound culture must be taken from clean tissue because pus or necrotic tissue will not provide an accurate profile of the microflora contained within the tissue.
  - Insert swab into the sterile container.

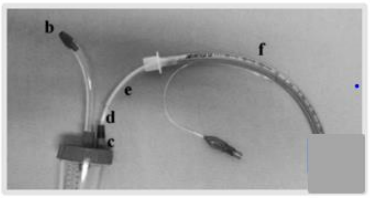
- Redress the wound and perform hand hygiene.
- Assess the patient and ensure that any wound pain has been managed. (This is done initially and again during the process.)
- Complete the lab slip and/or electronic document, including wound site, time the specimen was collected, and any antimicrobials the patient is receiving.
- Send the specimen to the lab immediately (within 1 hour) to keep the specimen stable. If specimen must be stored, refrigerate immediately after specimen collection.

4.6.3 Sputum:

- Have patient rinse with water to remove excess oral flora
- Instruct patient to cough deeply and collect and transport in a sterile container
- Lab* microbiology should perform a cytologic screening and specimens that are contaminated with oral secretions (presence of >10 squamous epithelial cell/LPF) should be recommend for re-collection
- Gram stain should be performed on all sputum specimens

4.6.4 Tracheal aspirate (*Please label as tracheal aspirate)

- Does not need to be screened like sputum;
- Perform gram stain along with routine cultures;
- Lab should report if specimen is purulent (≥25 WBC/LPF & ≤10 squamous cells)
- Collection method:
- Collect the specimen through a tracheostomy.
- Attach a sterile catheter to a Lukens trap and carefully pass the catheter through the site into the trachea.
- Apply suction to aspirate the sample into the Lukens trap.
- Place in sterile container.



Arrangement of the devices used in the collection of the TA by the protected technique: (a) Collection bottle; (b) Output for vacuum; (c) Entry of secretions; (d) Aspiration probe #10 Fr; (e) thick probe #20 Fr; (f) Orotracheal tube

- Transport/Storage: Onsite collections: Transport to the laboratory immediately. Offsite collections: Refrigerate specimen. Specimens must be promptly transported to the laboratory, with the next available courier, not to exceed 24 hours from the time of collection. However, delayed transport causes a delay of test results.

4.6.5 Bronchial alveolar lavage (BAL) and mini-BAL

- Obtained by bronchosopy or with use of a special catheter(mini-BAL)
- Requires prompt transport to the laboratory for processing (not acceptable for anaerobic cultures)
- Fluid should be concentrated for optimal yield for stains and cultures
- Consider quantitative bacterial cultures to guide interpretation with ≥104 CFU/mL considered significant

4.6.6 Urine collection from catheter:

- Urinary catheter in place only for short-term: collect specimen by aseptically aspirating from port of urinary catheter
- Urinary catheter in place long-term: first change urinary catheter then collect specimen by aseptically aspirating port of urinary catheter
- Caution: straight cath for urine collection may result in iatrogenic UTI

Transport: Send urine sample promptly to lab or keep urine refrigerated (up to 4 hours) if delay is anticipated.

Comment: Do not treat asymptomatic bacteriuria except in pregnancy or GU instrumentation

4.6.7 Stool for C. Difficile toxin assay

- Collect specimen in a sterile container and transport promptly to lab and give prior notification
- Comments:
  - Consider C. difficile for hospitalized patients with diarrhea occurring after 2 days of admission or those who had been in hospital and discharged within past 28 days
  - clinically significant diarrhea is defined as 3 or more unformed stools samples
  - within 24 hours
  - Multiple specimens per day are not indicated
  - Formed stools in general should not be submitted
  - If patient has been on laxatives in the last 48 hours cancel order and allow at least 48 hours without laxatives to reassess
  - Testing to evaluate for cure is not recommended.
  - PCR does not distinguish colonization versus infection, therefore indications for testing are very important

4.6.8 Cerebrospinal fluid (CSF)

- For bacteria send 1-2 mL; if mycobacteria or fungi suspected send 5-10 mL
- Initial evaluation, send CSF for cell count, glucose (also draw simultaneous blood glucose), and protein with gram stain and bacterial culture

Comment: An extra tube maybe kept for additional studies as needed pending initial results (such as bacterial antigens, AFB, and fungi, or PCR for HSV).

Resources:

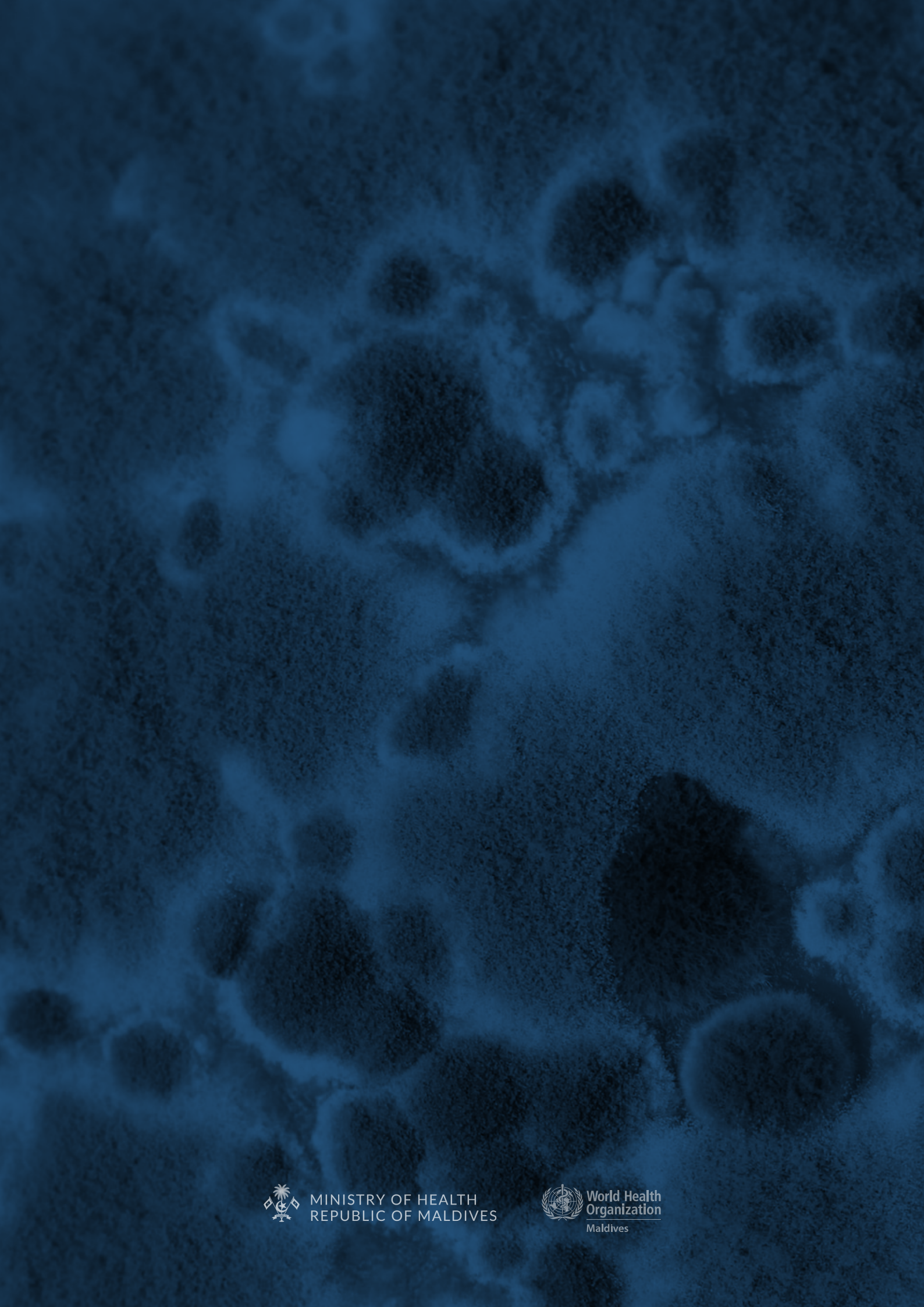
Septimus, M. D., & FIDSA, F. (2018). Antimicrobial Stewardship Implementing an Effective Program. https://scholarlyworks.lvhn.org/cgi/viewcontent.cgi?article=1014&context=fleming-infectious-disease-symposium

London Health Science Centre (LHSC). Critical Care Trauma Centre; Procedure: drawing blood cultureshttps://www.lhsc.on.ca/critical-care-trauma-centre/procedure-drawing-blood-cultures

Clinical Excellence Commission (2014). Blood Culture sampling guideline- adult. https://www.swslhd.health.nsw.gov.au/btf/pdfs/Education/Sepsis/Sepsis_blood_culture_sampling_guideline.pdf

National Institutes Of Health Clinical Center Clinical Center Nursing Department (2018). Procedure: Obtaining Blood Cultures from Peripheral and Central Venous Access Devices https://www.specialove.org/wp-content/uploads/2018/07/PRO_CVAD_Obtaining_Blood_Specimens-1.pdf

4.7 WHO MULTIMODAL IMPROVEMENT STRATEGY



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