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Health Care-Associated Infections (HAI) Surveillance Manual

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Glossary of Acronyms

ABUTI	Asymptomatic Bacteriuric Urinary Tract Infection
AIDS	Acquired Immunodeficiency Syndrome
ANC	Absolute Neutrophil Count
APIC	Association for Professionals in Infection Control and Epidemiology
APRV	Airway Pressure Release Ventilation
ASA	American Society of Anesthesiology
ASC	Active Surveillance Cultures
ASP	Antimicrobial Stewardship Program
AST	Active Surveillance Testing
AUR	Antimicrobial Use and Resistance
AVF	Arteriovenous Fistula
AVG	Arteriovenous Graft
BAL	Broncho Alveolar Lavage
C. DIFF	Clostridium Difficile
CAUTI	Catheter-Associated Urinary Tract Infection
CBAHI	Central Board for Accreditation of Healthcare Institutes
CCU	Coronary Care Unit
CDC	Centers for Disease Control and Prevention
CDI	Clostridium Difficile Infections
CFU	Colony Forming Units
CHG	Chlorhexidine Gluconate
CLABSI	Central Line-Associated Bloodstream Infection
CLIPS	Central Line Insertion Practice
CO	Community-Onset
COVID-19	Coronavirus Disease 2019
CPAP	Continuous Nasal Positive Airway Pressure
CRE	Carbapenem-Resistant Enterobacterales
CRKP	Carbapenem-Resistant Klebsiella Pneumonia

CSF	Cerebrospinal Fluid
DE	Dialysis Event
DOE	Date of Event
DUR	Device Utilization Ratio
DVT	Deep Venous Thrombosis
ECDC	European Centre for Disease Prevention and Control
ECMO	Extracorporeal Life Support
ELISA	Enzyme-Linked Immunoassay
EMR	Electronic Medical Record
ENT	Ear, Nose, and Throat
ETA	Endotracheal Aspirate
FIO_2	Fraction Of Inspired Oxygen
GCC	Gulf Cooperation Council
GIT	Gastrointestinal Tract
GVHD	Graft Versus Host Disease
HAI	Healthcare-Associated Infection
HCW	Health Care Workers
HD	Hemodialysis
HERO	Hemodialysis Reliable Outflow
HFO	High Frequency Oscillatory
HIV	Human Immunodeficiency Virus
HO	Healthcare Facility-Onset
HSCT	Hematopoietic Stem Cell Transplantation
IABP	Intra-Aortic Balloon Pump
ICP	Infection Control Professional
ICU	Intensive Care Unit
IDSA	Infectious Diseases Society of America
INICC	International Nosocomial Infection Control Consortium
IP	Infection Preventionist
IPC	Infection Prevention and Control
IPCAF	WHO Infection Prevention and Control Assessment Framework
IT	Information Technology

IVAC	Infection-Related Ventilator-Associated Complications
IWP	Infection Window Period
KAP	Knowledge, Attitude, and Practice
LABID	Laboratory-Identified
LCBI	Laboratory-Confirmed Bloodstream Infection
MAP	Mean Airway Pressure
MBI	Mucosal Barrier Injury
MDR	Multidrug-Resistant
MDRO	Multidrug-Resistant Organisms
MRSA	Methicillin-Resistant *Staphylococcus Aureus*
MSSA	Methicillin-Sensitive *Staphylococcus Aureus*
NHSN	National Healthcare Safety Network
NICU	Neonatal Intensive Care Unit
OR	Operating Room
PCR	Polymerase Chain Reaction
PED-VAE	Pediatric Ventilator-Associated Event
PEEP	Positive End-Expiratory Pressure
PICU	Pediatric Intensive Care Unit
PPE	Personal Protective Equipment
PPS	Point Prevalence Survey
PSB	Protected Specimen Brushing
PUD	Peptic Ulcer Disease
PVAP	Possible Ventilator-Associated Pneumonia
QAD	Qualifying Antimicrobial Day
RIT	Repeat Infection Timeframe
SCA	Specialty Care Area
SHEA	Society For Healthcare Epidemiology
SIR	Standardized Infection Ratio
SOT	Solid Organ Transplantation
SSI	Surgical Site Infection
SUR	Standardized Utilization Ratio
SUTI	Symptomatic Urinary Tract Infection

URI	Upper Respiratory Tract Infection
UTI	Urinary Tract Infection
VAC	Ventilator-Associated Condition
VAE	Ventilator-Associated Event
VAP	Ventilator-Associated Pneumonia
VRE	Vancomycin-Resistant Enterococci
WBC	White Blood Cell
WHO	World Health Organization

Introduction

Healthcare-associated infections (HAIs) represent a substantial burden on the healthcare system and one of the most common adverse events in health care delivery, contributing significantly to patient morbidity and mortality and quality of life.

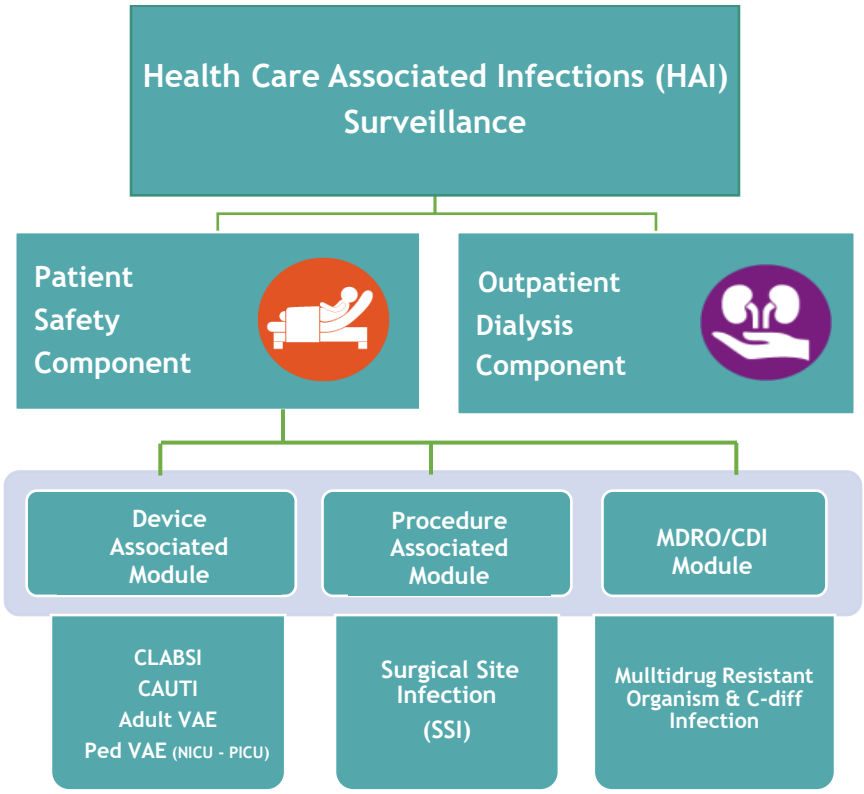
On average, 7% of patients in developed and 15% in developing countries will acquire at least one HAI. These infections are also associated with extended lengths of hospital stay and increased healthcare expenditures with a significant economic burden at the societal level.

Effective surveillance of HAIs is critical, as it generates essential data on infection incidence and trends, thereby informing evidence-based policies and interventions aimed at infection prevention. This manual has been developed to serve as a comprehensive resource for infection prevention & control practitioners, epidemiologists, biostatisticians, and other healthcare practitioners involved in infection prevention within clinical settings. It aims to support the implementation of standardized surveillance practices and to facilitate data-driven strategies for reducing HAIs.

The Public Health Authority (PHA) is responsible for the oversight and regulation of all hospitals across the Kingdom of Saudi Arabia. All governmental & Private Healthcare facilities including the long-term care facilities and standalone outpatient dialysis centers are required to report HAI Surveillance data via official electronic Platforms for 5 major modules that includes device associated module, procedure associated module, MDRO/CDI module, outpatient dialysis module & long-term care facility module.

It is extremely important to ensure high-quality HAI surveillance data through accountability and by identifying, understanding, and correcting problems related to accurate identification & reporting. Developing a standard approach to HAI Surveillance Protocols is important to ensure uniformity, accuracy & completeness of national HAI surveillance data reported via electronic platforms.

HAI Surveillance Modules



SURVEILLANCE OF HEALTHCARE ASSOCIATED INFECTIONS (HAIS)

Healthcare Associated Infections (HAIs)

- A localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or its toxin(s).
- Not present or incubating on admission to the facility.
- An infection is considered HAI if the date of the event of the site-specific infection criterion occurs on or after the 3rd calendar day of admission to an inpatient location where the day of admission is calendar day 1.
- Infections occurring in newborns with the date of event on hospital day 1 or day 2 are considered POA. Infections with a date of event on day 3 or later are HAI. Infections acquired as a result of passage through the birth canal and trans placentally-acquired viral, parasite and spirochete infections are excluded (for example, but not limited to herpes simplex, toxoplasmosis, rubella, CMV, or syphilis). Exception: See guidance about non-reporting of CLABSIs with Group B Streptococcus during a neonate's first 6 days of life.
- Reactivation of a latent infection (for example but not limited to herpes, shingles, syphilis, or tuberculosis) is not considered to be an HAI.

Infection Vs Colonization:

Infection	Colonization
– The successful transmission of a microorganism to the host with subsequent multiplication, colonization, and invasion. – Infection may be clinical or subclinical and may not produce an identifiable disease. – However, it is usually accompanied by measurable host response(s), either through the appearance of specific antibodies or through cell-mediated reaction(s) (e.g., positive tuberculin test results).	– The multiplication of a microorganism at a body site or sites without any overt clinical expression or detected immune reaction in the host at the time that the microorganism is isolated. – Colonization may or may not be a precursor of infection. – Colonization may be a form of carriage and is a potential source for transmission of infection.

Surveillance is conducted for following HAIs in various Surveillance Locations:

- *Central Line Associated Bloodstream Infection (CLABSI)*
- *Catheter Associated Urinary Tract Infection (CAUTI)*
- *Ventilator Associated Events (VAE)*
- *Dialysis Events (DE) in outpatient Dialysis Units*
- *Surgical Site Infections (SSIs)*
- *Multidrug-Resistant Organisms and Clostridium difficile infections (MDRO/CDI)*

Health Care-Associated Infections Surveillance

Essential Elements and Best Practices

Surveillance Definition:

- Surveillance is a systematic method of ongoing collecting, consolidating, and analyzing data concerning the distribution and determinates of a given disease or event, followed by the dissemination of that information to those who can improve the outcome.
- A facility infection prevention and control (IPC) program should use surveillance to identify infections and monitor performance of practices to reduce infection risks among residents, staff, and visitors.
- Information collected during surveillance activities can be used to develop and track prevention priorities for the facility.
- When conducting surveillance, clearly defined surveillance definitions should be used that are collected in a consistent way to ensure accurate and comparable data.

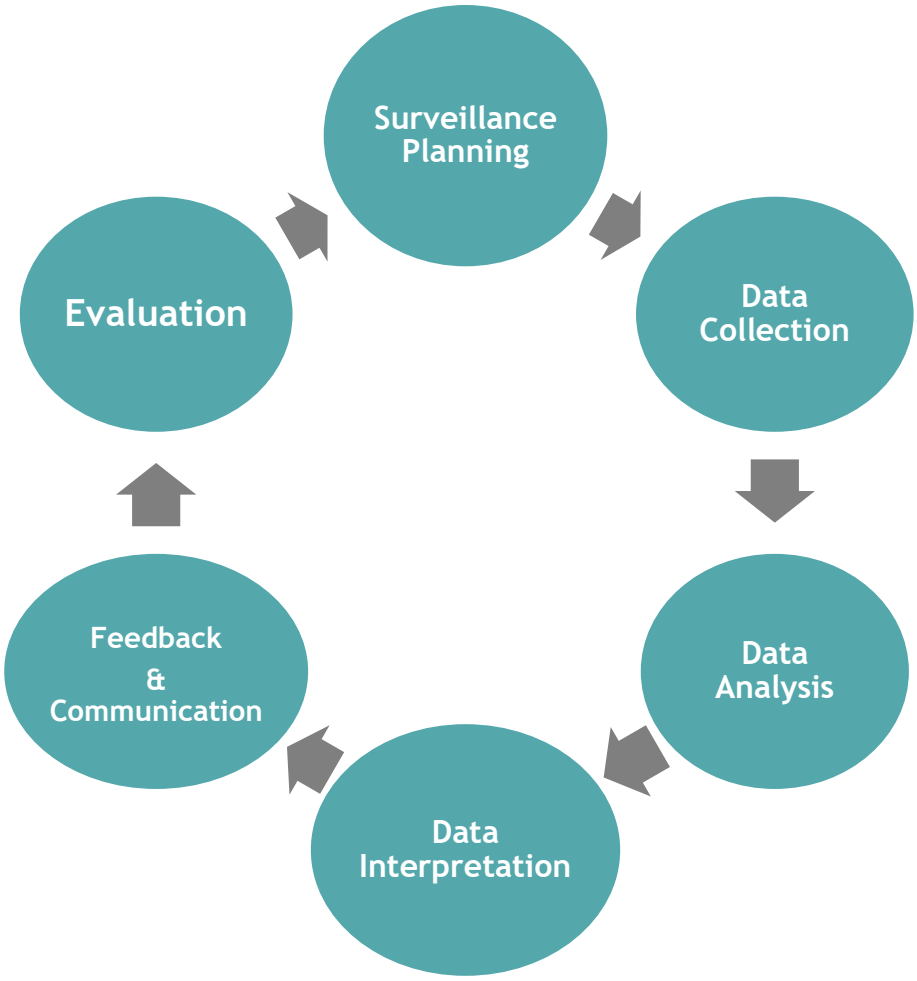
Objectives of HAI Surveillance:

Surveillance data can be used to serve several objectives:

- To measure the incidence of healthcare-associated infections (HAI) and organisms.
- To establish endemic rates of HAI.
- To early detect, investigate, and control hospital outbreaks of HAI.
- To monitor, evaluate, and implement the necessary preventive measures.
- To work on reducing HAI using standard bundles.
- To monitor the occurrence of adverse outcomes to identify potential risk factors.
- To prevent and control infections and occupational injuries in healthcare workers (HCWs).
- To monitor antimicrobial susceptibilities.
- To detect and report notifiable diseases to national regulatory body.
- To identify organisms and diseases of epidemiological importance, such as antibiotic-resistant organisms and tuberculosis, to prevent their spread.
- To ensure compliance with national and international regulations.
- To provide information that can be used by responsible partners within/outside the health care facilities to target performance improvement activities.
- To detect a bioterrorist event or an emerging infectious disease.

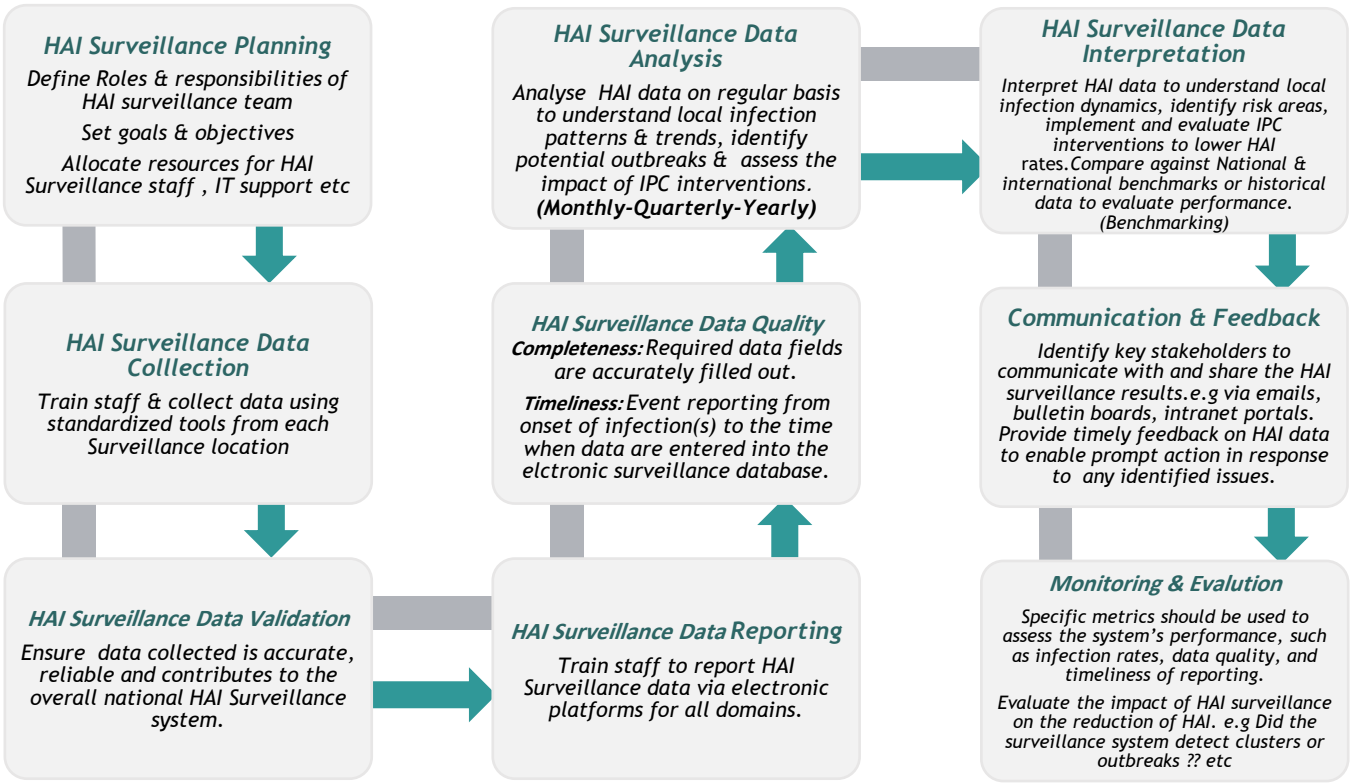
Surveillance Cycle

This chapter outlines the six essential elements of HAI surveillance, which are similar to public health surveillance programs for infectious diseases. These are: surveillance planning; data collection; analysis; interpretation; communication; and evaluation.



Health Care Associated Infections (HAI) Surveillance

PRACTICAL APPROACH

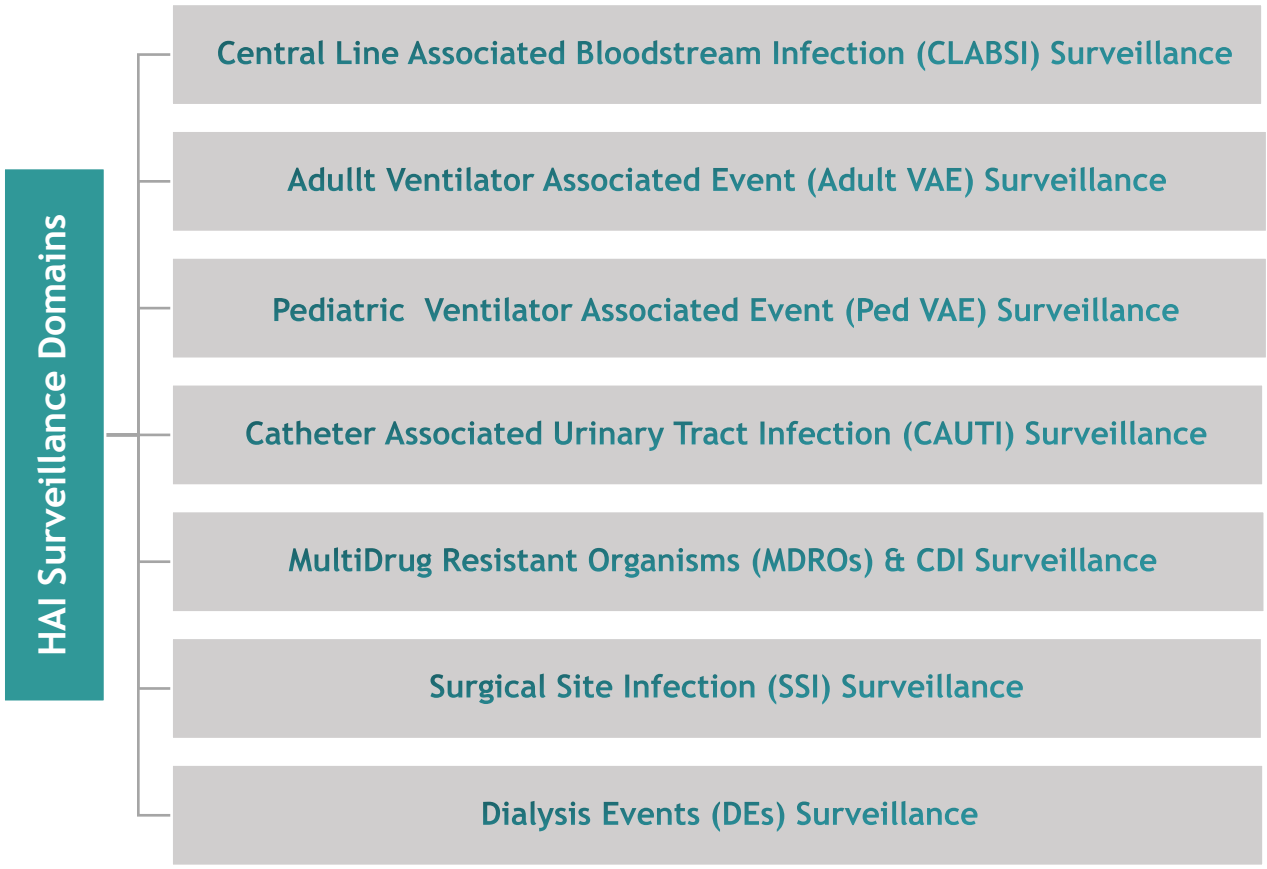


Establishing HAI Surveillance System

Establishing HAI surveillance system in healthcare facilities requires the following steps:

- Assess the population and identify those at greatest risk for the outcome (e.g. blood stream infection) or process (e.g. central line insertion practices) of interest.
- Select the appropriate outcome or process to be monitored by surveillance.
- Select the appropriate surveillance methodology.
- Develop policies and procedures for HAI Surveillance based on approved national guidelines and scientific references.
- Prepare surveillance resources.
- Assemble surveillance team & engage stakeholders.
- Train surveillance team.
- Determine observation location.
- Determine observation period.
- Monitor for the outcome or process.
- Stick to standardized definitions during monitoring.
- Collect appropriate denominator data.
- Create and maintain database.
- Analyze surveillance data.
- Report and use surveillance information in a timely manner.

HAI Surveillance Domains



Surveillance Methodology

The Patient Safety Surveillance Modules must use the following **methodology:**

1. Active Surveillance
2. Patient-Based Surveillance
3. Prospective Surveillance
4. Targeted Surveillance
5. Yields Risk-Adjusted Incidence Rates

- *ICP shall seek out infections during a patient's stay by screening a variety of data sources.*
- *Retrospective chart reviews should be used only when patients are discharged before all information can be gathered.*
- *Other HCWs (other than ICP) may be trained to screen data sources for these infections, but the ICP must make the final determination.*
- *To minimize the ICP's data collection burden, others may be trained to collect the denominator data (separate forms for device-associated infections).*

1. Active versus Passive:

1. Active Surveillance:

- *Trained personnel, mainly ICPs, vigorously look for HAI.*
- *Information accumulated by using a variety of data sources within and beyond the nursing ward.*

2. Passive Surveillance:

- *Persons who do not have a primary surveillance role, such as ward nurses or respiratory therapists, identify and report HAI.*
- *It is acceptable for denominator data.*

Items	Active Surveillance	Passive Surveillance
Person in charge	Data are collected by trained ICP as part of planned surveillance	Data are reported by non-trained personnel as per reporting regulations
Source of information	Attempt to search multiple data sources	No attempt to search multiple data sources
Time required	Needs more effort and time	Needs less effort and time
Missing data	Few missing events	More missing events
Example	ICP collect CLABSI numerator data	Staff nurse call ICP to report a pneumonia case

2. Patient-Based versus Laboratory-Based Surveillance:

1. Patient-Based Surveillance:

- *Count HAI, assess risk factors, and monitor patient care procedures and practices for adherence to infection control principles.*
- *Requires ward rounds and discussion with caregivers.*

2. Laboratory-Based Surveillance:

- *Detection is based solely on the findings of laboratory studies of clinical specimens.*

Items	Patient-Based Surveillance	Laboratory-Based Surveillance
Case-Finding	Data collected from multiple resources (e.g. visit patient care areas, review charts, & discuss with care giver)	Case-finding based solely on positive lab findings
Surveillance Definition	Can verify standard surveillance definition	Usually can NOT verify standard surveillance definition
Uses	Can monitor events, risk factors, and practices	Can NOT monitor risk factors and practices
Example	Device-associate HAI and SSI surveillance	LabID event detection in the MDRO/CDI

3. Prospective Versus Retrospective Surveillance:

1. Prospective Surveillance:

- *Monitor patients during their hospitalization.*
- *For SSIs, also monitor during the post-discharge period.*

2. Retrospective Surveillance:

- *Identify infections via chart reviews after patient discharge.*

Items	Prospective Surveillance	Retrospective Surveillance
Onset of data collection	Data collection starts before patient discharge	Data collection starts after patient discharge
Ascertainment bias	Less ascertainment bias	More ascertainment bias
Missing data	Few missing events as more resources are available	More missing events as less resources are available
Implementation	Easy to establish	May be difficult to establish

4. Priority-Directed versus Comprehensive Surveillance:

1. Priority-directed (also called targeted or focused) Surveillance:

- *Objectives for surveillance are defined.*
- *The focus is on specific events, processes, organisms, and/or patient populations.*

2. Comprehensive Surveillance:

- *Continuous monitoring of all patients for all events and/or processes.*
- *Highly personnel resource intensive if done manually.*

Items	Targeted Surveillance	Comprehensive Surveillance
Focus	Focus on important HAI (e.g. device-associated), locations (e.g. ICUs), and population (e.g. dialysis patients)	Covers all HAIs in all hospital locations and populations
Weight of problems	Weight of problems is respected. Priority & objective directed	Equal weights for different problems
Annual risk assessment	Preceded by annual risk assessment and plan	No need for annual risk assessment and plan
Implementation	Usually feasible & less labor intensive	Usually unfeasible & more labor intensive
Effectiveness	More cost-effective	Less cost-effective

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5. Risk-Adjusted Rates Versus Crude Rates Surveillance:

1. Risk-Adjusted rates:

- *Rates are controlled for variations in the distribution of major risk factors associated with an event's occurrence.*
- *Such rates allow inter- and intra-facility rate comparisons.*
- *Common methods used for risk-adjustment in HAI surveillance:*
  - *Stratification by location in surveillance of device associated infections*
  - *Stratification by surgery type in SSI surveillance*
  - *Stratification by risk index category in SSI surveillance*
  - *Stratification by birth weight group in neonatal CLABSI and Ped VAE*
  - *Stratification by type of central line in CLABSI in specialty care areas*
  - *Stratification by vascular access in dialysis event in dialysis centers*
  - *Standardized infection ratio (SIR)*

2. Crude rates:

- *Rates assume equal distribution of risk factors for all events.*
- *Such rates cannot be used for inter-facility comparisons.*

Items	Adjusted rates	Crude rates
Risk factor assumptions	Rates are controlled for variations in the distribution of major risk factors associated with an event's occurrence	Rates assume equal distribution of risk factors for all events
Credibility	Useful for benchmarking	Benchmarking may be misleading
Example	SIR for SSI for cesarean patients in surgical ward	SSI rates in all patients in surgical ward

HAI Surveillance Plan

Infection Control Risk Assessment:

Infection control risk assessment is a coordinated activity to identify the risks for acquiring and transmitting infections based on the patient population served, the types of services provided, and the analysis of surveillance data.

Purpose of Infection Control Risk Assessment:

1) Evaluation of potential risk for infections, contamination and exposures
2) Based on known risk, historical data and reports in literature
3) Evaluation of harm
4) Life threatening, loss of function, loss of community trust, loss of organization good
5) will, financial threat, legal and/or regulatory issues
6) Evaluation of organization's preparedness
7) To eliminate or mitigate the harm or risk of harm

Components of Infection Control Risk Assessment:

Probability of occurrence of the event/condition: based on known risks, historical data & reports in literature.

Rate	Probability of occurrence	Description
0	Never	No possibility to occur
1	Rare	Risk is not expected to occur
2	Maybe	Occur infrequently but remain a possibility, few times per year or per activity
3	Likely	Risk is not a persistent issue, once several times per year month or per activity

4	Expected	Occur frequently, pose a constant threat once or several times per day

Example of Infection Control Risk Assessment

Event or Condition	What is probability of event/condition occurring?					What is potential impact of event/condition on patients and staff?					What is organization's preparedness to deal with this event/condition?					Numerical risk level
Level	• Expected	• Likely	• Maybe	• Rare	• Never	• Life threatening	• Serious Loss	• Permanent harm	• Moderate clinical	• Minimal clinical	• None	• Poor	• Fair	• Good	• Solid	Total
	4	3	2	1	0	5	4	3	2	1	5	4	3	2	1	
C-diff infection	4							3					3			36
CABG SSI	4						4					4				64

- Multiply the ratings for each risk in the area of probability, impact and current systems
- C-diff infection risk: 4x3x3=36
- CABG SSI risk: 4x4x4=64
- Sort the total score in descending order
- Determine a cut off value below which no action is necessary
- Review with organization for acceptance of priorities

Surveillance Location and Duration

Surveillance is planned based on location and duration.

Types of Patient Care Hospital locations:

I: Inpatient locations: Locations serving patients whose date of admission to the healthcare facility and the date of discharge are different calendar days.

1. **Intensive Care Units (ICU):** A care area that provides intensive observation, diagnosis, and therapeutic procedures for adults (Adult ICU), children (Pediatric ICU, PICU), or neonates (Neonatal ICU, NICU) who are critically ill. The critical care could be surgical, medical, trauma, respiratory, neurologic…etc. Care areas that provide step-down, intermediate care or telemetry are not considered ICU.
2. **Specialty Care Area (SCA):** Hospital location which includes one of the following units: Bone marrow transplant, solid organ transplant, inpatient acute dialysis, hematology/oncology.
3. **Other inpatient Locations:** including any inpatient locations which are not ICU or SCA e.g. inpatient medical, surgical, step-down units, and OR. In addition, others may include an operating room, C-section room, interventional radiology room, cardiac Catheterization lab, or Post-Anesthesia Care Unit.

II- Outpatient locations: Locations serving patients whose date of admission to the healthcare facility and the date of discharge are the same calendar day. These may include any outpatient clinic, Outpatient Emergency Department, or same day surgery and its 24-hour observation area

III: Non-patient care locations:

- Community locations: e.g. Home care.
- Non-patient care hospital locations: e.g. Laboratory or laundry.

Surveillance Domains as per Location

Domains	Inpatients Locations					Out-patients
	Adult ICU	Pediatric ICU	Neonatal ICU	SCA	Long Term Care & Other Wards	
CLABSI & Central Line Care Bundle	Yes	Yes	Yes	Yes	Yes	No
VAE & Ventilator Care Bundle	VAE	Ped-VAE	Ped-VAE	Yes	Yes	No
CAUTI & Urinary Catheter Bundle	Yes	Yes	No	Yes	Yes	No
MDRO & Prevention Bundle	Yes	Yes	Yes	Yes	Yes	**Yes**
DE & Prevention Bundle	No					Yes
SSI & Surgical Bundle	Yes					Yes

Surveillance Duration:

- The least time period to do surveillance is **one month** (to allow for denominator collection).
- Usually **one quarter (3 months)** are enough to give evidence about the rates of infection.
- In bigger units' shorter duration can be tried and in smaller units longer duration can be tried.

Facility Location Mapping

Location is mapped according to acuity level and type of service.

A: 80% rule for determining the acuity level of the unit:

- The acuity level of a unit is determined by the type of care served in that unit.
- That is, if at least 80% of patients are of the same acuity level (for example 80% acute care and 20% non-acute care), that unit is mapped as that acuity level (for example acute care unit). The choice will be based on the list of acuity levels of hospital locations (shown below).
- If the 80% rule does not hold, try splitting the unit into 2 virtual locations. The use of virtual locations is recommended only for units that are geographically split by patient service or those in which beds are designated by service (for example neurology patients are housed in beds 1 through 10 and the neurosurgery patients are housed in beds 11 through 20).
- If the 80% rule and virtual locations do not hold, map the unit as mixed acuity unit (comprised of patients with varying levels of acuity).

List of Acuity levels of Hospital Locations:

- *Adult Critical Care Units*
- *Pediatric Critical Care Units*
- *Neonatal Critical Care Units*
- *Specialty Care Areas (SCA)/Oncology*
- *Adult Wards*
- *Pediatric Wards*
- *Neonatal Wards*
- *Step Down Units*
- *Mixed Acuity Units*
- *Operating Rooms*
- *Chronic Care*
- *Long Term Acute Care*
- *Rehabilitation*
- *Outpatient (acute) locations*
- *Clinic (non-acute) settings*

Operating Rooms (OR):

- OR: A patient care area that meets the American Institute of Architects (AIA) criteria for an operating room. This may include an operating room, C-section room, interventional radiology room, or a cardiac catheterization lab.
- Could be inpatient or outpatient.

B: 80% Rule for Determining the Type of Unit:

- The type of unit is determined by the kind of patients cared for in that unit.
- That is, if at least 80% of patients are of a certain type (for example patients with trauma), that unit is mapped as that type of patients (for example trauma ICU).
- If the 80% rule does not hold, try splitting the unit into 2 virtual locations. The use of virtual locations is recommended only for units that are geographically split by patient service or those in which beds are designated by service (for example neurology patients are housed in beds 1 through 10 and the neurosurgery patients are housed in beds 11 through 20).

If the 80% rule and virtual locations do not hold, you have two scenarios:

- *When a unit houses roughly equal populations (for example 50/50 or 60/40 of medical and surgical patients), that unit is mapped as a combined patient unit e.g. **Medical/Surgical ICU.***
- *When a unit houses mixed populations but one of them >60% (for example 70% medical and 30% surgical), that unit is mapped as that type of the patient majority e.g. **Medical ICU.***

Infection Pathogens

HAIs are caused by Bacterial, Fungal, and Viral pathogens. The focus here will be on bacterial and fungal pathogens.

1: Difference between Gram-Positive and Gram-Negative Bacteria

Items	Gram-Positive Bacteria	Gram-Negative Bacteria
Gram stain	Appears as purple-colored when examined under the microscope	Appears as pink-colored when examined under the microscope
Cell wall	Composed of thick layers peptidoglycan	Composed of thin layers of peptidoglycan
Toxins	Produce exotoxins	Produce endotoxins
Examples Pathogenic	**Pathogenic:** • *Staphylococcus aureus* • *Methicillin Sensitive Staphylococcus aureus* • *Enterococcus spp* • *Clostridium* • *Streptococcus pneumoniae* • *Streptococcus spp* **Commensals:** • Coagulase negative *Staphylococci* • *Streptococcus viridans* • *Diphtheroids* • *Corynebacterium spp.* • *Bacillus spp* • *Propionibacterium spp.* • *Aerococcus spp* • *Micrococcus spp* • *Rhodococcus*	• *Acinetobacter spp* • *Bacteroides spp* • *Citrobacter spp* • *Enterobacter spp* • *Escherichia coli* • *Fusobacterium spp* • *Haemophilus spp* • *Klebsiella spp* • *Legionella spp* • *Peptostreptococcus spp* • *Prevotella spp* • *Proteus spp* • *Providencia* • *Pseudomonas aeruginosa* • *Serratia spp* • *Stenotrophomonas maltophilia* • *Veillonella spp*

2: Most frequent Bacterial Pathogens Causing HAIs:

The common pathogens causing HAIs (device-associated and SSI) according to frequency (Saudi Arabia 2015-2024).

Bacterial Pathogens Causing HAIs
1. *Klebsiella spp.*
2. *Pseudomonas spp.*
3. *Staphylococcus aureus.*
4. *Escherichia coli.*
5. *Enterococcus spp.*
6. *Candida.*
7. *Enterobacter spp.*
8. *MRSA.*
9. *Acinetobacter spp.*
10. *Stenotrophomonas melophilia.*
11. *Streptococcus spp.*
12. *Coagulase-negative Staphylococci.*
13. *Serratia spp.*
14. *Proteus.*
15. *Citrobacter spp.*
16. Other commensals.
17. Other intestinal organisms.

Commensal Organisms:

All of the outer surfaces of the human body are covered with agents that normally do no harm and may, in fact, be beneficial. Those commensal organisms on the skin help to break down dying skin cells or to destroy debris secreted by the many minute glands and pores that open on the skin. Many organisms in the intestinal tract break down complex waste products into simple substances, and others help in the manufacture of chemical compounds that are essential to human life.

Skin Commensals Organisms (Short List):

Common Skin Commensals
1. *Diphtheroids [Corynebacterium spp].*
2. *Bacillus spp.*
3. *Propionibacterium spp.*
4. *Coagulase-negative Staphylococci [*including *S. epidermidis].*
5. *Viridans group Streptococci.*
6. *Aerococcus spp.*
7. *Micrococcus spp.*
8. *Rhodococcus.*

Intestinal Pathogens (MBI pathogens short list)
1. *Bacteroides spp.*
2. *Candida spp.*
3. *Clostridium spp.*
4. *Enterococcus spp.*
5. *Fusobacterium spp.*
6. *Peptostreptococcus spp.*
7. *Prevotella spp.*
8. *Veillonella spp.*
9. *Enterobacteriaceae.*

Enterobacteriaceae (Short List)

Enterobacteriaceae are a large family of different types of gram-negative, facultatively anaerobic, rod-shaped bacteria that do not form endospores. They include some of the normal inhabitants of the small and large gastrointestinal tracts (as their name said). They are common causes of HAIs and include:

Enterobacteriaceae
1. *Citrobacter*
2. *Enterobacter*
3. *Escherichia*
4. *Klebsiella*
5. *Proteus*
6. *Providencia*
7. *Salmonella*
8. *Serratia*
9. *Shigella*
10. *Yersinia*

Fungal Pathogens (short list)

They can cause HAIs specially in immunocompromised or hospitalized with serious underlying diseases. They include the following groups:

1: Yeast		
Candida	**Cryptococcus**	**Other Yeast**
C. albicans	*C. neoformans*	Pneumocystis
C. glabrata	*C. gattii*	Saccharomyces
C. parapsilosis	--	Trichosporon
C. tropicalis	--	--
C. krusei	--	--
C. auris	--	--

2: Molds		
Aspergillus	***Mucorales***	***Other Molds***
A. fumigatus	*M. Rhizopus*	*Fusarium spp.*
A. flavus	*M. Mucor*	*Scedosporium spp.*
A. Niger	--	--
A. terreus	--	--

Dimorphic Fungi Mycoses:

Specific fungal pathogens typically causing community-associated infections **cannot** be used to meet any HAI definition:

1. *Blastomyces*
2. *Histoplasma*
3. *Coccidioides*
4. *Paracoccidioides*
5. *Cryptococcus*
6. *Pneumocystis*

Viral pathogens (short list)

1. *Influenza* virus
2. *Respiratory syncytial* virus
3. *Adenovirus*
4. *Parainfluenza* virus
5. *Rhinovirus*
6. *Human metapneumovirus*
7. *Coronavirus*

Non-accepted Organisms:

- Specific fungal pathogens typically causing community-associated infections **cannot** be used to meet any HAI definition:

1. *Blastomyces*
2. *Histoplasma*
3. *Coccidioides*
4. *Paracoccidioides*
5. *Cryptococcus*
6. *Pneumocystis*

Key Terms for Identifying Healthcare-Associated Infections (HAI)

Device-Associated Infections:

- Device-associated infection is an infection in a patient with a device (e.g., ventilator, central line or indwelling urinary catheter) that was in place for more than 2 calendar days before onset of infection.

- The date of device-associated HAI event is the date the first element used to meet the infection criterion occurs for the first time within the seven-day infection window period.

- If the device-associated HAI develops within 2 calendar days of discharge from a location, it is associated with the discharging location.

Common Criteria for Device-Associated Infections:

The common criteria shown below are applicable for surveillance of device-associated HAI with the exception of VAE. Additionally, these criteria are not applicable to SSI and MDRO (LabID Events). The criteria included the following:

1. Infection Window Period for HAI:

- It is the 7-days during which all site-specific infection criteria must be met.
- It includes the day the first positive diagnostic test that is an element of the site-specific infection criterion, was obtained, the 3 calendar days before and the 3 calendar days after.

2. Date of HAI Event:

- It is the date the first element used to meet an NHSN site-specific infection criterion occurs for the first time within the seven-day infection window period.

3. Present on Admission (POA):

- An infection is considered POA if the date of event of the infection criterion occur.
  - Two calendar days before day of admission
  - First day of admission (day 1)
  - Day after admission (day 2)
- Exceptions: SSI, MDRO, CDI, and MRSA bacteremia may occur after patient's discharge from facility and be present upon readmission.

4. Healthcare-Associated Infection (HAI):

- An infection is considered HAI if the date of event of the infection at or after the third day of admission of the patient considering the day of admission is day number one.
- HAI is a localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or its toxin(s). Not present or incubating on admission to the facility.

5. Location of Attribution:

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

6. Transfer Rule:

- If all elements of an HAI were present within 2 calendar days of transfer from one inpatient location to another in the same facility (i.e., on the day of transfer or the next day), the HAI is attributed to the transferring location.
- If all elements of an HAI were present within 2 calendar days of transfer from one inpatient facility to another, the HAI is attributed to the transferring facility.
- However, infections cannot be attributed to a location where patients are not housed overnight (like an OR or ED). In this situation, the infection should be attributed to the next inpatient location.

7. Multiple Transfers:

- If the 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.

8. Repeat Infection Timeframe (RIT):

- It is a 14-day timeframe during which no new infections of the same type are reported.
- The date of the event is Day 1 of the 14-day RIT.
- Additional pathogens recovered during the RIT from the same type of infection are added to the event.
- The RIT applies during a patient's single admission, including the day of discharge and the day after, in keeping with the Transfer Rule.
- An RIT does not carry over from one admission to another even if readmission is to the same facility.
- The RIT can apply at the level of specific type of infection with the exception of BSI, UTI, and PNEU where the RIT will apply at the major type of infection.

9. Device Removal and Reinsertion:

- If central line or urinary catheter were removed and reinserted before a full calendar day without a device (central line or urinary catheter), then continue the day count.
- Therefore, if the patient is without a device (central line or urinary catheter) for at least one full calendar day (NOT to be read as 24 hours), then start a new day count.

10. Secondary BSI Attribution Period:

- It is the period in which a positive blood culture must be collected to be considered as a secondary bloodstream infection to a primary site infection.
- This period includes the Infection Window Period combined with RIT.
- In case of DA HAI: It is 14-17 days in length depending upon the date of event.
- In case of SSI: 17-day period that includes the date of SSI event, 3 days prior and 13 days after.

11. Pathogen Assignment Guidance:

- Additional pathogens recovered during the RIT from the same type of infection or during the secondary BSI attribution period are added to the event.
- Exception: Pathogens excluded from specific infection definitions (e.g., yeast in UTI, Enterococcus spp. in PNEU) are also excluded as pathogens for BSIs secondary to that type of infection.
- Secondary BSI pathogens may be assigned to more than one infection source at the same time.

12. Microbiologic Testing:

- Organisms identified from a specimen by a culture or non-culture based microbiologic testing method is acceptable to meet the HAI definition.
- However, for the purpose of meeting the HAI definition culture or non-culture based microbiologic testing method must be performed for purposes of clinical diagnosis or treatment (e.g., not active surveillance culture/testing (ASC/AST).

Difference Between Surveillance and Clinical Definitions

Surveillance and clinical definitions are different due to different purposes, as shown below:

Items	Clinical Criteria	Surveillance Criteria
Main aim	Aim to provide diagnosis and treatment for cared patients	Aim to provide trends for risk assessment, prevention & policy change
Main focus	Focus on individual patients	Focus on a patient population
Allowance for clinical Judgment	Clinical judgment is important	Clinical judgment is absent or minimal

CHAPTER – I

Patient Safety Component

A: Device Associated Module

Central Line Associated Bloodstream Infection (CLABSI) Surveillance

1: Initaite CLABSI Surveillance for each patient on Central Line in Adult, Pediatric & Neonatal Locations

Adullt Ventilator Associated Event (Adult VAE) Surveillance

Initaite VAE Surveillance for each patient on Ventilator using Adult VAE Monitoring Form

Pediatric Ventilator Associated Event (Ped VAE) Surveillance

Initaite Ped VAE Surveillance for each patient on Ventilator using Ped VAE Monitoring Form (PICUs & NICUs)

Catheter Associated Urinary Tract Infection (CAUTI) Surveillance

1: Initaite CAUTI Surveillance for each patient with indwelling Urinary Catheter

SURVEILLANCE OF CENTRAL LINE ASSOCIATED BLOOD STREAM INFECTION (CLABSI)

Central Line-Associated Bloodstream Infection

CLABSI:

- CLABSI is a primary bloodstream infection (BSI) in a patient who had a central line or umbilical catheter.
- The central line or umbilical catheter has to be in place for >2 days and in place at the date of event or the day before.
- Primary BSI is a laboratory-confirmed bloodstream infection (LCBI) that is not secondary to an infection meeting CDC/NHSN criteria at another body site.

Surveillance Settings:

Surveillance can be done in any inpatient location where denominator data can be collected, this includes:

- ICUs
- NICUs
- SCA
- Other inpatient locations including Long Term Care Locations
- Inpatients receiving dialysis are included in any CLABSI surveillance in the location in which they are housed, regardless of whether or not the central line is the only central line and only accessed for dialysis

Surveillance Methodology:

- Active
- Patient based
- Prospective
- Priority-directed targeted
- Yield risk-adjusted incidence rates

Date of Event (DOE):

It is the date when the FIRST element used to meet the CLABSI criterion occurs for the first time within the 7-day infection window period.

Primary Bloodstream Infection (BSI):

A Laboratory Confirmed Bloodstream Infection (LCBI) that is not secondary to an infection at another body site (see Appendix: Secondary BSI Guide and CDC/NHSN Surveillance Definitions for Specific Types of Infection, urinary tract infection (UTI), pneumonia (PNEU), and surgical site infection (SSI).

Secondary BSI:

A BSI that is thought to be seeded from a site-specific infection at another body site (see Appendix: Secondary BSI Guide and CDC/NHSN Surveillance Definitions for Specific Types of Infection, UTI, PNEU, and 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). The SBAP is 14-17 days in length depending upon the date of event (See Secondary BSI Attribution period).

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 needleless device) any central line for:

o Infusion

o Withdrawal of blood

- Use for hemodynamic monitoring

Central Line:

It is an intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring. The following are considered great vessels for the purpose of CLABSI surveillance:

- 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.

Notes about central line:

- Neither the insertion site nor the type of device may be used to determine if a line qualifies as a central line.
- The device must terminate in one of the great vessels or in or near the heart, and be used for one of the purposes outlined above, to qualify as a central line.
- An introducer is considered an intravascular catheter and depending on the location of its tip and use, may be a central line.
- Pacemaker wires and other non-lumened devices inserted into central blood vessels or the heart are not considered central lines, because fluids are not infused, pushed, nor withdrawn through such devices.
- Infusion: The introduction of a solution through a blood vessel via a catheter lumen. This may include continuous infusions such as nutritional fluids or medications, or it may include intermittent infusions such as flushes, IV antimicrobial administration, or blood transfusion or hemodialysis.

The following devices are not considered central lines:

- Arterial catheters unless in the pulmonary artery, aorta or umbilical artery
- Arteriovenous fistula
- Arteriovenous graft
- Extracorporeal life support (ECMO)
- Hemodialysis reliable outflow (HERO) dialysis catheter
- Intra-aortic balloon pump (IABP) devices
- Peripheral IV or Midlines
- Ventricular Assist Device (VAD)

Type of Central Lines:

- Temporary central line: A non-tunneled, non-implanted catheter.
- Permanent central line: Includes
  - ✓ Tunneled catheters, including certain dialysis catheters.
  - ✓ Implanted catheters (including ports).
- Umbilical catheter: A central vascular device 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 for **more 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.

Eligible BSI Organism:

- Any organism that is eligible for use to meet LCBI or MBI-LCBI criteria. In other words, an organism that is not an excluded pathogen for use in meeting LCBI or MBI-LCBI criteria.

- **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.

Counting Central Line Days:

- If a patient has more than one temporary central line on a given day, this is counted only as one central line day
- If a patient has both a temporary and a permanent central line on the same day, the day is counted as one temporary central line day.
- If an infant has both an umbilical catheter and a non-umbilical central line, count as an umbilical catheter day only

Central line Removal and Reinsertion:

- If the central line was removed and reinserted before a full calendar day without a central line, then continue the day count.
- Therefore, if the patient is without a central line for at least one full calendar day (NOT to be read as 24 hours), then start a new day count.

Hospital days	1	2	3	4	5	6	7
Central line days	1	2	3	Removal (4)	Re-insertion (5)	6	7

Hospital days	1	2	3	4	5	6	7
Central line days	1	2	3	Removal (4)	---	Re-insertion (1)	2

Location of attribution:

- The inpatient location where the patient was assigned on the date of the LCBI event, which is further defined as the date when the first element used to meet the LCBI criterion occurred.
- OR/ Post Anesthesia Care Unit/Recovery Room/dialysis unit /ERs cannot be considered a location of attribution for BSI.

Transfer Rule:

- If the date of the event for a CLABSI is the day of transfer or discharge, or the next day, the CLABSI is attributed to the transferring location.
- Receiving facilities should share information about such HAIs with the transferring facility to enable reporting.

Example:

- *Patient with a central line in place in the SICU is transferred to the surgical ward. The day after transfer is the date of event for an LCBI. This is reported as a CLABSI for the SICU.*
- *Patient with a central line in place is transferred from the medical ward to the coronary care ICU (CCU). An LCBI date of event is on day four in the CCU. The central line is still in place. This is reported as a CLABSI for the CCU because the date of event was not the date of transfer from the medical ward, or the next day.*

Multiple Transfers:

- If the patient has been transferred to more than one location on the date of CLABSI, or the day before, attribute the CLABSI to the first location in which the patient was housed the day before the CLABSI's date of event.

Date	3/22	3/23	3/24
Locations	Unit A	Unit A Unit B Unit C	Unit C Unit D CLABSI was diagnosed

- *CLABSI is attributed to Unit A since Unit A was the first location in which the patient was housed the day before the date of event.*

CDC-NHSN CRITERIA FOR IDENTIFICATION OF CLABSI

I: Laboratory-Confirmed Bloodstream Infection (LCBI-1)

Patient of **any age** has a **recognized pathogen** identified from **one or more** blood specimens by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment.

AND

Organism(s) identified in blood is not related to an infection at another site.

II: Laboratory-Confirmed Bloodstream Infection (LCBI-2)

Patient of **any age** has at least one of the following **signs or symptoms**: fever (>38.0°C), chills, or hypotension.

AND

The same common commensal is identified from two or more blood specimens drawn on separate occasions, by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment. Criterion elements must occur within the Infection Window Period

AND

Organism(s) identified from blood is not related to an infection at another site.

III: Laboratory-Confirmed Bloodstream Infection (LCBI-3)

Patient ≤ 1 year of age has at least one of the following **signs or symptoms**: fever (>38.0°C), hypothermia (<36.0°C), apnea, or bradycardia.

AND

The same common **commensal** is identified from **two or more** blood specimens drawn on separate occasions, by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment. Criterion elements must occur within the Infection Window Period

AND

Organism(s) identified from blood is not related to an infection at another site.

Blood Specimen Collection Protocols

Two or more blood specimens drawn on separate occasions:

- The "two or more blood specimens drawn on separate occasions" criterion is met when these two conditions are met:
  1. There is blood collected from at least two separate blood draws on the same or consecutive calendar days.
  2. The blood cultures are assigned separate specimen numbers, processed individually, and are reported separately in the final laboratory report. The separate specimen numbers indicate two separate site preparations (decontamination steps) are performed during specimen collection.
- *Separate occasions* are met with different venipunctures, a combination of venipuncture and lumen withdrawal, or different lumens of the same central line), or at different times.
- The guidance above is intended to reduce misidentification of contaminated blood specimens as LCBIs. For example, aseptic technique indicates separate site decontaminations would be performed for blood specimens drawn from different sites.
- If both culture sets are positive, there is less chance that contamination was the cause than if 2 positive blood cultures were collected from a single blood draw (in other words, collected using a vacutainer or via venipuncture and attaching multiple bottles after a single decontamination of the site), these specimens would be considered a single access (or the same occasion).

Specimen collection sites:

- Blood specimens drawn through central lines can have a higher rate of contamination than blood specimens collected through peripheral venipuncture.
- However, all positive blood specimens, **regardless of the site** from which they are drawn or the purpose for which they are collected, must be included when conducting in-plan CLABSI surveillance (for example, weekly blood cultures performed in hematology and oncology locations).
- Catheter tip cultures **cannot** be used in place of blood specimens for meeting LCBI criteria.

Infection Window Period:

It is the 7-day time period which includes the collection date of the positive blood, the 3 calendar days before and the 3 calendar days after.

Repeat Infection time frame (RIT)

- It is 14-day timeframe during which no new CLABSI of the same type are reported. The date of event is Day 1 of the 14-day RIT.
- Note that only primary BSIs create a BSI RIT. Secondary BSIs do not create a BSI RIT.

Skin commensals organisms

It is applicable for LCBI-2 and LCBI-3. They include

- *Diphtheroids [Corynebacterium spp].*
- *Bacillus spp.*
- *Propionibacterium spp.*
- Coagulase-negative *Staphylococci* [including *S. epidermidis*]
- *Viridans group streptococci.*
- *Aerococcus spp.*
- *Micrococcus spp.*
- *Rhodococcus.*

Matching organisms:

- If genus and species are identified in both specimens, they must be the same.
    - ✓ Example: *Pseudomonas aeruginosa and Pseudomonas aeruginosa*
- If one organism is less definitively identified than the other, the lesser identified organism must be identified at least to the genus level and at that level the organisms must be the same.
- Example: *Pseudomonas species and Pseudomonas aeruginosa.*

– Exception-1: *Staphylococcus* and coagulase negative/positive *Staphylococcus*

– Exception-2: *Streptococcus species* and *Streptococcus viridans*

- The matching common commensals represent a single element; therefore, the collection date of the first common commensal is the date of the first diagnostic test used to determine the Infection Window Period (IWP).

Examples of Matching/Non-Matching Organisms

First Culture	Second Culture	Sameness	Report as…
Coagulase positive *Staphylococci*	*S. aureus*	Different (look at exception above)	*S. aureus*
S. epidermidis	Coagulase-negative *Staphylococci*	*Same (Staph epidermidis is part of* Coagulase-negative *Staphylococci)*	*S. epidermidis*
Enterococcus spp.	*E. faecium*	*Same (genus and species levels)*	*E. faecium*
Bacillus spp.	*B. cereus*	*Same (genus and species levels)*	*B. cereus*
S. salivarius	*Strep. viridans*	*Same (just synonymous names)*	*S. salivarius*

Secondary BSI:

- It is BSI meeting the LCBI criteria BUT is secondary to another site of infection.
- 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.

Scenarios of Secondary BSI:

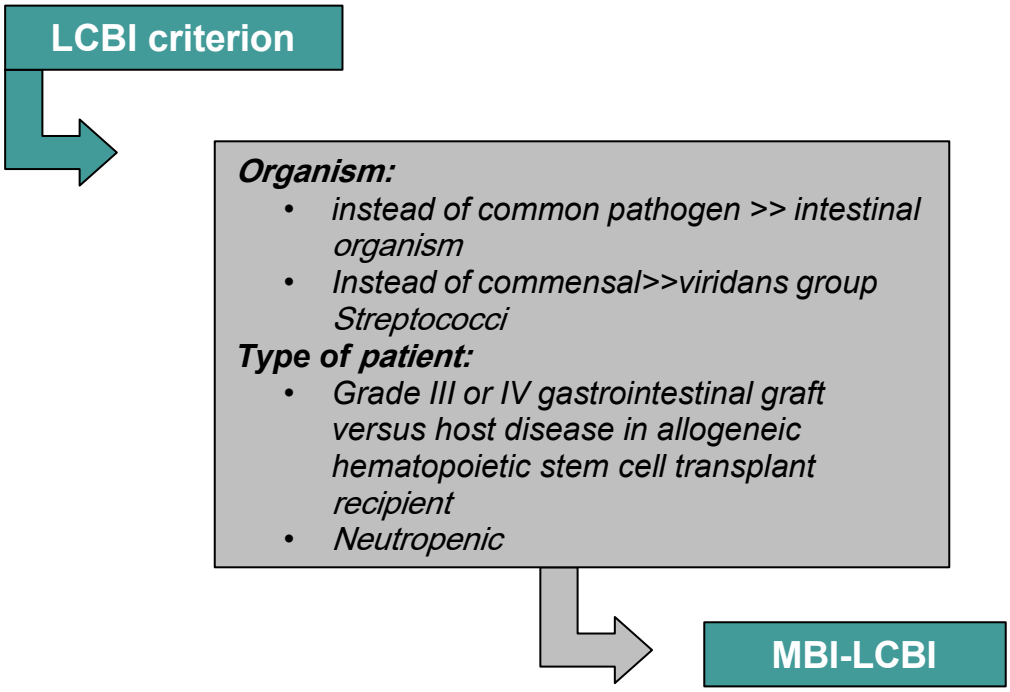
Scenario 1	Scenario 2
Blood specimen must contain at least one **matching** organism of the site specific specimen	Blood specimen must be **an element of the site specific criterion***
And is collected in the secondary **BSI attribution period**	And is collected during the site specific infection's **infection window period**
And an **organism identified from the site specific infection** is used as an element to meet the site specific infection criterion	And an **organism identified in the blood specimen** is an element that is used to meet the site-specific infection criterion

Examples of scenarios of secondary BSI:

Scenario 1	Scenario 2
SSI (SI or DI or OS) • Positive wound • Matching positive blood during BSI attribution period	**IAB criterion 3b** • Fever, nausea or abdominal pain, **positive blood specimen** during IWP and CT scan showing infection in abdominal cavity
SUTI • Positive urine during IWP • Matching positive blood during BSI attribution period	**PNU 2 or 3** (one criterion during IWP) • Infiltrate on chest imaging test, fever, new onset of cough and organism identified from **blood specimen** during IWP
PNU 2 or 3 or PVAP • Positive respiratory specimen during IWP • Matching positive blood during BSI attribution period	**PNU 2 or 3** (Two criteria during IWP) • Infiltrate on chest imaging test, fever, new onset of cough and organism identified from **blood and BAL** specimens during IWP

Mucosal Barrier Injury (MBI)

- The mucosal barrier injury (MBI) LCBI meets the need for more specific BSI definition in **oncology patients.**
- In this population, CLABSI rates are inflated by misclassification of BSI resulting from translocation of intestinal organisms.
- These BSIs are not impacted by CLABSI prevention measures and not associated with the central line.
- Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infection (MBI-LCBI).
    - ✓ Patient who meets LCBI criteria with at least one blood specimen showing intestinal organisms
    - ✓ AND
    - ✓ Patient meets at least one of the following:
        - Grade III or IV gastrointestinal graft versus host disease in allogeneic hematopoietic stem cell transplant recipient
        - Is neutropenic



MBI-LCBI-1

Patient of **any age** meets **criterion 1 for LCBI** with at least **one** blood specimen identified by a culture or non-culture based microbiologic testing method, with **ONLY intestinal organisms** from the MBI-LCBI organisms list.

And

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 <18 years of age) with onset on or within 7 calendar days before the date the positive blood specimen was collected.
2. Is **neutropenic**, defined as at least two separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm3 within a 7-day time period which includes the date the positive blood specimen was collected (Day 1), the 3 calendar days before and the 3 calendar days after.

MBI-LCBI-2

Patient of **any age** meets **criterion 2 for LCBI** with at least **two** blood specimens identified by a culture or non-culture based microbiologic testing method, with **only viridans group *Streptococci* and/or *Rothia spp*.** but no other organisms.

And

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 <18 years of age) with onset on or within 7 calendar days before the date the positive blood specimen was collected.
2. Is **neutropenic**, defined as at least two separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm^3 within a 7-day time period which includes the date the positive blood specimen was collected (Day 1), the 3 calendar days before and the 3 calendar days after.

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MBI-LCBI-3

Patient **≤1 year of age** meets **criterion 3 for LCBI** with at least **two** blood specimens identified by a culture or non-culture based microbiologic testing method, with **only viridans group *Streptococci* and/or *Rothia* spp.** but no other organisms. *And*
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. ≥ 20 ml/kg diarrhea in a 24-hour period with onset on or within 7 calendar days before the date the first positive blood specimen is collected.
2. Is **neutropenic**, defined as at least two separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) < 500 cells/mm^3 within a 7-day time period which includes the date the positive blood specimen was collected (Day 1), the 3 calendar days before and the 3 calendar days after.

Blood Specimen Collection for MBI-LCBI:

- In MBI-LCBI 1, 2 and 3, "No other organisms" means there is no identification of a non-MBI-LCBI pathogen (such as S. aureus) or 2 matching common commensals (such as coagulase-negative staphylococci) collected from the blood on separate occasions that would otherwise meet LCBI criteria. If this occurs, the infection does not meet MBI-LCBI criteria.
- When a blood specimen positive for an organism not included on the NHSN MBI organism list is collected during the BSI RIT of an MBI-LCBI, the initial MBI-LCBI event is edited to an LCBI and the identified non-MBI organism is added.
- MBI-RIT Exception: An MBI-LCBI designation will not change to an LCBI event if the following TWO criteria are met:
  - *The blood culture with the non-MBI organism is collected during an existing BSI (MBI-LCBI) RIT*
  - *The blood culture with the non-MBI organism is deemed secondary to an NHSN site-specific infection*

Intestinal pathogens (MBI pathogens short list)

- *Bacteroides spp.*
- *Candida spp.*
- *Clostridium spp.*
- *Enterococcus spp.*
- *Fusobacterium spp.*
- *Peptostreptococcus spp.*
- *Prevotella spp.*
- *Veillonella spp.*
- *Enterobacteriaceae.*

Enterobacteriaceae (short list)

- *Citrobacter*
- *Enterobacter*
- *Escherichia*
- *Klebsiella*
- *Proteus*
- *Providencia*
- *Salmonella*
- *Serratia*
- *Shigella*
- *Yersinia*

Collection of Denominator Data for CLABSI

1. Manual, Daily:

Patient days and central line days should be collected at the same time, every day, for each location performing surveillance to ensure that differing collection methods don't inadvertently result in device days being > patient days.

2. Manual, Weekly:

Patient days and central line days should be collected at the same time on the same designated day, once per week. The idea is to reduce staff time spent collecting surveillance data, once weekly sampling of denominator data is good for:

- For locations with 75 or more device days per month
- For locations other than specialty care areas/oncology and NICUs
- If the day designated for the collection of sampled data is missed, collect the data on the next available day instead

3. Electronic Sources:

When patient days and central line days are available from electronic databases, these sources may be used as long as the counts are not substantially different (+/- 5%) from those collected manually.

CLABSI Data Analysis

Measure	Calculation	Application
CLABSI Rates	$\frac{\text{The number of CLABSIs for a location}}{\text{The number of central line days for that location}}$ X1000	Location specific measure
MBI-LCBI Rates	$\frac{\text{The number of MBI-LCBIs for a location}}{\text{The number of central line days for that location}}$ X1000	Location specific measure
CLABSI SIR	$\frac{\text{The number of observed CLABSIs -}}{\text{The number of predicted CLABSIs}}$	Both location specific and summarized measure
MBI-LCBI SIR	$\frac{\text{The number of observed MBI-LCBIs}}{\text{The number of predicted MBI-LCBIs}}$	Both location specific and summarized measure
Central line DUR	$\frac{\text{The number of central line days for a location}}{\text{The number of patient days for that location}}$	Location specific measure
Central Line SUR	$\frac{\text{The number of observed central line days}}{\text{The number of predicted central line days}}$	Both location specific and summarized measure

SIR, standardized infection ratio; DUR, device utilization ratio; SUR, standardized utilization ratio

- *CLABSI rates and central line DUR should be presented by unit (for example, adult ICU, pediatric ICU…etc.).*
- *CLABSI rates and central line DUR in neonatal ICU should be presented by unit and birthweight categories (which includes A = **≤750 g; B = 751-1000 g; C = 1001- 1500 g; D = 1501-2500 g; E = >2500 g)**.*
- *CLABSI rates and central line DUR in special care areas (such as oncology and transplant units) should be presented by unit and type of catheter (temporary and permanent).*
- *CLABSI SIR and central line SUR can be presented for single locations and can be summarized across multiple locations, adjusting for differences in the incidence of infection or device utilization (respectively) between different location types.*
- *In neonatal ICU, CLABSI SIR and central line SUR can be additionally summarized across birthweight categories, adjusting for differences in the incidence of infection or device utilization (respectively) between different birthweight categories.*
- *In special care areas (such as oncology and transplant units), CLABSI SIR and central line SUR can be additionally summarized across all types of catheter, adjusting for differences in the incidence of infection or device utilization (respectively) between different catheter types.*

SURVEILLANCE OF CATHETER ASSOCIATED URINARY TRACT INFECTIONS (CAUTI)

CAUTI SURVEILLANCE

- CAUTI Definitions
- CAUTI Surveillance Methodology & Locations
- Indwelling Urinary Catheter Definition
- Counting Urinary Catheter Days - Insertion & Reinsertion
- Location of Attribution, Transfer Rule, Multiple Transfers
- Key Terms for CAUTI Idetification *(DOE, IWP, RIT)*
- CDC-NHSN Criteria for CAUTI identification
- Symptomatic UTI (SUTI 1a)
- Symptomatic UTI (SUTI 2)
- Asymptomatic Bacteremic Urinary Tract Infection (ABUTI)
- Collection of Denomintaor Data for CAUTI
- CAUTI Data Analysis (CAUTI Rate, CAUTI SIR etc)
- Excluded Organisms for CAUTI Definitions

Catheter-Associated Urinary Tract Infection

Urinary Tract Infections:

(UTI) are defined using Symptomatic Urinary Tract Infection (SUTI) criteria and Asymptomatic Bacteremic UTI (ABUTI).

Note: A UTI is a primary site of infection; it is never considered secondary to another site of infection.

CAUTI:

- CAUTI is defined as a symptomatic urinary tract infection (SUTI) or asymptomatic bacteremic UTI (ABUTI) in a patient who had an indwelling urinary catheter.
- Indwelling urinary catheter has to be in place for >2 days and in place at the date of event or the day before.

Surveillance Settings:

Surveillance can be done in any inpatient location where denominator data can be collected, this includes:

- ICUs
- SCA
- Other inpatient locations including Long Term Care Locations
- NICUs (may participate, but only off plan)

Surveillance methodology

- Active
- Patient based
- Prospective
- Priority-directed targeted
- Yield risk-adjusted incidence rates

Date of Event (DOE):

It is the date when the FIRST element used to meet the CAUTI criterion occurs for the first time within the 7-day infection window period.

Indwelling Urinary Catheter:

- Indwelling catheter: A drainage tube that is inserted into the urinary bladder through the urethra, is left in place, and is connected to a drainage bag (including leg bags).
- These devices are also called Foley's catheters.
- Condom or straight in-and-out catheters are not included nor are nephrostomy tubes, ileoconduits, or suprapubic catheters unless a Foley's catheter is also present.
- Indwelling urethral catheters that are used for intermittent or continuous irrigation are included in CAUTI surveillance.

Urinary Catheter Removal and Reinsertion:

- If indwelling urinary catheter was removed and reinserted before a full calendar day without a urinary catheter, then continue the day count.
- Therefore if the patient is without a urinary catheter for at least one full calendar day (NOT to be read as 24 hours), then start a new day count.

Hospital days	1	2	3	4	5	6	7
Urinary catheter days	1	2	3	Removal (4)	Re-insertion (5)	6	7

Hospital days	1	2	3	4	5	6	7
Urinary catheter days	1	2	3	Removal (4)	---	Re-insertion (1)	2

Repeat Infection time frame (RIT):

- It is 14-day timeframe during which no new CAUTI of the same type are reported.
- The date of event is Day 1 of the 14-day RIT.

Location of attribution:

- The inpatient location where the patient was assigned on the date of the CAUTI event, which is further defined as the date when the first element used to meet the CAUTI criterion occurred.
- OR/ Post Anesthesia Care Unit/ Recovery Room/ dialysis unit/ ERs cannot be considered a location of attribution for CAUTI.

Transfer Rule:

- If the date of event for a CAUTI is the day of transfer or discharge, or the next day, the CAUTI is attributed to the transferring location.
- Receiving facilities should share information about such HAIs with the transferring facility to enable reporting.
- Example:

– *Patient in the SICU with a Foley catheter, which has been in place for 5 days, is transferred to a surgical ward.*
– *The next day is determined to be the date of event for a CAUTI.*
– *This is reported as a CAUTI for the SICU*

Multiple Transfers:

- If the patient has been transferred to more than one location on the date of CAUTI, or the day before, attribute the CAUTI to the first location in which the patient was housed the day before the CAUTI's date of event.

Date	3/22	3/23	3/24
Locations	Unit A	Unit A Unit B Unit C	Unit C Unit D CAUTI was diagnosed

- *CAUTI is attributed to Unit A since Unit A was the first location in which the patient was housed the day before the date of event.*

CDC-NHSN CRITERIA FOR IDENTIFICATION OF CAUTI

I: Catheter Associated Urinary Tract Infection (CAUTI) in any age patient

Symptomatic UTI (SUTI-1a)

Patient must meet 1, 2, and 3 below:

1. Patient of any age had an indwelling urinary catheter that had been in place for > 2 days 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)
   - Suprapubic pain or tenderness
   - Costovertebral angle pain or tenderness
   - Urinary urgency (only if catheter is not in place)
   - Urinary frequency (only if catheter is not in place)
   - Dysuria (only if catheter is not in place)
3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium $\geq 10^5$ CFU/ml.

II: CAUTI in Patients 1 year of age or less

Symptomatic UTI (SUTI-2)

Patient must meet 1, 2, and 3 below:

1. Patient is ≤1 year and had an indwelling urinary catheter that had been in place for > 2 days 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)
   - hypothermia (<36.0°C)
   - apnea*
   - bradycardia*
   - lethargy*
   - vomiting*
   - suprapubic tenderness* (*With no other recognized cause)
3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium ≥10^5 CFU/ml.

III: Asymptomatic Bacteremic Urinary Tract Infection (ABUTI)

Patient must meet 1, 2, and 3 below:

1. Patient of any age with an indwelling urinary catheter (an IUC that had been in place for > 2 days) has no signs or symptoms of SUTI 1 or 2 according to age.
2. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium ≥10^5 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.

Note: All elements of the ABUTI criterion must occur during the Infection Window Period

Comments about CAUTI Definition

- The following excluded organisms cannot be used to meet the UTI definition:
  - ✓ Any Candida species as well as a report of “yeast” that is not otherwise specified
  - ✓ mold
  - ✓ dimorphic fungi or
  - ✓ parasites
- “Mixed flora” cannot be reported as a pathogen to meet the CAUTI criteria.
- An acceptable urine specimen may include these organisms as long as one bacterium of greater than or equal to 100,000 CFU/ml is also present. Additionally, these non-bacterial organisms identified from blood cannot be deemed secondary to a UTI since they are excluded as organisms in the UTI definition.
- Suprapubic tenderness whether elicited by palpation (tenderness-sign) or provided as a subjective complaint of suprapubic pain (pain-symptom), documentation of either found in the medical record is acceptable as a part of SUTI criterion if documented in the medical record during the Infection Window Period.
- Lower abdominal pain or bladder or pelvic discomfort are examples of symptoms that can be used as suprapubic tenderness. Generalized “abdominal pain” in the medical record is not to be interpreted as suprapubic tenderness as there are many causes of abdominal pain and this symptom is too general.
- Left or right lower back or flank pain are examples of symptoms that can be used as costovertebral angle pain or tenderness. Generalized "low back pain" is not to be interpreted as costovertebral angle pain or tenderness.
- Fever and hypothermia are non-specific symptoms of infection and cannot be excluded from CAUTI determination because they are clinically deemed due to another recognized cause.

Collection of Denominator Data for CAUTI

1. Manual, Daily:

Patient days and urinary catheter days should be collected at the same time, every day, for each location performing surveillance to ensure that differing collection methods don't inadvertently result in device days being > patient days.

2. Manual, Weekly:

Patient days and urinary catheter days should be collected at the same time on the same designated day, once per week. The idea is to reduce staff time spent collecting surveillance data, once weekly sampling of denominator data is good for

- For locations with 75 or more device days per month.
- For locations other than specialty care areas/oncology and NICUs.
- It was shown that the use of Friday or Saturday generates the least accurate estimates, so avoid them.
- If the day designated for the collection of sampled data is missed, collect the data on the next available day instead.

3. Electronic Sources:

- When patient days and urinary catheter days are available from electronic databases, these sources may be used as long as the counts are not substantially different (+/- 5%) from those collected manually.

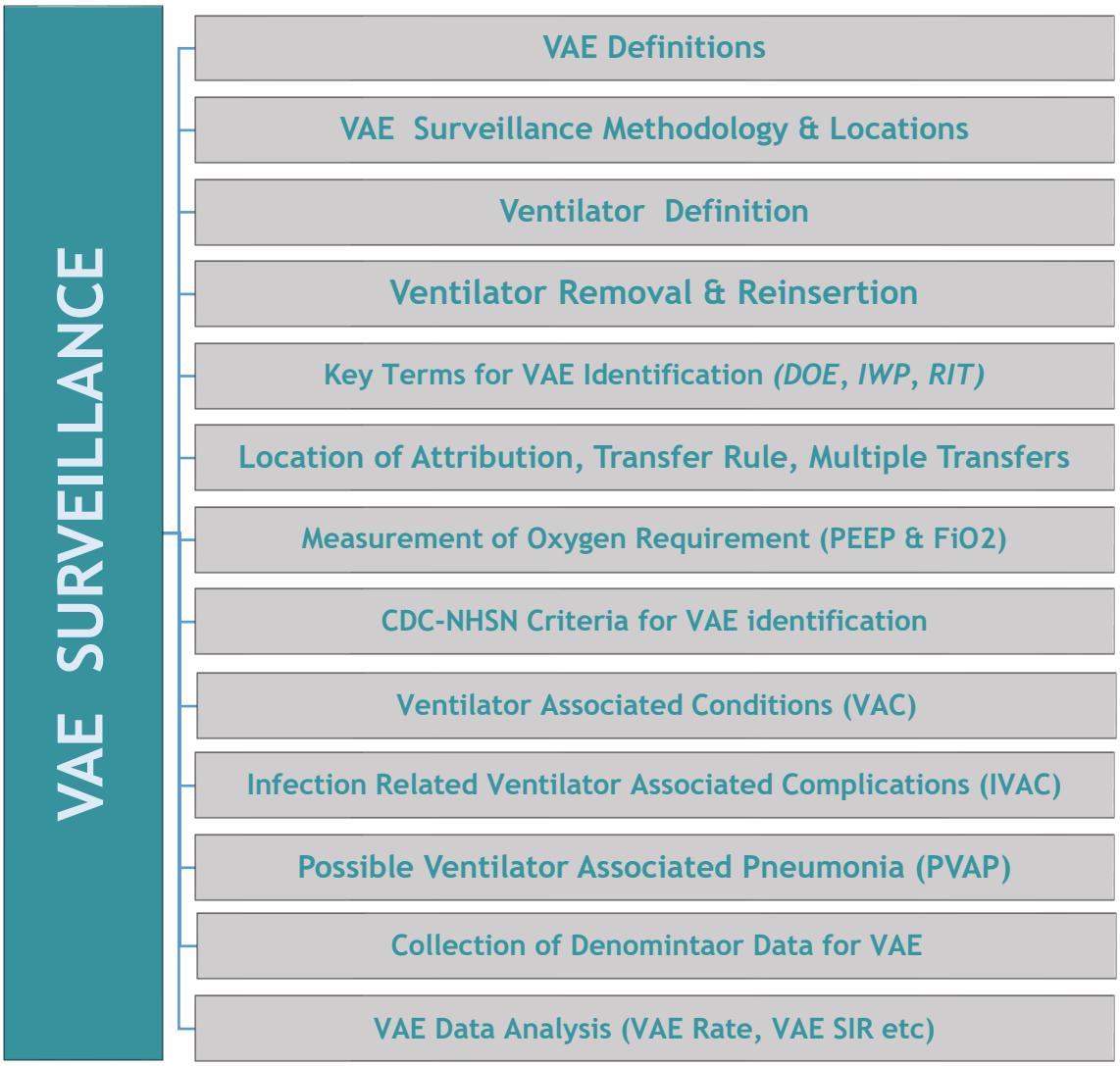
CAUTI Data Analysis

Measure	Calculation	Application
CAUTI Rates	$\frac{\text{The number of CAUTIs for a location}}{\text{The number of urinary catheter days for that location}} \times 1000$	Location specific measure
CAUTI SIR	$\frac{\text{The number of observed CAUTIs}}{\text{The number of predicted CAUTIs}}$	Both location specific and summarized measure
Urinary catheter DUR	$\frac{\text{The number of urinary catheter days for a location}}{\text{The number of patient days for that location}}$	Location specific measure
Urinary catheter SUR	$\frac{\text{The number of observed urinary catheter days}}{\text{The number of predicted urinary catheter days}}$	Both location specific and summarized measure

SIR, standardized infection ratio; DUR, device utilization ratio; SUR, standardized utilization ratio

- ✓ CAUTI Rates and urinary catheter DUR should be presented by unit (for example, adult ICU, pediatric ICU…etc.).
- ✓ CAUTI SIR and urinary catheter SUR can be presented for single locations and can be summarized across multiple locations, adjusting for differences in the incidence of infection or device utilization (respectively) between different location types.

SURVEILLANCE OF ADULT VENTILATOR ASSOCIATED EVENTS (VAE)



Ventilator-Associated Event (VAE)

- ✓ VAEs are identified by using a combination of objective criteria: deterioration in respiratory status after a period of stability or improvement on the ventilator, evidence of infection or inflammation, and laboratory evidence of respiratory infection.
- ✓ Ventilator is defined as a device to assist or control respiration continuously, inclusive of the weaning period, through a tracheostomy or by endotracheal intubation. The ventilator has to be in place for >2 days.
- ✓ The 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.
- ✓ Three tiers of VAE definitions – hierarchical
    - **Ventilator-associated condition (VAC)**
    - **Infection-related ventilator-associated complications (IVAC)**
    - **Possible ventilator-associated pneumonia (PVAP)**

Surveillance Settings:

- ✓ Inpatient locations eligible to participate in VAE surveillance are those adult locations in acute care hospitals, long term acute care hospitals, and inpatient rehabilitation facilities where denominator data (ventilator and patient days) can be collected for patients.
- ✓ Currently it is implemented in adult ICUs and SCA, step-down units, and wards.
- ✓ Pediatric and neonatal units should conduct Ped VAE surveillance.

Inclusion and Exclusion Criteria

Patients INCLUDED in VAE Surveillance:

- Patients in adult locations are eligible for VAE surveillance
- Pediatric patients in adult locations
- Adults in pediatric locations should be included in Ped VAE
- Patients on a ventilator who are receiving:
  - a conventional mode of mechanical ventilation (for example, synchronized intermittent mandatory ventilation)
  - Airway Pressure Release Ventilation (APRV) or related modes
- Patients on a ventilator who are receiving a conventional mode of mechanical ventilation, or APRV or related modes: o while in the prone position o while receiving nitric oxide therapy, helium-oxygen mixtures (heliox), or epoprostenol therapy)

Patients EXCLUDED from VAE Surveillance:

• **All patients in the neonatal and pediatric inpatient locations regardless of patient's age.**

• Patients on high-frequency ventilation, extracorporeal life support, or paracorporeal membrane oxygenation are excluded from VAE surveillance during periods of time when the support is in place for the entire calendar day.

Surveillance Methodology:

- ✓ Active
- ✓ Patient based
- ✓ Prospective
- ✓ Priority-directed targeted
- ✓ Yield risk-adjusted incidence rates

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.
- ✓ Lung expansion devices such as intermittent positive-pressure breathing (IPPB); nasal positive end-expiratory pressure (nasal PEEP); and continuous nasal positive airway pressure (CPAP, hypoCPAP) are not considered ventilators unless delivered via tracheostomy or endotracheal intubation (e.g., ET-CPAP).
- ✓ Patients on Airway Pressure Release Ventilation (APRV) or related modes of mechanical ventilation (e.g., BiLevel, Bi Vent, BiPhasic, PCV+, DuoPAP) are INCLUDED in VAE protocol, but the VAE period of stability or improvement on the ventilator and the period of worsening oxygenation should be determined by changes in FiO2 only, since changes in PEEP may not be applicable to APRV.

Ventilator Removal and Reinsertion:

- ✓ If the ventilator was removed and reinserted before a full calendar day without a ventilator, then continue the day count.
- ✓ Therefore, if the patient is without a ventilator for at least one full calendar day (NOT to be read as 24 hours), then start a new day count.
- ✓ **Episode of mechanical ventilation:** the period of days during which the patient was mechanically ventilated for some portion of each consecutive day.

Hospital days	1	2	3	4	5	6	7
Ventilator days	1	2	3	Extubated (4)	Re-intubated (5)	6	7
Ventilator episodes	1	1	1	1	1	1	1

Hospital days	1	2	3	4	5	6	7
Ventilator days	1	2	3	Extubated (4)	---	Re-intubated (1)	2
Ventilator episodes	1	1	1	1	---	2	2

Date of Event (DOE):

- ✓ The date of onset of worsening oxygenation.
- ✓ This is defined as the first calendar day of the required ≥ 2-day period of worsening oxygenation following a ≥ 2-day period of stability or improvement on the ventilator.

Infection Window Period:

- ✓ 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 (i.e., the first day of worsening oxygenation, the day of VAE onset).
- ✓ However, it could be shorter if VAE occurs early in the course of mechanical ventilation (cannot include the first 2 days on ventilator).
- ✓ The earliest day on which VAE criteria can be fulfilled is day 4 of mechanical ventilation (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.

Ventilator Days	10	11	12	13	14	15	16
VAE day	-3	-2	-1	1	2	3	4
Oxygenation	Stable/ improve	Stable/ improve	Stable/ improve	Worsen	Worsen	Worsen	Worsen
DOE		Day2 before	Day1 before	DOE	Day1 after	Day2 after	
Window		1	2	3	4	5	

Ventilator days	1	2	3	4	5	6	7
VAE day	-3	-2	-1	1	2	3	4
Oxygenation	Stable/ improve	Stable/ improve	Stable/ improve	Worsen	Worsen	Worsen	Worsen
DOE		Day2 before	Day1 before	DOE	Day1 after	Day2 after	
Window	Cannot include	Cannot include	1	2	3	4	

Location of Attribution:

- ✓ The inpatient location where the patient was assigned on the date of the VAE event, which is further defined as the date of onset of worsening oxygenation.
- ✓ OR/Post Anesthesia Care Unit/ Recovery Room/dialysis unit/ ERs cannot be considered a location of attribution for VAE.

Transfer Rule:

- ✓ If a VAE develops on the day of transfer or the day following transfer from one inpatient location to another in the same facility or to a new facility (where the day of transfer is day 1), the event is attributed to the transferring location.
- ✓ Example:
  - ✓ Patient on a ventilator in the SICU who has had improving oxygenation for 3 days is transferred to the MICU, still on the ventilator.

- ✓ On the day of transfer, after the patient has arrived in the MICU, the patient experiences an acute decompensation, requiring an increase of 0.30 (30 points) in FiO2 that persists during the following calendar day.
- ✓ VAC criteria are met on calendar day 2 in the MICU.
- ✓ Because the onset of worsening oxygenation occurred on the day of transfer to the MICU, the VAC event is attributed to the SICU.

Multiple Transfers:

- ✓ If the patient has been transferred to more than one location on the date of VAE, or the day before, attribute the VAE to the first location in which the patient was housed the day before the VAE's date of event.

Date	3/22	3/23	3/24
Locations	Unit A	Unit A Unit B Unit C	Unit C Unit D VAE was diagnosed

- ✓ VAE is attributed to Unit A since Unit A was the first location in which the patient was housed the day before the date of event.

Repeat Infection time frame (RIT)

- ✓ A new VAE cannot be identified or reported until a 14-day period has elapsed after the day of onset of worsening oxygenation (the event date, day 1).
- ✓ However, the period of stability can be diagnosed during the defined 14 days.

Secondary BSIs:

- ✓ Secondary BSIs may be reported for PVAP events but NOT reported for VAC or IVAC events provided that:
- ✓ The organism identified from blood specimen matches an organism identified from an appropriate respiratory specimen (respiratory secretions, pleural fluid and lung tissue).
- ✓ Collection times: respiratory specimen have been collected during the 5-day

infection window and the positive blood specimen collected during the 14-day event period starting by the date of event.

- ✓ In cases where PVAP is met with only the histopathology criterion and there is a positive blood specimen a secondary BSI is not reported.
- ✓ Do not limit reporting to just those organisms isolated in culture. For example, influenza A identified by PCR in respiratory specimen and culture of blood specimen, a secondary BSI is reported.

Measurements of Oxygen Requirement

- ✓ **Fraction of inspired oxygen (FiO_2)** is oxygen concentration (%) is typically maintained below 0.5 even with ventilation, to avoid oxygen toxicity. Natural air includes 20.9% oxygen, which is equivalent to FiO_2 of 0.21.
- ✓ **Positive end-expiratory pressure (PEEP)** is the pressure in the lungs above atmospheric pressure applied by a ventilator. A small amount of applied PEEP (0 to 5 cm H_2O) is used in most mechanically ventilated patients to mitigate end-expiratory alveolar collapse.

Daily Minimum PEEP:

- ✓ The lowest value of PEEP during a calendar day that is set on the ventilator and maintained for at least 1 hour.
- ✓ In the event that ventilator settings are monitored and recorded less frequently than once per hour or where there is no value that is documented to have been maintained for at least one hour, the daily minimum PEEP is simply the lowest value of PEEP set on the ventilator during the calendar day.

- ✓ EXAMPLE: The patient is intubated and the PEEP is set at the following values through the remainder of the calendar day:

Time-1	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
Value-1	10	8	5	5	8	8

Time-2	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
Value-2	8	5	8	5	8	8

Time-3	12:00 AM	4:00 AM	8:00 AM	12:00 PM	4:00 PM	8:00 PM
Value-3	5	8	5	8	8	10

- ✓ In the first example, the daily minimum PEEP for the purposes of VAE surveillance is 5 cmH_2O. It was the lowest value that is maintained for one hour.
- ✓ In the second example, the daily minimum PEEP for the purposes of VAE surveillance is 8 cmH_2O. The value 5 cmH_2O cannot be used as it was not maintained for one hour.
- ✓ In the third example, the daily minimum PEEP is 5 cmH_2O. PEEP settings are being monitored and recorded every 4 hours; therefore the lowest recorded PEEP setting for the calendar day is the value used in VAE surveillance.

Daily Minimum FiO_2 :

- ✓ The lowest value of FiO_2 during a calendar day that is set on the ventilator and maintained for at least 1 hour.
- ✓ In the event that ventilator settings are monitored and recorded less frequently than once per hour or where there is no value that has been maintained for at least one hour, the daily minimum FiO_2 is simply the lowest value of FiO_2 set on the ventilator during the calendar day.

- ✓ EXAMPLE: The patient is intubated and the FiO_2 is set at the following values through the remainder of the calendar day:

Time-1	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
Value-1	1.0	0.8	0.5	0.5	0.8	0.8

Time-2	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
Value-2	0.8	0.8	0.5	0.8	0.5	0.8

Time-3	2:00 PM	4:00 PM	6:00 PM	8:00 PM	10:00 PM	12:00 AM
Value-3	1.00	0.60	0.40	0.50	0.55	0.60

- ✓ In the first example, the daily minimum FiO_2 for the purposes of VAE surveillance is 0.5. It was the lowest value that is maintained for one hour
- ✓ In the second example, the daily minimum FiO_2 for the purposes of VAE surveillance is 0.8. The value 0.5 cannot be used as it was not maintained for one hour
- ✓ In the third example, the daily minimum FiO_2 is 0.40. FiO_2 settings are being monitored and recorded every 2 hours; therefore, the lowest recorded FiO_2 setting for the calendar day is the value used in VAE surveillance.

Definitions of VAE

I: Ventilator-Associated Condition (VAC):

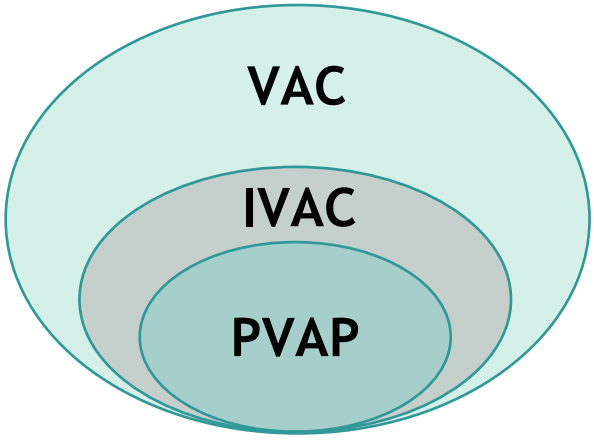
- ✓ After a period of stability or improvement on the ventilator sustained for ≥ 2 calendar days, the patient has **one** of the following indicators of worsening oxygenation;
  - ✓ Increase in daily minimum FiO_2 values of ≥ 0.20 points or
  - ✓ Increase in daily minimum PEEP values of ≥ 3 cm H_2O

II: Infection-related Ventilator-Associated Complication (IVAC):

- ✓ After meeting the criteria of VAC, the patient meets the following **two** criteria;
  - ✓ Temperature > 38 °C or < 36°C, OR white blood cell count ≥ 12,000 cells/mm^3 or ≤ 4,000 cells/mm^3
  - ✓ A new antimicrobial agent(s) is started, and is continued for ≥ 4 calendar days

III: Possible Ventilator-Associated Pneumonia (PVAP):

- ✓ After meeting the criteria of VAC and IVAC, the patient meets **one** of the following criteria;
  - ✓ **Criterion 1:** Positive culture of respiratory specimens without the requirement for purulent respiratory secretions.
  - ✓ **Criterion 2:** Purulent respiratory secretions plus organisms identified from defined respiratory specimens.
  - ✓ **Criterion 3:** One of the following positive tests: Organism identified from pleural fluid, Lung histopathology, *Legionella* detection, or viral detection.



1. Ventilator-Associated Condition (VAC)

After a period of stability or improvement on the ventilator sustained for ≥ 2 calendar days, the patient has **one** the following indicators of worsening oxygenation;

- Increase in daily minimum FiO_2 values of ≥ 0.20 points or
- Increase in daily minimum PEEP values of ≥ 3 cm H_2O

EXAMPLE: In the example below, the baseline period is defined by mechanical ventilation (MV) days 1 through 4, and the period of worsening oxygenation by MV days 5 and 6, where the daily minimum PEEP is ≥ 3 cmH_2O greater than the daily minimum PEEP of the first day in the baseline period. Note that there is no VAC on MV day 3, because PEEP values 0-5 cm H_2O are considered equivalent for the purposes of this surveillance.

Ventilator Days	Daily minimum PEEP (cm H_2O)	Daily minimum FIO_2 (%)	VAE
1	0	100%	
2	0	50%	
3	3	50%	
4	5	50%	
5	**8**	50%	VAC
6	**8**	50%	

EXAMPLE: In the example below, the baseline period is defined by mechanical ventilation (MV) days 3 and 4, and the period of worsening oxygenation by MV days 5 and 6, where the daily minimum FiO_2 is ≥ 0.20 (20 points) over the daily minimum FiO_2 of the first day in the baseline period.

Ventilator Days	Daily minimum PEEP (cm H_2O)	Daily minimum FIO_2 (%)	VAE
1	8	100%	
2	6	50%	
3	5	40%	
4	5	40%	

5	6	**70%**	VAC
6	6	**70%**	

EXAMPLE: In the example below, there is no VAC, because the FiO_2 on MV day 4 is higher than the FiO_2 on MV day 3 (and therefore not stable or decreasing) – even though the FiO_2 on MV days 3 and 4 meets the 20-point threshold when compared with the daily minimum FiO_2 on MV days 5 and 6.

Ventilator Days	Daily minimum PEEP (cm H_2O)	Daily minimum FIO_2 (%)	VAE
1	8	100%	
2	6	50%	
3	5	35%	
4	5	40%	
5	6	70%	No event
6	6	70%	

2. Infection-related Ventilator-Associated Complication (IVAC):

After meeting the criteria of VAC, the patient meets the following **two** criteria;

- Temperature > 38 °C or < 36°C, OR white blood cell count ≥ 12,000 cells/mm^3 or ≤ 4,000 cells/mm^3
- A new antimicrobial agent (s) is started, and is continued for ≥ 4 calendar days

New Antimicrobial Agent:

- Any agent initiated on or after the third calendar day of mechanical ventilation AND in the VAE Window Period
- The agent is considered new for the purposes of this definition if it was NOT given to the patient during the 2-days before the window
- Qualifying Antimicrobial Day (QAD): 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
- The requirement for 4 consecutive QADs can be met with 4 days of therapy with

the same antimicrobial (with a gap of no more than 1 calendar day between administrations of that antimicrobial) or it can be met with 4 days of therapy with multiple antimicrobial agents, as long as each antimicrobial was started within the VAE Window Period.

Routes of Administration of New Antimicrobial Agent

Route of Administration	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.

Qualifying Antimicrobial Days (QAD)

Ventilator Days	2	3	4	5	6	7	8
Oxygenation		Stable/ improve	Stable/ improve	Worsen	Worsen		
Antimicrobial agent	Ceftriaxone	Ceftriaxone	Ceftriaxone	Meropenem	Meropenem	Meropenem	Meropenem
QAD				1	2	3	4

- Meropenem is a new start while ceftriaxone is not as it was given to the patient the day before the 5-day period.
- The number of QAD is 4.

Ventilator Days	2	3	4	5	6	7	8
Oxygenation		Stable/ improve	Stable/ improve	Worsen	Worsen		
Antimicrobial agent	Ceftriaxone	Ceftriaxone	Ceftriaxone	Meropenem	Imipenem	Piperacillin/ Tazobactam	Piperacillin/ Tazobactam
QAD				1	2	3	4

- Meropenem, Imipenem and Piperacillin/ Tazobactam are new start while ceftriaxone is not as it was given to the patient the day before the 5-day period.
- The number of QAD is 4.

Ventilator Days	2	3	4	5	6	7	8
Oxygenation		Stable/ improve	Stable/ improve	Worsen	Worsen		
Antimicrobial agent			Levofloxacin		Levofloxacin		Levofloxacin
QAD			1	2	3	4	5

- Because there is a gap of no more than 1 calendar day between days of levofloxacin administration, the requirement for 4 consecutive QADs is met.
- The number of QAD is 5.

Ventilator Days	2	3	4	5	6	7	8
Oxygenation		Stable/ improve	Stable/ improve	Worsen	Worsen		
Antimicrobial agent			Vancomycin			Vancomycin	
QAD							

- Because there is a gap of more than 1 calendar day between days of vancomycin administration, the requirement for 4 consecutive QADs is not met.
- The number of QAD is 0.

3. Possible Ventilator-Associated Pneumonia (PVAP):

After meeting the criteria of VAC and IVAC, the patient meets **one** of the following criteria:

Criterion 1: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds, without 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 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*

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: 1) abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli; 2) evidence of lung parenchyma invasion by fungi (hyphae, pseudo hyphae or yeast forms); 3) 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

Criterion 1-PVAP: Threshold values for cultured specimens used in the diagnosis of pneumonia

Specimen Collection / Technique	Values*
1. Lung tissue	≥10^4 CFU/g tissue
2. Bronchoscopically (B) obtained specimens	
• Broncho alveolar lavage (B-BAL)	≥10^4 CFU/ml
• Protected BAL (B-PBAL)	≥10^4 CFU/ml
• Protected specimen brushing (B-PSB)	10^3 CFU/ml
3. Non Bronchoscopically (NB) obtained (blind) specimens	
• Broncho alveolar lavage (NB-BAL)	≥10^4 CFU/ml

• Protected specimen brushing (NB-PSB)	10^3 CFU/ml
4. Endotracheal aspirate (ETA)	≥ 10^5 CFU/ml

**CFU = colony forming units, g = gram, ml = milliliter*

Semi-Quantitative Results:

- Semi-quantitative Results for cultured specimens such as "moderate" or "heavy" or "many" or "numerous" growth, or 2+, 3+, or 4+ growth can meet Criterion 1 of the PVAP surveillance definition
- Semi-quantitative results for purulent respiratory secretions can meet Criterion 2 of the PVAP surveillance definition

✓ Neutrophils: Many, heavy, numerous, 4+, or ≥ 25 neutrophils per low power field (lpf) [x100]

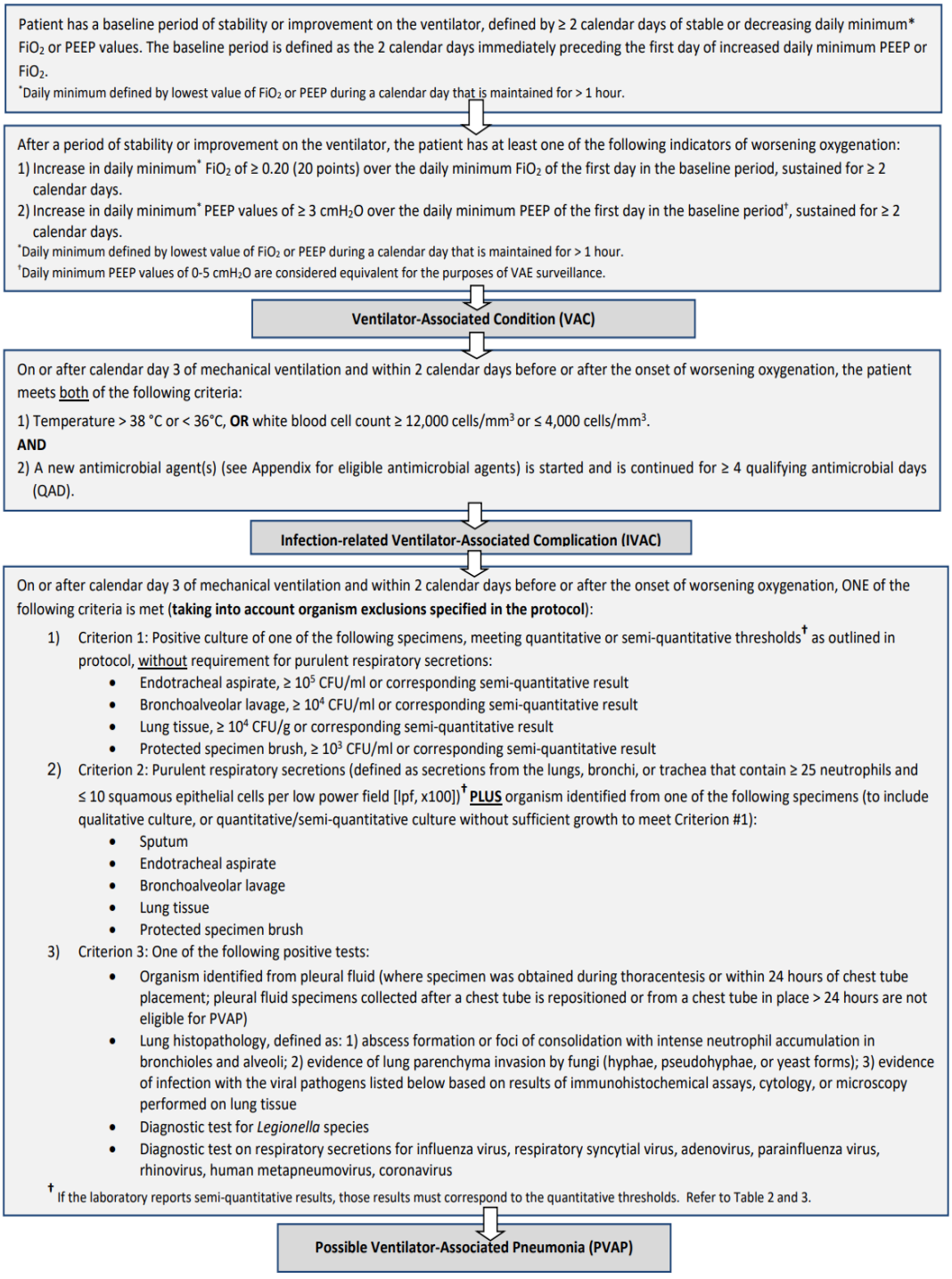
✓ Squamous cells: No, rare, occasional, few, 1+ or 2+, or ≤ 10 squamous epithelial cells per lpf [x100]

Note: *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 within 24 hours of chest tube placement; pleural fluid specimens collected after a chest tube is repositioned or from a chest tube in place > 24 hours are not eligible for PVAP).

Ventilator Associated Events (VAE) Surveillance Algorithm



Collection of Denominator Data for VAE

1. Manual, Daily:

- Patient days and ventilator days should be collected at the same time, every day, for each location performing surveillance to ensure that differing collection methods don't inadvertently result in device days being > patient days.

2. Electronic Sources:

- When patient days and ventilator days are available from electronic databases, these sources may be used as long as the counts are not substantially different (+/- 5%) from those collected manually.

Analysis of VAE

Measure	Calculation	Application
VAE Rates	The number of VAEs for a location / The number of ventilator days for that location X1000	Location specific measure
VAE SIR	The number of observed VAEs / The number of predicted VAEs	Both location specific and summarized measure
Ventilator DUR	The number of ventilator days for a location / The number of patient days for that location	Location specific measure
Ventilator SUR	The number of observed Ventilator Days / The number of Predicted Ventilator Days	Both location specific and summarized measure

SIR, standardized infection ratio; DUR, device utilization ratio; SUR, standardized utilization ratio

- VAE rates and ventilator DUR should be presented by unit (for example, adult ICU, pediatric ICU…etc.).
- VAE rates and ventilator DUR in neonatal ICU should be presented by unit and birthweight categories (which includes A = ≤750 g; B = 751-1000 g; C = 1001-1500 g; D = 1501-2500 g; E = >2500 g).
- VAE SIR and ventilator SUR can be presented for single locations and can be summarized across multiple locations, adjusting for differences in the incidence of infection or device utilization (respectively) between different location types.
- In neonatal ICU, VAE SIR and ventilator SUR can be additionally summarized across birthweight categories, adjusting for differences in the incidence of infection or device utilization (respectively) between different birthweight categories.

Adult VAE Monitoring Form

A: PATIENT'S INFORMATION			
Patient Name:		Age:	Gender:
MRN:		Bed No:	
Date of Admission:		Date of Mechanical Ventilation (MV)	

DATE	MV DAY	VAC			IVAC					PVAP			
		Daily PEEP Min	Daily Fio2 Min	VAC	Temp > 38°C or < 36°	WBC ≥ 12,000 or≤ 4,000	New Antimicrobial Agent	QAD	IVAC	Type of Specimen	Positive Culture (specify Organism with CFU/ml or count: +4;+3,+2)	Purulent Respiratory Secretions (≥ 25 neutrophils and ≤ 10 squamous epithelial cells)	PVAP
	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
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MV - Mechanical ventilation. PEEP min = Daily minimum PEEP. FiO2 min = Daily minimum FiO2. Temp min = Daily minimum temperature. Temp max = Daily maximum temperature. WBC min = Daily minimum white blood cell count. WBC max = Daily maximum white blood cell count. ABX = antimicrobial agents. Polys / epis = Polymorphonuclear leukocytes and squamous epithelial cells from respiratory specimen.

VAC- Increase in daily min FIO2 of >0.20 (20%) over the daily minimum FIO2 of the first day in the baseline period, sustained for ≥ 2 calendar days OR Increase in daily min PEEP values of ≥ 3cmH2O over the daily min PEEP of the first day in the baseline period sustained for ≥ 2 calendar days;

IVAC- Temperature < 36°C or > 38°C, white blood cell counts ≤ 4,000 cells,/mm3 or ≥ 12,000 cells/mm3); a new antimicrobial agent started and continued for ≥ 4 days; QAD *Qualifying Antimicrobial Days*

PVAP- 1-positive culture (ETA; BAL; Lung Tissue, Protective specimen brush); 2- purulent resp. secretions (lungs, bronchi, trachea > 25 neutrophils and < 10 squamous epithelial cells PLUS organism from sputum; endotracheal asp; bronchial lavage; lung tissue; protected specimen brush; 3- positive test in pleural fluid; lung histopathology; dx test for legionella spec; dx test for influenza virus, RSV, Adenovirus, parainfluenza virus, rhinovirus, coronavirus

وقايـــة
هيئـة الصحـة العامـة
PUBLIC HEALTH AUTHORITY

Denominator Data Collection Form

Adult & Pediatric Locations

(AICUs & PICUs)

Date	No. of Patients	No. of Patients on Central Line	No. of Patients on Urinary Catheters	No. of Patients on Ventilator
1.				
2.				
3.				
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29.				
30.				
TOTAL				
	Patient days	Central line Days	Urinary Catheter Days	Ventilator days

Pediatric Ventilator-Associated Event
(PedVAE)

VAE surveillance in Pediatric and Neonatal Populations:

Detection of a PedVAE is determined by identification of deterioration in respiratory status after a period of stability or improvement on the ventilator using two key parameters.

Surveillance Settings:

- VAE surveillance can be done in pediatric locations including (Long Term Care) and neonatal inpatient location where denominator data can be collected.
- Can be implemented in pediatric and neonatal ICUs and SCA, step-down units, and wards.

Surveillance Methodology

- Active
- Patient based
- Prospective
- Priority-Directed targeted
- Yield risk-adjusted incidence rates

Eligibility of patients:

- Patients on specific modes of mechanical ventilation:
  - ✓ *High frequency oscillatory or jet ventilation (HFO)*
  - ✓ *Airway pressure release ventilation (APRV)-FiO_2 parameter only*
- Patients who are receiving a conventional mode of mechanical ventilation while receiving:
  - ✓ Surfactant
  - ✓ Corticosteroids
  - ✓ Prone positioning
  - ✓ Nitric oxide therapy
  - ✓ Helium-oxygen mixture
  - ✓ Epoprostenol therapy

Exclusions:

- Patients on extracorporeal life support or paracorporeal membrane oxygenation
- Non-acute care locations in acute care facilities
- Pediatric patients in adult locations

Ped VAE is similar to VAE in the following definitions:

- Ventilator definition
- Date of event: the date of onset of worsening oxygenation
- Location of attribution and transfer rule are similar to VAE
- 14-day event period: 14-day period, starting on the day of onset of worsening oxygenation (the date of event, day 1). A new PedVAE cannot be identified or reported until this 14-day period has elapsed.
- Episode of Mechanical Ventilation: Defined as a period of days during which the patient was mechanically ventilated for some portion of each consecutive day.
- Location of attribution and transfer rule

PedVAE is different from VAE in the following:

- Use of mean airway pressure (MAP) instead of PEEP.
- Locations are only pediatric and neonatal locations.
- No differentiation to VAC, IVAC, PVAP (so it is comparable to VAC in VAE).
- No secondary BSI can be attributed to PedVAE.

Daily Minimum FiO_2:

- The lowest value of FiO_2 during a calendar day that is set on the ventilator and maintained for > 1 hour.
- If there is no value that has been maintained for >1 hour then select the lowest value available regardless of the period of time in which the setting was maintained.
  - ✓ Ventilation initiated late in the calendar day
  - ✓ Ventilation discontinued early in the calendar day
  - ✓ Ventilator settings are very unstable throughout the day
- If FiO_2 is recorded every 15/30 minutes, 5/3 consecutive recordings of FiO_2 are needed to meet the required >1 hour minimum duration
- Increase in the daily minimum FiO_2 of at least 0.25 (25 points) over the daily

minimum FiO_2 of the first day in the baseline period is one of two criteria that can be used in meeting the PedVAE definition.

Mean Airway Pressure (MAP):

- The average pressure exerted on the airway and lungs from the beginning of inspiration until the beginning of the next inspiration.
- Daily minimum MAP is the lowest value documented during the calendar day (not necessarily maintained for > 1 hour)
- A sustained increase in the daily minimum MAP of ≥ 4 cmH_2O following a period of stability or improvement on the ventilator is one of two criteria that can be used in meeting the PedVAE definition.
- For patients < 30 days:
  - ✓ MAP values of 0-8 cmH_2O are considered equal to 8 cmH_2O
  - ✓ Any day where daily minimum MAP is 0-8 cmH_20 will be assigned a daily minimum MAP value of 8 cmH_20.
- For patients ≥ 30 days:
  - ✓ MAP values 0-10 cmH_2O are considered equal to 10 cmH_2O
  - ✓ Any day where daily minimum MAP is 0-10 cmH_20 will be assigned a daily minimum MAP value of 10 cmH_20.

Baseline Period:

- Baseline period is ≥ 2 calendar days of stable or decreasing daily minimum FiO_2 or MAP values and immediately precedes the first day of increased daily minimum MAP or FiO_2

Worsening of oxygenation:

- The patient has at least one of the following :
  - ✓ Increase in daily minimum FiO_2 of ≥ 0.25 (25 points) over the daily minimum FiO_2 of the first day in the baseline period, sustained for ≥ 2 calendar days.

    OR
  - ✓ Increase in daily minimum MAP values of ≥ 4 cmH_2O over the daily minimum MAP of the first day in the baseline period, sustained for ≥ 2 calendar days.

PedVAE diagnosis:

- Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum FiO_2 or MAP values.
- After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:
  - ✓ Increase in daily minimum FiO_2 of ≥ 0.25 (25 points) over the daily minimum FiO_2 of the first day in the baseline period, sustained for ≥ 2 calendar days.
  - ✓ Increase in daily minimum MAP values of ≥ 4 cmH_2O over the daily minimum MAP of the first day in the baseline period, sustained for ≥ 2 calendar days.

Analysis of PedVAE

Measure	Calculation	Application
PedVAE Rates	$\frac{\text{The number of Ped VAEs for a location}}{\text{The number of ventilator days for that location}}$ X1000	Location specific measure
Ventilator DUR	$\frac{\text{The number of ventilator days for a location}}{\text{The number of patient days for that location}}$	Location specific measure

- PedVAE rates and ventilator DUR should be presented by unit (for example, pediatric ICU, pediatric cardiac ICU…etc.).
- PedVAE rates and ventilator DUR in neonatal ICU should be presented by unit and birthweight categories (which includes A = ≤750 g; B = 751-1000 g; C = 1001-1500 g; D = 1501-2500 g; E = >2500 g).

Pediatric VAE (Ped VAE) Monitoring Form
PICUs & NICUs

A: PATIENT'S INFORMATION			
Patient Name:		Age:	Gender:
MRN:		Bed No:	Unit:
Date of Admission:		Date of Mechanical Ventilation (MV)	

DATE	MV DAY	Mean Airway Pressure MAP_{Min}	Fraction of Inspired Oxygen $FiO2_{Min}$	Comments
	1			
	2			
	3			
	4			
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Reporting Instructions

Daily Minimum FiO2: *The lowest value of FiO2 during a calendar day that is set on the ventilator and maintained for > 1 hour.*

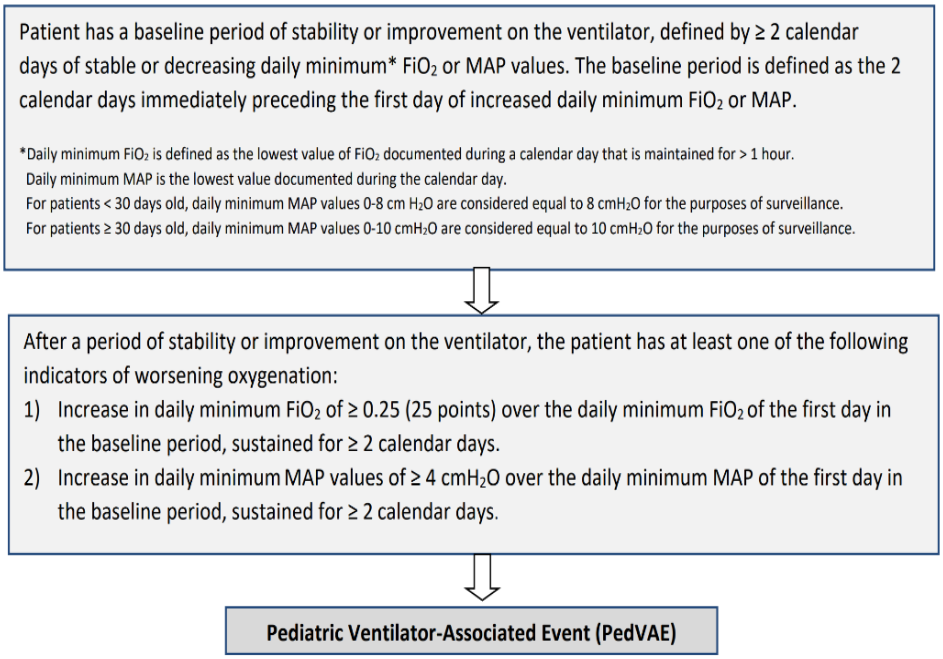
Daily Minimum MAP: *The lowest value of MAP during a calendar day.*

PedVAE: *PedVAEs are identified by deterioration in respiratory status after a period of stability or improvement on the ventilator. Patients must be mechanically ventilated for at least 4 calendar days to fulfill PedVAE criteria (where the day of intubation and initiation of mechanical ventilation is day 1).*

Mean Airway Pressure (MAP): *A sustained increase in the daily minimum MAP of ≥ 4 cmH2O following a period of stability or improvement on the ventilator is one of two criteria that can be used in meeting the PedVAE definition.*

Fraction of Inspired Oxygen (FiO2): *A sustained increase in the daily minimum FiO2 of ≥ 0.25 (25 points) following a period of stability or improvement on the ventilator is one of the two criteria that can be used in meeting the PedVAE definition.*

Figure 1: Pediatric Ventilator-Associated Events (PedVAE) Surveillance Algorithm



Denominator Data Collection Form
Neonatal Locations NICU

Date	Birth Weight Categories														
	<750 gm			751-1000 gm			1001-1500 gm			1501-2500 gm			>2500 gm		
	Pts	CL	VENT	Pts	CL	VENT	Pts	CL	VENT	Pts	CL	VENT	Pts	CL	VENT
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Total															

Pts- Number of Infants CL- No. of Infants on Central line VENT- No. of Infants on Ventilator

Patient Safety Component

B: Multidrug Drug Resistant Organism (MDRO) & Clostridium difficile (CDI) Module

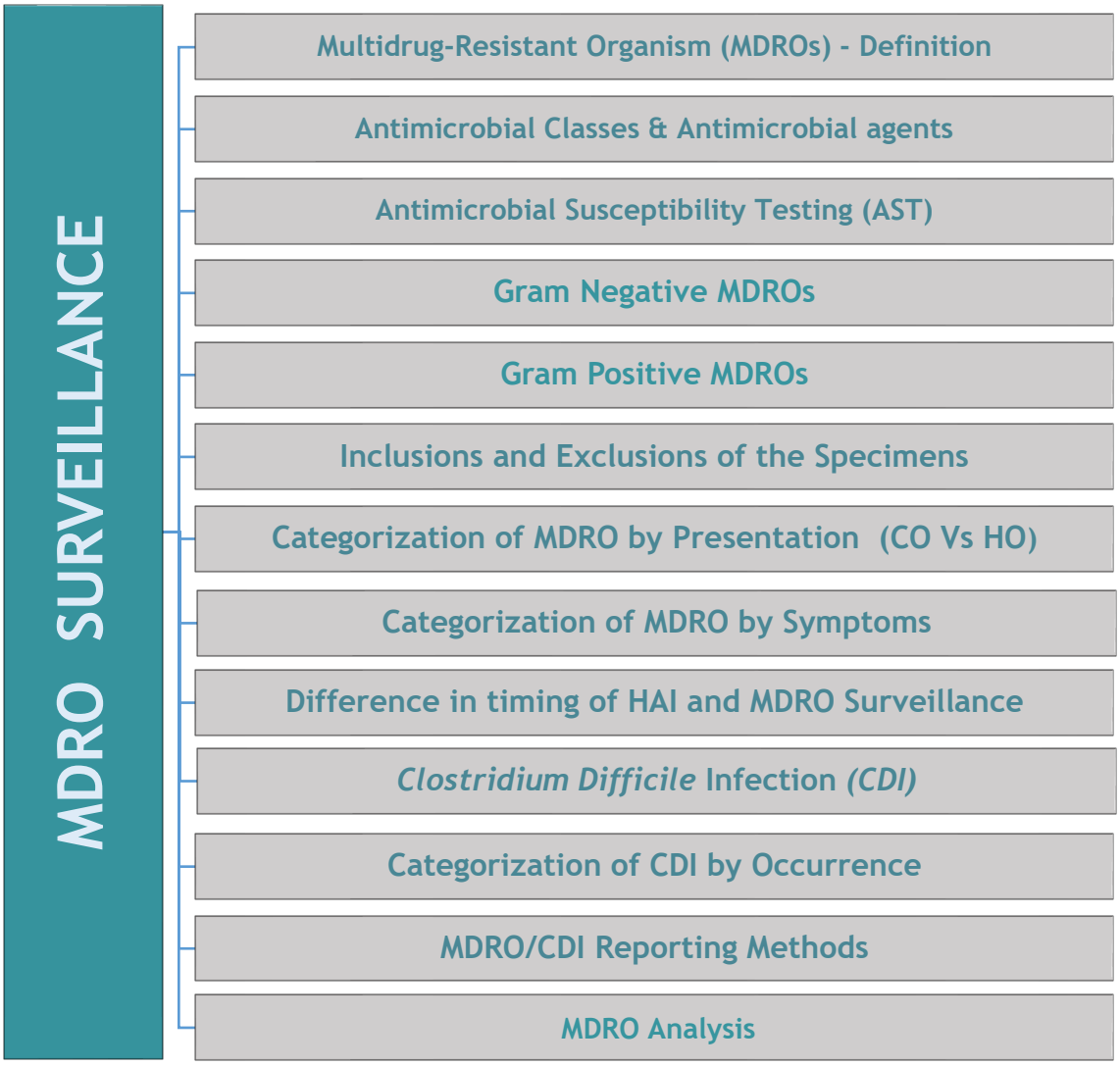
Multidrug Drug Resistant *Organism (MDRO) & CDI Surveillance:*

1: Initaite MDRO / CDI Module & report Laboratory-Identified (LabID) Event.

2: Include all non-duplicate MDRO isolates from any specimen source and unique blood source MDRO isolates.

3: Include ONLY positive laboratory results (e.g., cultures) that are collected for "clinical" purposes (i.e., for diagnosis and treatment).

SURVEILLANCE OF MULTIDRUG-RESISTANT ORGANISMS & CLOSTRIDIUM DIFFICILE INFECTION (MDROs/CDI MODULE)



Multidrug-Resistant Organism & *Clostridium Difficile* Infection (MDROs/CDI)

MDROs are defined as microorganisms, predominantly bacteria, that are resistant to one or more classes of antimicrobial agents.

Antimicrobial Classes & Antimicrobial Agents:

Antimicrobial Classes: are groups of antimicrobial agents that share a common mechanism of action or structural characteristics (e.g., Cephalosporins).

Antimicrobial Agents: are specific drugs or compounds that belong to a particular antimicrobial class and are used to treat infections (e.g., Cefepime).

Antimicrobial Susceptibility Testing (AST):

AST results should be classified according to the guidelines of the Clinical and Laboratory Standards Institute (CLSI) to determine the susceptibility of microorganisms to specific antimicrobial agents. The classification typically falls into one of three categories:

Susceptible (S): The microorganism is likely to be inhibited by the standard dose of the antimicrobial agent when used in treatment, indicating effective therapy.

Intermediate (I): The microorganism may be inhibited by the antimicrobial agent but requires a higher dose or specific conditions (e.g., high drug concentration at the site of infection). This category serves as a buffer zone to account for variability in testing or therapeutic scenarios.

Resistant (R): The microorganism is unlikely to be inhibited by the antimicrobial agent, even at higher doses, indicating that the agent would not be effective for treatment.

These classifications are based on the Minimum Inhibitory Concentration (MIC) or zone diameter measurements, which are compared against established CLSI breakpoints. The breakpoints are updated periodically based on new data about antimicrobial efficacy, resistance mechanisms, and clinical outcomes

Gram NEGATIVE MDROs
1. CephR –Cephalosporin Resistant *Klebsiella*
2. CRE – Carbapenem Resistant Enterobacterales
3. MDR *Acinetobacter*
4. MDR *Klebsiella*
5. MDR *Pseudomonas*
Gram POSITIVE MDROs
1. MRSA – Methicillin-Resistant *Staphylococcus aureus*
2. VRE – Vancomycin Resistant *Enterococcus*
YEAST
Candida auris

A: Gram Negative MDROs:

Gram Negative MDROs include the followings:

1. CephR-*Klebsiella*:

Includes *Klebsiella oxytoca* or *Klebsiella pneumoniae* that are testing non-susceptible (either resistant or intermediate) to at least 1 cephalosporin agent.

Antimicrobial Class	Antimicrobial Agents
Cephalosporins	Cefepime Ceftazidime Cefotaxime Ceftriaxone Ceftazidime/Avibactam Ceftolozane/Tazobactam

2. Carbapenem-Resistant Enterobacterales (CRE):

Carbapenem-resistant *Enterobacterales* includes any *Escherichia coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae*, *Klebsiella aerogenes* or other *Enterobacter spp*. that testing resistant to at least 1 carbapenem agent or by detection of a carbapenemase enzyme.

Antimicrobial Class	Antimicrobial Agents
Carbapenems	Imipenem Meropenem Doripenem Ertapenem

3. MDR Acinetobacter:

Any *Acinetobacter* spp. that is testing non-susceptible (resistant or intermediate) to at least 1 agent in at least 3 antimicrobial classes of the following 6 antimicrobial classes.

Antimicrobial Class	Antimicrobial Agents
Aminoglycosides	Amikacin, Gentamicin, Tobramycin.
Carbapenems	Imipenem, Meropenem, Doripenem.
Cephalosporins	Cefepime, Ceftazidime, Cefotaxime, Ceftriaxone.
Fluoroquinolones	Ciprofloxacin, Levofloxacin.
ß-lactam/ ß-lactamase inhibitor combination	Piperacillin/ tazobactam.
Sulbactam	Ampicillin/ sulbactam.

4. MDR Klebsiella:

Klebsiella oxytoca or *Klebsiella pneumoniae* that testing non-susceptible (resistant or intermediate) to at least 1 agent in 3 of following 5 antimicrobial classes.

Antimicrobial Class	Antimicrobial Agents
Aminoglycosides	Amikacin, Gentamicin, Tobramycin.
Carbapenems	Imipenem, Meropenem, Doripenem.
Cephalosporins	Cefepime, Ceftazidime, Cefotaxime, Ceftriaxone.
Fluoroquinolones	Ciprofloxacin, Levofloxacin.
ß-Lactam combination	Piperacillin/tazobactam, Ampicillin/sulbactam.

5. MDR Pseudomonas:

Any *Pseudomonas aeruginosa* that testing non-susceptible (resistant or intermediate) to at least 1 agent in at least 3 antimicrobial classes of the following 5 antimicrobial classes.

Antimicrobial Class	Antimicrobial Agents
Aminoglycosides	Amikacin, Gentamicin, Tobramycin.
Carbapenems	Imipenem, Meropenem, Doripenem.
Cephalosporins	Cefepime, Ceftazidime.
Fluoroquinolones	Ciprofloxacin, Levofloxacin.
ß-Lactam combination	Piperacillin/tazobactam.

B: Gram Positive MDROs:

Gram Positive MDROs include MRSA and VRE:

1: MRSA: Methicillin-Resistant Staphylococcus Aureus:

Includes S. aureus cultured from any specimen that tests oxacillin-resistant, cefoxitin-resistant, or methicillin-resistant by standard susceptibility testing methods, or any laboratory finding of MRSA.

2: VRE: Vancomycin-Resistant Enterococcus:

Includes Enterococcus faecalis, Enterococcus faecium, or other Enterococcus spp., that are resistant to vancomycin, by standard susceptibility testing methods or a laboratory finding of VRE.

C: Yeast:

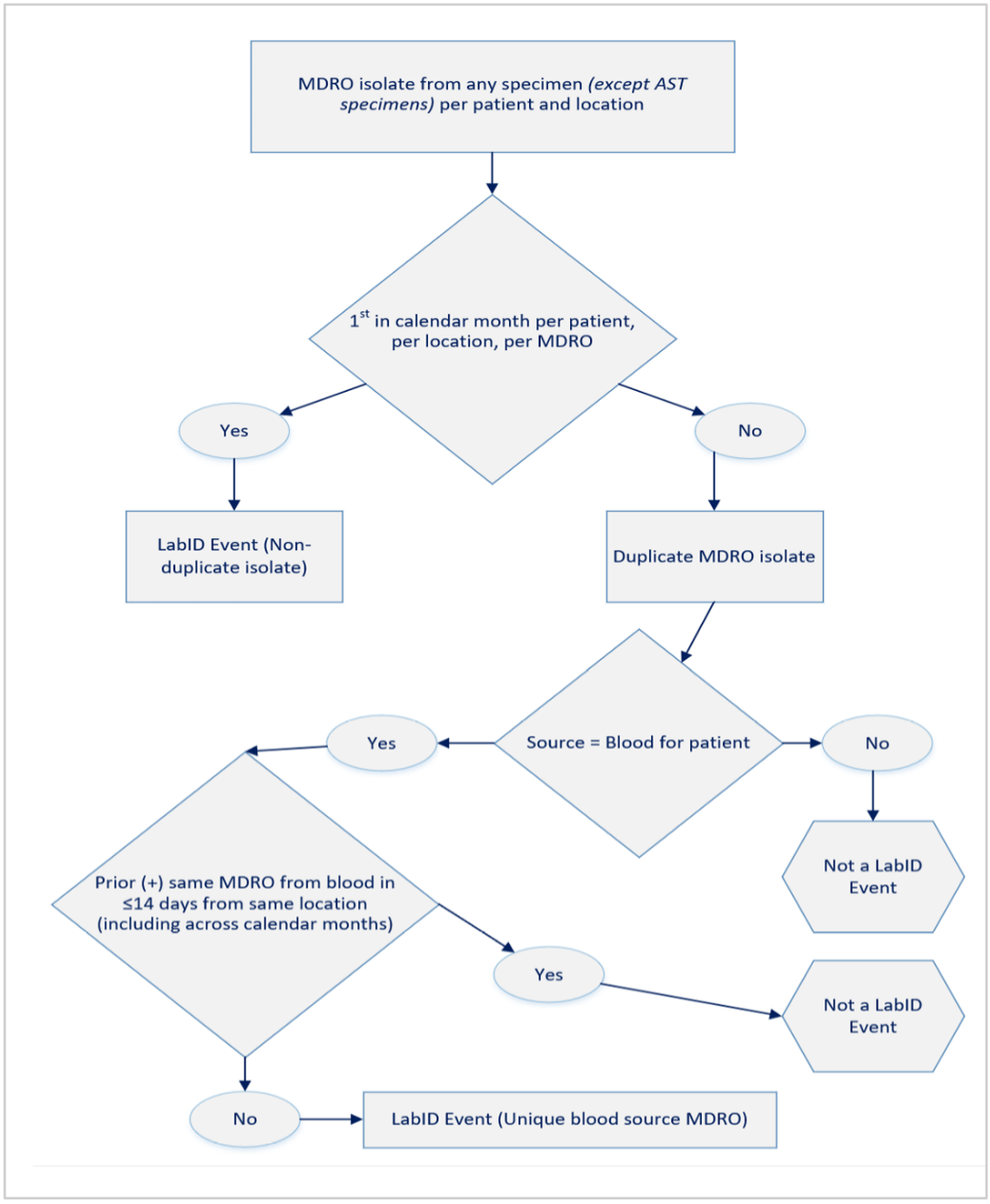
1. Candida Auris:

- Candida auris is an emerging fungal pathogen that has shown resistance to multiple antifungal agents.
- *C. auris* can cause severe infections in immunocompromised patients ranging from superficial (skin) infections to severe life-threatening infections such as bloodstream infections.
- *C.* auris and has been known to persist on surfaces and spreads easily among patients in healthcare facilities making it a significant concern for infection control in healthcare settings.

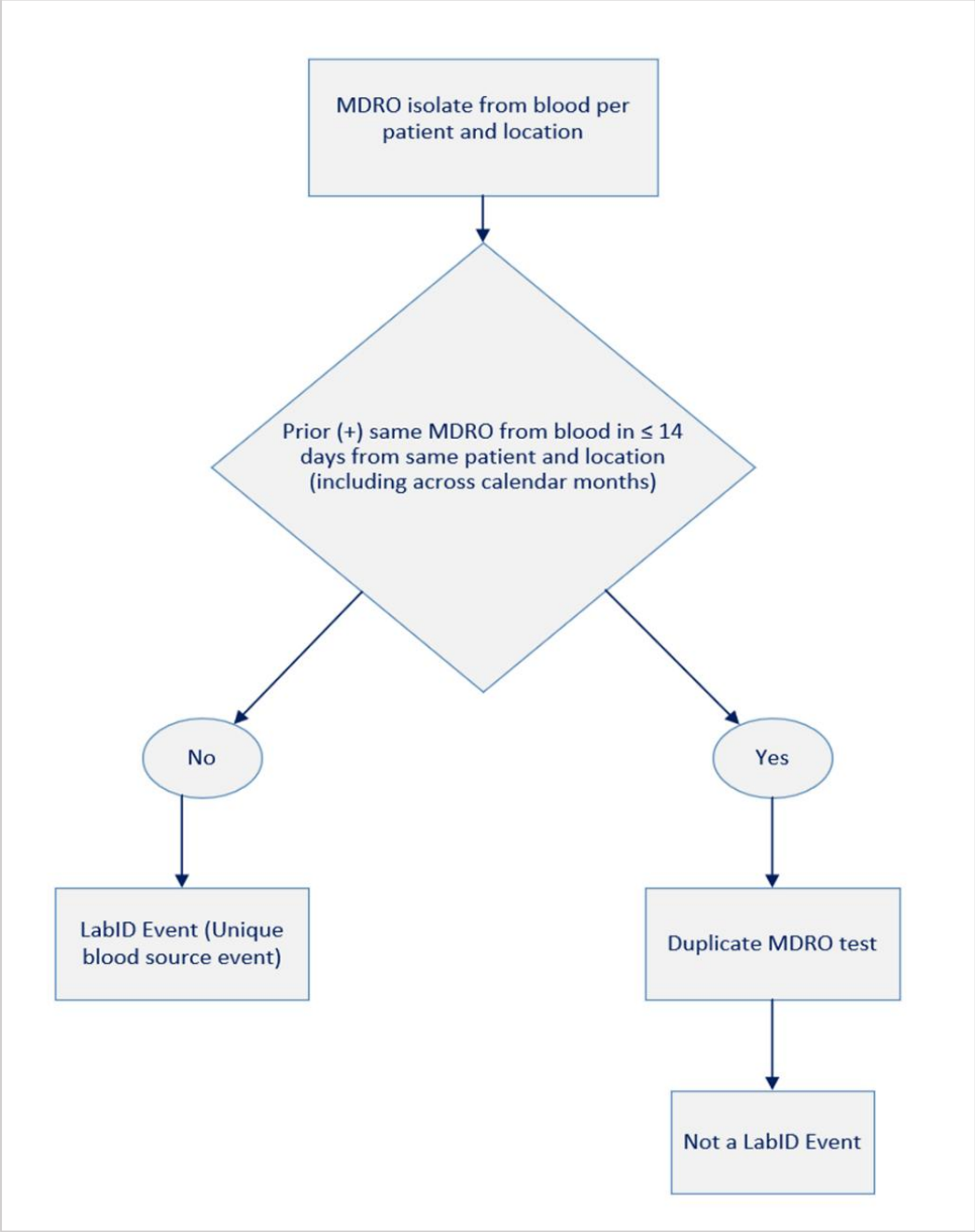
Inclusions and Exclusions of the Specimens

Inclusion Criteria	Exclusion Criteria
Unique Blood Source: – An MDRO isolated from **blood** in a patient with NO prior positive blood culture for the same MDRO in ≤2 weeks (14 days or less), even across calendar months and different facility admissions – An MDRO isolated from **Non-blood Sample** in a patient with NO prior positive blood culture for the same MDRO in ONE month (30 days or less), even across calendar months – and different facility admissions	**Duplicate MDRO Isolates:** – An MDRO isolated from **blood** in a patient with prior positive blood culture for the same MDRO in ≤2 weeks (14 days or less), even across calendar months and different facility admissions – An MDRO isolated from **Non-blood Sample** in a patient with prior positive blood culture for the same MDRO in ONE month (30 days or less), even across calendar months – and different facility admissions
Clinical specimen: – Any specimen, obtained for clinical decision making, testing positive for an MDRO	**Surveillance (screening) specimen:** – Any sample collected as a part of active surveillance culture/testing (ASC/AST), i.e. screening or non-clinical decision

MDRO Test Result Algorithm for All Specimens Laboratory-Identified (LabID) Events

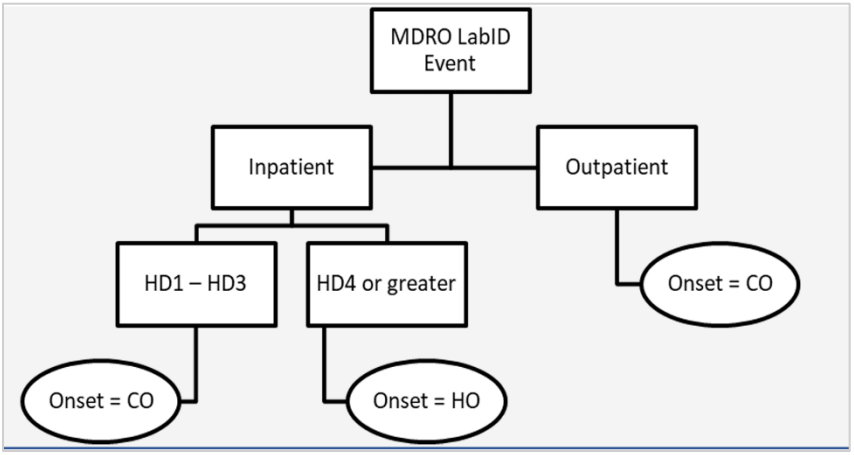


MDRO Test Result Algorithm for Blood Specimens Only Laboratory-Identified (LabID) Events



Categorization of MDRO by Presentation:

- **Community-Onset (CO):** Any specimen collected for clinical decision making tested positive from outpatient location or an inpatient location in the first 3 days of admission to the facility
- **Healthcare Facility-Onset (HO):** Any specimen collected for clinical decision making tested positive from inpatient location 4 days or more after admission to the facility.



HD: Hospital Day

Categorization of MDRO by Symptoms:

Infection	Colonization
• Infection is the entry and multiplication of organisms in the tissue of a host. • Infection may be clinical or subclinical and may not produce identifiable disease. • However, it is usually accompanied by measurable host response(s), either through the appearance of specific antibodies or through cell-mediated reaction(s).	• The multiplication of a microorganism at a body site or sites without any overt clinical expression or detected immune reaction in the host, at the time the organism is isolated. • Colonization may or may not be a precursor of infection. • Colonization may be a form of carriage and a potential transmission source. • Commensal or normal flora are microorganisms present in or on a body site without causing clinical infection.

Difference in timing of HAI and MDRO Surveillance

Admission Days	HAI	Present on admission	MDRO-Community-onset	MDRO-Healthcare-onset
1	Free during the first 2 days	Signs of infection in the first 2 days	Clinical specimen collected in the first 3 days is positive	Not healthcare onset
2				
3	Signs of infection on or after 3rd day	Signs of infection may or may not continue on or after 3rd day		
4			Not community onset	Clinical specimen collected after 3rd day is positive
5				

MDRO/CDI Reporting Methods:

1. **Facility-wide by location:**
   - Report MDRO LabID event and denominator for each location separately and cover all locations in a facility.
   - Must monitor all specimen sources.
   - This reporting method requires the most effort but provides the most detail for local and national statistical data.

2. **Selected locations:**
   - Report MDRO LabID event and denominator from one or more specific locations (including long term care) within a facility.
   - Exception: inpatient rehabilitation units, 24-hour observation, and emergency department
   - Must monitor all specimen sources.
   - This reporting method is ideal for use during targeted prevention programs.

3. **Overall Facility-Wide:**
   - Report MDRO LabID event and denominator from all inpatient locations AND separately for outpatient locations (emergency department, and 24-hour observation locations)
   - Must monitor All specimen sources.
   - Exception: rehabilitation facility and inpatient psychiatric

4. **Overall facility-wide: Blood Specimens Only:**
   - Report MDRO LabID event and denominator from all inpatient locations AND separately for outpatient locations (emergency department, and 24-hour observation locations).
   - Blood Specimens Only.
   - Exception: rehabilitation facility and inpatient psychiatric.

MDRO/ CDI Reporting Methods:

1. **Laboratory-Identified (LabID) Event:**
   - Include all non-duplicate MDRO isolates from any specimen source and unique blood source MDRO isolates.
   - Allows laboratory testing data to be used without clinical evaluation of the patient
   - Provides proxy infection measures of MDRO and/or *C. difficile* exposure burden, infection burden, and healthcare acquisition.
   - ONLY for positive laboratory results (e.g., cultures) that are collected for "clinical" purposes (i.e., for diagnosis and treatment).

2. **Infection Surveillance Reporting:**
   - Enables users to utilize HAI definitions for identifying and reporting infections associated with MDROs and/or *C. difficile*.
   - Surveillance must occur from at least one patient care area and requires active, patient-based, prospective surveillance of the chosen MDRO (s) and/or *C. difficile* infections (CDIs) by a trained Infection Preventionists (IP).

- Infection Surveillance can occur in any inpatient location where such infections may be identified and where denominator data can be collected,
- Surveillance for all types of HAIs with MDRO selected for monitoring in at least one location in the healthcare facility.
- No active surveillance culture/testing (ASC/AST) results are to be included in this reporting of individual results.

MDRO/ CDI Reporting Methods

Items	LabID *MDRO*	LabID *CDI*	Infection
1. Facility-wide by location	YES	YES	
2. Selected locations	YES	YES	YES
3. Overall facility-wide	YES	YES	
4. Overall facility-wide: Blood Specimens Only	YES		

Active Surveillance Culture/Testing (ASC/AST)

- It is a testing that is intended to identify the presence/carriage of microorganisms for the purpose of instituting or discontinuing isolation precautions
- Can be done in inpatient locations, especially ICUs
- Can target one or more organisms, with the most common being *MRSA* and/or *VRE*

Patient eligibility for ASC/AST

- All patients in the chosen unit irrespective of the organism history or
- All patients in the chosen unit who have NO documented positive infection or colonization of the target organism (such as *MRSA* or *VRE*) during the previous 12 months.

Timing of ASC/AST

- At admission: Specimens for AST are obtained within 3 days from admission
- At both admission and discharge: Specimens for AST are obtained within 3 days from admission and at the time of discharge/transfer in patients who stay of more than 3 days. Discharge/transfer AST should include all discharges (including discharges from the facility or to other wards or deaths) and can include the most recent weekly AST if performed more than 3 days after admission to the patient care location. Discharge/transfer AST should not be performed on patients who tested positive on AST admission.

Admission specimens	Discharge/transfer specimens	Need for isolation at admission	Organism acquisition during stay
Negative	Not done	No	Cannot be assessed
Negative	Negative	No	No
Negative	Positive	No	Yes
Positive	Should not be done	Yes	Not applicable

MDRO Analysis

Measure	Calculation	Application
MDRO infection incidence rate	$\frac{\text{The number of infections of a certain MDRO type}}{\text{The number of patient days}} \times 1000$	Location-specific measure
MDRO- LabID Event	$\frac{\text{Laboratory-identified MDRO Events}}{\text{The number of patient days, admissions, or encounters}}$	Location-specific measure

MDRO-Infection Surveillance:

- Rate is then stratified by time (e.g., month, quarter, etc.) and patient care location.

MDRO-Laboratory-Identified (LabID) Event:

- These data are used to calculate four distinct proxy measures including:
  - ✓ Admission prevalence rate
  - ✓ Overall prevalence rate based on clinical testing (measures of exposure burden),
  - ✓ MDRO bloodstream infection incidence rate (a measure of infection burden), and
  - ✓ Overall MDRO infection/colonization incidence rate (a measure of healthcare acquisition).
- LabID Events proxy measures are categorized as healthcare facility-onset (4 days or more days after admission to the facility) versus community-onset (≤ 3 days after admission to the facility).

Clostridium Difficile Infection (CDI)

A positive laboratory test result for *C. difficile* toxin A and/or B, (includes molecular assays [PCR] and/or toxin assays) tested on an unformed stool specimen (must conform to the container) OR A toxin-producing *C. difficile* organism detected by culture or other laboratory means performed on an unformed stool sample (must conform to the container).

Settings:

Infection Surveillance will occur in any inpatient location where denominator data can be collected, which may include critical/intensive care units (ICU), specialty care areas (SCA), step-down units, wards, and chronic care units. Surveillance will NOT be performed in Neonatal Intensive Care Units (NICU), Specialty Care Nurseries (SCN), babies in LDRP, or well-baby nurseries. If LDRP locations are being monitored, baby counts must be removed.

Duplicate C. Difficile:

- Any *C. difficile* toxin-positive laboratory result from the same patient and location, following a previous C. difficile toxin-positive laboratory result within 14 days even across calendar months and readmissions to the same facility location.
- There should be 14 days with no *C. difficile* toxin-positive laboratory result for the patient and specific location before another *C. difficile* LabID Event is entered into national electronic platform for the patient and location.
- The date of specimen collection of a previously submitted *C. difficile* LabID Event is considered Day 1.

Categorization of CDI by Occurrence:

- **Incident CDI Assay:** Any positive test for CDI from a specimen obtained >8 weeks after the most recent positive test for CDI (or with no previous positive test for CDI documented) for that patient.
- **Recurrent CDI Assay:** Any positive test for CDI from a specimen obtained >2 weeks and ≤8 weeks after the most recent positive test for CDI for that patient.

Categorizing of CDI by Presentation:

- **Community-Onset (CO):** Any positive test for CDI collected in an outpatient location or an inpatient location ≤3 days after admission to the facility and the patient was not previously discharged from an inpatient location within the same facility within 4 weeks prior to current date of specimen collection.
- **Community-Onset Healthcare Facility-Associated (CO-HCFA):** Any positive test for CDI collected from a patient who was discharged from the facility within 4 weeks prior to current date of stool specimen collection. The previous discharge must have been from an inpatient location within the same facility (in other words, an outpatient visit does not qualify for this definition).
- **Healthcare Facility-Onset (HO):** Any positive test for CDI collected 4 days or more after admission to the facility.

***** ***Location of Attribution and Transfer Rule apply to Infection Surveillance.***

Reporting: C. Difficile Infections:

Numerator: The total number of HAI CDI cases identified during the surveillance month for a location.

Denominator: The total number of patient days and admissions during the surveillance month for a location.

Data Analysis: Data are stratified by time (for example, month, quarter, etc.) and by patient care location.

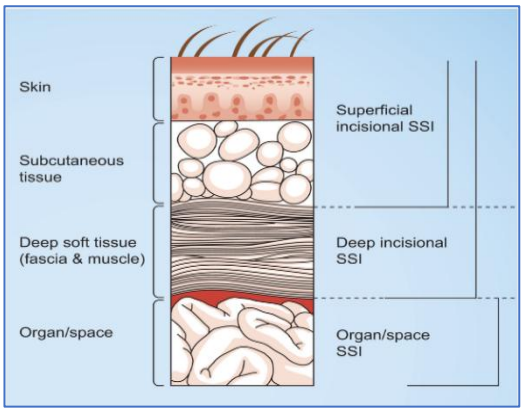
$$\textbf{C. } \textit{difficile} \textbf{ Infection Incidence Rate} = \frac{\text{Number of HAI CDI cases}}{\text{Number of patient days}} \times 10{,}000$$

Differentiating Between LabID Event and Infection Surveillance

Category	LabID Event	Infection Surveillance (using HAI surveillance definitions)
Protocol	LabID Event protocol	Infection Surveillance protocol and HAI site-specific definitions in NHSN manual (e.g., BSI, UTI, SSI, VAE)
Signs & Symptoms	NONE. Laboratory and admission data, without clinical evaluation of patient	Combination of laboratory data and clinical evaluation of patient (signs/symptoms)
Surveillance Rules	• HAI and POA do **NOT** apply • Transfer Rule does **NOT** apply • Location = location of patient at time of specimen collection • Event date = specimen collection date	• HAI and POA **do** apply • Transfer Rule applies • See NHSN protocol for details regarding location and date of event
Denominator Reporting	• Number of patient days and admissions • Can be reported by specific location or facility-wide, depending on reporting option(s) selected • Inpatient and/or outpatient	• Device days and patient days must be collected separately for each monitored location • Inpatient reporting only
Categorization of Infections	• Events categorized based on inpatient or outpatient location and admission and specimen collection dates: ○ Healthcare Facility-Onset (HO) ○ Community-Onset (CO) ○ Community-Onset Healthcare Facility-Associated (CO-HCFA) for *C. difficile* only • HO, CO, and CO-HCFA (if applicable) • Additional categorizations are applied to *C. difficile*, including Incident CDI event and Recurrent CDI event.	• HAI protocols used • Events are either HAI or not, **therefore LabID Event categorizations do not apply**

Patient Safety Component

C: Procedure Associated Module



Surgical Site Infection (SSI) Surveillance:

1: Initaite SSI Surveillance for each patient who will undergo Surgical Procedure in your hopsital.(Surgical Procedure/s selected based on high risk & High Volume.
2:Conduct Post Discharge Surveillance 30l90 days for detection of SSIs.

SURVEILLANCE OF SURGICAL SITE INFECTIONS (SSI)

SSI SURVEILLANCE

- Surgical Site Infection (SSI) - Definition
- Surveillance Settings & Methods
- SSI Surveillance Requirements
- Surveillance Types
- Post Discharge Surveillance
- Definition of an NHSN Operative Procedure
- Date of Event (DOE)
- Secondary BSI Attribution Period for SSI
- SSI Risk Index Category
- American Society of Anesthesiology (ASA) Score
- Wound Class (Class I,II,III,IV)
- CDC-NHSN Criteria for Surgical Site Infections
- SSI Event Reporting Instructions - PATOS
- SSI Event Attribution
- SSI Data Analysis

Surgical Site Infection (SSI)

Infection occurs within 30 or 90 days (according to the operative procedures) after an operative procedure that involves the skin or subcutaneous tissue (superficial incisional SSI), deep soft tissue (deep incisional SSI), or any other part of the body that is opened or manipulated during the operative procedure (organ/ space SSI).

Surveillance Settings:

Surveillance will occur with surgical patients in any inpatient/outpatient setting where the selected NHSN operative procedure(s) are performed.

Surveillance Methods:

- Active
- Patient based
- Prospective
- Priority-directed targeted
- Yield risk-adjusted incidence rates

Surveillance Requirements:

- Select at least one NHSN operative procedure category for at least one month
- A procedure must meet the NHSN definition of an operative procedure in order to be included in SSI surveillance.
- All procedures included in the NHSN monthly surveillance plan are followed for superficial incisional, deep incisional, and organ/space SSI events and the type of SSI reported must reflect the deepest tissue level where SSI criteria is met during the surveillance period.
- SSI events where infection present at the time of surgery (PATOS) are reported with SSI.
- An SSI event is attributed to the facility in which the NHSN operative procedure is performed.

Surveillance Types:

- Concurrent and post discharge surveillance methods should be used to detect SSIs following inpatient operative procedures.
- Post-discharge surveillance for outpatient operative procedures.

Post-Discharge Surveillance:

- 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
- 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)
- Review of medical records or surgery clinic patient records
- Any combination of these methods (or other methods identified by the facility) which has the capacity to identify all SSIs is acceptable for use; however, NHSN criteria for SSI must be used.
- A post-discharge surveillance form for detecting Surgical Site Infections (SSIs) is a tool used to monitor for SSIs after a patient has been discharged from a healthcare facility following surgery. It helps identify SSIs that may develop post-discharge, even if the infection wasn't detected during the patient's hospital stay. *(Refer to Page # 133 for template)*

Definition of an Operative Procedure:

- Takes place during an operation where at least one incision (including laparoscopic approach and cranial Burr holes) 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 room (OR), defined as a patient care area that met the Facilities Guidelines Institute's (FGI) or American Institute of Architects' (AIA) criteria for an operating room when it was constructed or renovated. This may include an operating room, C-section room, interventional radiology room, or a cardiac catheterization lab.
- Exclusions: Otherwise eligible procedures that are assigned an ASA score of 6 are not eligible for NHSN SSI surveillance.

Eligible Surgeries Under Operative Procedure

Code	Name	Description
BRST	Breast surgery	Excision of lesion or tissue of breast including radical, modified, or quadrant resection, lumpectomy, incisional biopsy, or mammoplasty
CARD	Cardiac surgery	Procedures on the heart; includes valves or septum; does not include coronary artery bypass graft, surgery on vessels, heart transplantation, or pacemaker implantation
CBGB	Coronary bypass with chest & donor incisions	Chest procedure to perform direct revascularization of the heart; includes obtaining suitable vein from donor site for grafting

NHSN Operative Procedures

Code	Name
AAA	Abdominal aortic aneurysm repair
AMP	Limb amputation
APPY	Appendix surgery
AVSD	AV shunt for dialysis
BILI	Bile duct, liver or pancreatic surgery
BRST	Breast surgery
CARD	Cardiac surgery
CBGB	Coronary bypass with chest & donor incisions
CBGC	Coronary bypass graft with chest incision
CEA	Carotid Endarterectomy
CHOL	Gallbladder surgery
COLO	Colon surgery

Code	Name
HYST	Abdominal hysterectomy
KPRO	Knee prosthesis
KTP	Kidney transplant
LAM	Laminectomy
LTP	Liver transplant
NECK	Neck surgery
NEPH	Kidney surgery
OVRY	Ovarian surgery
PACE	Pacemaker surgery
PRST	Prostate surgery
PVBY	Peripheral vascular bypass surgery
REC	Rectal surgery

CRAN	Craniotomy	SB	Small bowel surgery
CSEC	Cesarean section	SPLE	Spleen surgery
FUSN	Spinal fusion	THOR	Thoracic surgery
FX	Open reduction of fracture	THYR	Thyroid and/or parathyroid surgery
GAST	Gastric surgery	VHYS	Vaginal hysterectomy
HER	Herniorrhaphy	VSHN	Ventricular shunt
HPRO	Hip prosthesis	XLAP	Exploratory laparotomy
HTP	Heart transplant	AVSD	Shunt for Dialysis

Timeframe for SSI elements:

- SSI surveillance is based on a **30 or 90 day SSI surveillance period,** which is determined by operative procedure category and the tissue level of SSI event.
- The Infection Window Period (IWP), Present on Admission (POA), Healthcare-associated Infection (HAI), and Repeat Infection Timeframe (RIT) definitions do not apply to SSI surveillance.
- **SSI guidelines do not offer a strict timeframe for elements of criteria to occur** but historically, all elements used to meet an SSI criterion *generally* occur within a 7-10 day timeframe. To ensure that all elements associate to the SSI, the elements must be relational to one another.
- Each case differs based on the individual elements occurring and the type of SSI but the DOE for an SSI must occur within the appropriate 30- or 90-day SSI surveillance period.

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. Synonym: infection date.
- All elements required to meet an SSI criterion usually occur within a 7 to 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 SSI event, 3 days prior, and 13 days after.

Denominator for Procedure Details

1: ASA Physical Status:

- Assessment by the anesthesiologist of the patient's preoperative physical condition using the American Society of Anesthesiologists' (ASA) Physical Status Classification System.
- Patients are assigned an ASA score of 1-6 at time of surgery.
- Patients with an ASA score of 1-5 are eligible for SSI surveillance.
- Patients that are assigned an ASA score of 6 (a declared brain-dead patient whose organs are being removed for donor purposes) are not eligible for SSI surveillance.

American Society of Anesthesiology (ASA) score:

- Assessment by the anesthesiologist of the patient's preoperative physical condition

  1 = Normally healthy patient

  2 = Patient with mild systemic disease

  3 = Patient with severe systemic disease that is not incapacitating

  4 = Patient with an incapacitating systemic disease that is a constant threat to life

  5 = Moribund patient not expected to survive for 24 hours with or without operation

  Note: Do NOT report procedures with an ASA physical status of 6 (a declared brain-dead patient whose organs are being removed for donor purposes) to national electronic platform.

2: 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.
- The definition of diabetes excludes patients with no diagnosis of diabetes. The definition also excludes patients who receive insulin for perioperative control of hyperglycemia but have no diagnosis of diabetes.

3: Wound Class:

- An assessment of the degree of contamination of a surgical wound at the time of the surgical procedure.
- Wound class is assigned by a person involved in the surgical procedure (for example, surgeon, circulating nurse, etc.)
- The **four wound classifications** available are:

I. Clean (C)
II. Clean-Contaminated (CC)
III. Contaminated (CO)
IV. Dirty/Infected (D]
(Refer to SSI Risk Index Category for details)

The following operative procedure categories cannot be recorded as clean (C) within the application: APPY, BILI, CHOL, COLO, REC, SB, and VHYS. If a clean (C) wound class was assigned to a procedure in one of these procedure categories, the procedure cannot be included in the denominator for procedure data. The IP should not modify the wound class.

4: Duration of Operative Procedure:

The interval in hours and minutes between the Procedure/Surgery Start Time and the Procedure/Surgery Finish Time defined by the Association of Anesthesia Clinical Directors (AACD).

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

5: Emergency Operative Procedure:

- A procedure that is documented per the facility's protocol to be an Emergency or Urgent procedure.

6: 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.

7: Inpatient Operative Procedure:

- An operative procedure performed on a patient whose date of admission to the healthcare facility and the date of discharge are different calendar days.

8: Outpatient Operative Procedure:

- An operative procedure performed on a patient whose date of admission to the healthcare facility and date of discharge are the same calendar day.

9: 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.
- 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.

10: 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.

10: Scope:

- An instrument used to reach and visualize the site of the operative procedure. In the context of an operative procedure, use of a scope involves creation of several small incisions to perform or assist in the performance of an operation rather than use of a traditional larger incision (specifically, open approach).

11: Trauma:

- Blunt or penetrating injury occurring prior to the start of the procedure
- Complex trauma cases may require multiple trips to the OR during the same admission to repair the initial trauma.

SSI Risk Index Category

- The SSI Risk Index categorizes surgical patients based on the presence of specific risk factors to assess the likelihood of developing a **surgical site infection (SSI).**
- The index uses three dichotomous variables: **ASA score, wound classification, and procedure duration.** Each factor present adds a point to the index, with a score ranging from 0 (lowest risk) to 3 (highest risk).
- Patient Risk Scoring is a method of stratification of risk for infection associated with surgery. The higher the patient's risk score the higher the risk the patient has of developing an SSI.

Calculation of SSI Risk Index Category:

The risk index score, ranging from 0-3, is sum up the number risk factors present at the time of the operation among the following three domains:

1) ASA Score:

American Society of Anesthesiologists score of 3, 4, or 5 = Score 1

2) Wound Class:

Contaminated (Class 3) or Dirty/infected (Class 4) wound class = Score 1

3) Operative Duration:

Operation lasting longer than the 75th percentile duration for that specific procedure i.e. operation lasting more than the duration cut point: = Score 1

1) American Society of Anesthesiology (ASA) Score:

- Anesthesiologist assesses the patient's preoperative physical condition using the American Society of Anesthesiologists' (ASA) Classification.
- The ASA classification system is a numerical quantification of disease severity and potential for suffering complications from general anesthesia.
- Patients with an ASA class of 3, 4 or 5 will be assigned a risk score of 1.

ASA Score Classification

ASA	ASA Description	Risk Score
1	Normally Healthy Patient	0
2	Patient with Mild Systemic Disease	0
3	Patient with Severe Systemic Disease that is not incapacitating	1
4	Patient with an incapacitating systemic disease that is a constant threat to life	1
5	Moribund patient not expected to survive for 24 hours with or without operation	1

2) 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.)

Surgical Wound Classification

Wound Class	Wound Classification Description	Risk Score
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. • The following NHSN operative procedure categories are NEVER considered to have a clean wound classification: APPY, BILI, CHOL, COLO, REC (Rectal surgery), SB (Small bowel), and VHYS (Vaginal hysterectomy)	0
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.	0
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.	1
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

3) Duration of Operative Procedure:

- The interval in hours and minutes between the Procedure/Surgery Start Time and the Procedure/Surgery Finish Time defined by the Association of Anesthesia Clinical Directors (AACD).

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

- If the procedure under review takes longer than the reported duration cut point for the equivalent procedure, then a **risk score of 1** will be assigned.
- Operation lasting more than the duration cut point minutes, where the duration cut point is the approximate **75th percentile** of the duration of surgery in minutes for the operative procedure i.e. 75% of the operations for that procedure were shorter than the documented duration cut point and 25% were longer.

Calculation of Patient Risk Score

Example:

A score is assigned for each risk factor and the total score is calculated by adding the three scores together (ASA class + Duration of surgery + Surgical wound classification).

Patient X underwent surgical Procedure in your facility. His ASA score, wound class & procedure duration is as follows:

- **ASA Class of 3 (*Patient with Severe Systemic Disease that is not incapacitating)***
- **Surgical Wound Class "Clean"**
- **Surgery Duration >75th Percentile**

#	Patient Risk Index Category	Risk Score
1	ASA Score *(Add 1 if score was 3,4 or 5 otherwise 0)*	1
2	Wound Class *(Add 1 if wound class was III or IV otherwise 0)*	0
3	Procedure Duration *(Add 1 if procedure duration exceeds the operation specific cut off point, otherwise 0)*	1
	Risk Index Category Total Score (0, 1,2 ,3)	**2**

CDC Criteria for Identification of Surgical Site Infections

Surgical Site Infection Criteria (SSI)

I: 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 the patient has at least **one** of the following:

1. Purulent drainage from the superficial incision.
2. Organisms 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)).
3. Superficial incision that is deliberately opened by a surgeon, physician* or physician 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
   - Heat
4. Diagnosis of a superficial incisional SSI by a physician or physician designee.

The term physician for the purpose of application of the NHSN SSI criteria may be interpreted to mean a surgeon, infectious disease physician, emergency physician, other physician on the case, or physician's designee (nurse practitioner or physician's assistant).

There are two specific types of superficial incisional SSIs:

1. **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).

2. **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 SSI:

- Diagnosis/treatment of cellulitis (redness/warmth/swelling), by itself, does not meet criterion "d" 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)
- For an NHSN 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.

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Surgical Site Infection Criteria (SSI)

II: Deep incisional SSI

Must meet the following criteria:

The date of event occurs within 30 or 90 days after the NHSN operative procedure (where day 1 = the procedure date).

AND involves deep soft tissues of the incision (for example, fascial and muscle layers).

AND the patient has at least **one** of the following:

1. Purulent drainage from the deep incision.
2. A deep incision that spontaneously dehisces, or is deliberately opened or aspirated by a surgeon, physician* or physician designee.

   AND organism(s) identified from the deep soft tissues of the incision 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.
3. An abscess or other evidence of infection involving the deep incision that is detected on gross anatomical or histopathologic exam, or imaging test.

*The term physician for the purpose of application of the NHSN SSI criteria may be interpreted to mean a surgeon, infectious disease physician, emergency physician, other physician on the case, or physician's designee (nurse practitioner or physician's assistant).

There are two specific types of deep incisional SSIs:

1. **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).

2. **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).

Surgical Site Infection Criteria (SSI)

III: Organ/Space SSI

Must meet the following criteria:

Date of event occurs within 30 or 90 days after the NHSN operative procedure (where day 1 = the procedure date)

AND involves any part of the body deeper than the fascial/muscle layers that is opened or manipulated during the operative procedure

AND the patient has at least **one** of the following:

1. Purulent drainage from a drain that is placed into the organ/space (for example, closed suction drainage system, open drain, T-tube drain, CT-guided drainage).
2. Organism(s) identified from fluid or tissue in the organ/space 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)).
3. An abscess or other evidence of infection involving the organ/space that is detected on gross anatomical or histopathologic exam, or imaging test evidence suggestive of infection.

AND

Meets at least one criterion for a specific organ/space infection site listed in Table attached. These criteria are found in the Surveillance Definitions for Specific Types of Infections

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

Category	Operative Procedure
BRST	Breast surgery
CARD	Cardiac surgery
CBGB	Coronary artery bypass graft with both chest and donor site incisions
CBGC	Coronary artery bypass graft with chest incision only
CRAN	Craniotomy
FUSN	Spinal fusion
FX	Open reduction of fracture
HER	Herniorrhaphy
HPRO	Hip prosthesis
KPRO	Knee prosthesis
PACE	Pacemaker surgery
PVBY	Peripheral vascular bypass surgery
VSHN	Ventricular shunt

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	Intra-abdominal 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		

Denominator:

All patients having any of the procedures included in the selected NHSN operative procedure category(s) are monitored for SSI. The Surgical Site Infection (SSI) form is completed for each SSI.

SSI Event Reporting Instructions

1. Infection presents at time of surgery (PATOS)

- Must be documented at the start of or during the surgery
- Must be to the same depth as the SSI that is being attributed to the procedures (e.g., if a patient has evidence of an intraabdominal infection at the time of

surgery and then later returns with a superficial or deep incisional SSI, so it NOT PATOS

- Previous infection does not need to meet NHSN definition, but infection or abscess evidence does need to be noted
- **Example:**
  - Patient admitted with an acute abdomen.
  - Sent to OR for an exploratory laparotomy where there is a finding of an abscess due to ruptured appendix and an APPY is performed.
  - Patient returns two weeks later and meets criteria for an organ space IAB SSI.
  - This is PATOS SSI event.

- **Example:**
  - Patient is admitted with a ruptured diverticulum.
  - In the OR note the surgeon documents that there are multiple abscesses in the intra-abdominal cavity.
  - Patient returns three weeks later and meets criteria for a superficial SSI.
  - This is NOT PATOS SSI event.

2. Excluded organisms:

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.

3. Attribution of SSI after multiple types of NHSN procedures are performed during a single trip to the OR:

- Procedure-associated HAIs are attributed to the procedure NOT the location
- If a patient has several NHSN operative procedures prior to an infection, report the operative procedure code of the operation that was performed most closely in time prior to the infection date, unless there is evidence that the infection is associated

with a different operation.

- If more than one NHSN operative procedure was done through a single incision, attempt to determine the procedure that is thought to be associated with the infection.
- If it is not clear (as is often the case when the infection is a superficial incisional SSI), or if the infection site being reported is not an SSI, use the NHSN Principal Operative Procedure Selection Lists to select which operative procedure to report.

NHSN Principal Operative Procedure Category Selection List

Priority	Category	Abdominal Operative Procedures
1	LTP	Liver transplant
2	COLO	Colon surgery
3	BILI	Bile duct, liver or pancreatic surgery
4	SB	Small bowel surgery
5	REC	Rectal surgery
6	KTP	Kidney transplant
7	GAST	Gastric surgery
8	AAA	Abdominal aortic aneurysm repair
9	HYST	Abdominal hysterectomy
10	CSEC	Cesarean section
11	XLAP	Laparotomy
12	APPY	Appendix surgery
13	HER	Herniorrhaphy
14	NEPH	Kidney surgery
15	VHYS	Vaginal hysterectomy
16	SPLE	Spleen surgery
17	CHOL	Gall bladder surgery
18	OVRY	Ovarian surgery

4. Multiple tissue levels are involved in the infection:

The type of SSI (superficial incisional, deep incisional, or organ/space) reported must reflect the deepest tissue level where SSI criteria is met during the surveillance period.

- Report infection that involves the organ/space as an organ/space SSI, whether or not it also involves the superficial or deep incision sites.
- Report infection that involves the superficial and deep incisional sites as a deep incisional SSI.
- If an SSI started as a deep incisional SSI on day 10 of the SSI surveillance period and then a week later (day 17 of the SSI surveillance period) meets criteria for an organ space SSI, the date of event would be the date of the organ/ space SSI.

5. Attributing SSI when several procedures are performed on different dates:

If a patient has several operative procedures performed on different dates, attribute the SSI to the most recently performed operative procedure.

6. Attributing SSI to NHSN procedures that involve multiple primary incision sites:

If multiple primary incision sites of the same NHSN operative procedure become infected, only report as a single SSI, and assign the type of SSI (superficial incisional, deep incisional, or organ/space) that represents the deepest tissue level where SSI criteria is met at any of the involved primary incision sites during the surveillance period. Examples:

- *If one laparoscopic incision meets criteria for a superficial incisional SSI and another meets criteria for a deep incisional SSI, only report one deep incisional SSI.*
- *If one or more laparoscopic incision sites meet criteria for superficial incisional SSI but the patient also has an organ/space SSI related to the laparoscopic procedure, only report one organ/space SSI.*

- *If an operative procedure is limited to a single breast and involves multiple incisions in that breast that become infected, only report a single SSI.*
- *In a colostomy formation or reversal (take down) procedure, the stoma and other abdominal incision sites are considered primary incisions. If both the stoma and another abdominal incision site develop superficial incisional SSI, report only as one SSI (SIP).*

7. Attributing SSI to NHSN procedures that have secondary incision sites:

- Certain procedures can involve secondary incisions (specifically the following, BRST, CBGB, CEA, FUSN, PVBY, REC, and VSHN).
- The surveillance period for all secondary incision sites is 30 days, regardless of the required deep incisional or organ/space SSI surveillance period for the primary incision site(s).
- Procedures meeting this designation are reported as only one operative procedure.
- For example:
- A saphenous vein harvest incision site in a CBGB procedure is considered the secondary incision site. One CBGB procedure is reported, the saphenous vein harvest site is monitored for 30 days after surgery for SSI, and the chest incision is monitored for 90 days after surgery for SSI. If the patient develops an SSI of the leg site (such as a superficial incisional SSI) and an SSI of the chest site (such as a deep incisional SSI) two SSIs are reported.
- A tissue harvest site (for example, Transverse Rectus Abdominis Myocutaneous [TRAM] flap) in a BRST procedure is considered the secondary incision site. One BRST procedure is reported, and if the secondary incision site gets infected, report as either SIS or DIS as appropriate.

8. SSI detected at another facility:

It is required that if an SSI is detected at a facility other than the one in which the operation was performed, SSI event is attributed to the facility in which the NHSN operative procedure is performed.

9. SSI following invasive manipulation/accession of the operative site:

An SSI will not be attributed if the following 3 criteria are ALL met:

- During the post-operative period the surgical site is without evidence of infection and,
- Invasive manipulation/accession of the site is performed for diagnostic or therapeutic purposes (for example, needle aspiration, accession of ventricular shunts, accession of breast expanders) and,
- Infection subsequently develops in a tissue level which was entered during the manipulation/accession.

SSI Data Analysis

Measure	Calculation	Application
SSI Rates	The number of SSIs detected after a procedure / Total number of that procedures examined X100	Procedure specific measure
SSI SIR	The number of Observed SSIs / The number of Predicted SSIs	Both procedure specific and summarized measure

SIR, standardized infection ratio

- SSI rates should be presented by operative procedure (for example, herniorrhaphy, gall bladder surgery, …etc.) and by risk index category (0, 1, 2, and 3).
- SSI SIR can be presented for single procedures and can be summarized across multiple procedures, adjusting for differences in the incidence of infection between different procedure types.
- SSI SIR can be additionally summarized across different risk index categories, adjusting for differences in the incidence of infection between different risk index categories.

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POST DISCHARGE SSI SURVEILLANCE

SSI DETECTION FORM

A: PATIENT'S INFORMATION					
Patient Name:			Age:	Gender:	MRN:
Type of Procedure:			Date of Procedure:		
Reporting Location	ER: ☐	Wound Clinic ☐	Surgical OPD ☐	Readmission: ☐	Reporting Date:

SECTION I: WOUND ASSESSMENT			
1:	Sign & Symptoms	Purulent drainage from wound (Pus)	☐
		Redness	☐
		Heat / Warmth	☐
		Pain or tenderness	☐
		Localized swelling	☐
		Fever > 38º	☐
		Wound Dehiscence	☐
		Abscess on gross anatomical exam	☐

SECTION II: Microbiology & Laboratory Testing				
#	Type Specimen	Date of Specimen Collection	Organisms / Pathogens	Date of Result
1:	Wound Culture			
2:	Blood Culture			

SECTION III: Imaging (Deep or Organ Space SSI)				
#	Type of Imaging	Description	Date	Findings
1:	Ultrasound	*To detect fluid collections / abscesses*		
2:	CT Scan MRI	*For deeper anatomical infections after abdominal or spinal surgeries etc.*		

For Infection Control Department	
Date Received: -----/----/----	*Received by: ----------*

Diagnostic Criteria for SSI

SECTION IV: Surgical Site Infection Criteria		
Superficial Incisional SSI	**Deep Incisional SSI**	**Organ / Space SSI**
Involves only skin and subcutaneous tissue of the incision (within 30 days after any NHSN operative procedure)	*Involves deep soft tissues of the incision (e.g., fascial and muscle layers) (within 30- 90 days after any NHSN operative procedure) e.g. deep abscess*	*Infection involves any part of the body deeper than the fascial/muscle layers, that is opened or manipulated during the operative procedure (within 30- 90 days after any NHSN operative procedure) e.g. endometritis (organ), peritonitis (space)*
At least ONE of the following: I: Purulent drainage from superficial Incision II: Organisms identified from an aseptically-obtained specimen from the superficial incision or subcutaneous tissue culture or non-culture based testing III: Superficial incision that is deliberately opened by a surgeon, attending physician** or other designee and culture or non-culture based testing is not performed. **AND** Any one of the following: – Pain /tenderness – localized swelling – Erythema – Heat IV: Diagnosis of a superficial incisional SSI by the surgeon or attending Physician or other designee.	***At least ONE of the following:*** I: Purulent drainage from the deep Incision II: A deep incision that spontaneously dehisces, or is deliberately opened or aspirated by a surgeon, attending physician or other designee and organism is identified by a culture **AND** Any one of the following; – Fever > 38 ˚ C – Localized pain / tenderness III. An abscess or other evidence of infection involving the deep incision that is detected on gross anatomical or histopathology exam, or imaging test	***At least ONE of the following:*** I: Purulent drainage from a drain that is placed into the organ/space (e.g., closed suction drainage system, open drain, T-tube drain, CT guided drainage) II: Organisms are identified from an aseptically-obtained fluid or tissue in the organ/space by a culture. III: An abscess or other evidence of infection involving the organ/space that is detected on gross anatomical or histopathologic exam, or imaging test.

CHAPTER – II

Outpatient Dialysis Component

Dialysis Event (DE) Surveillance:

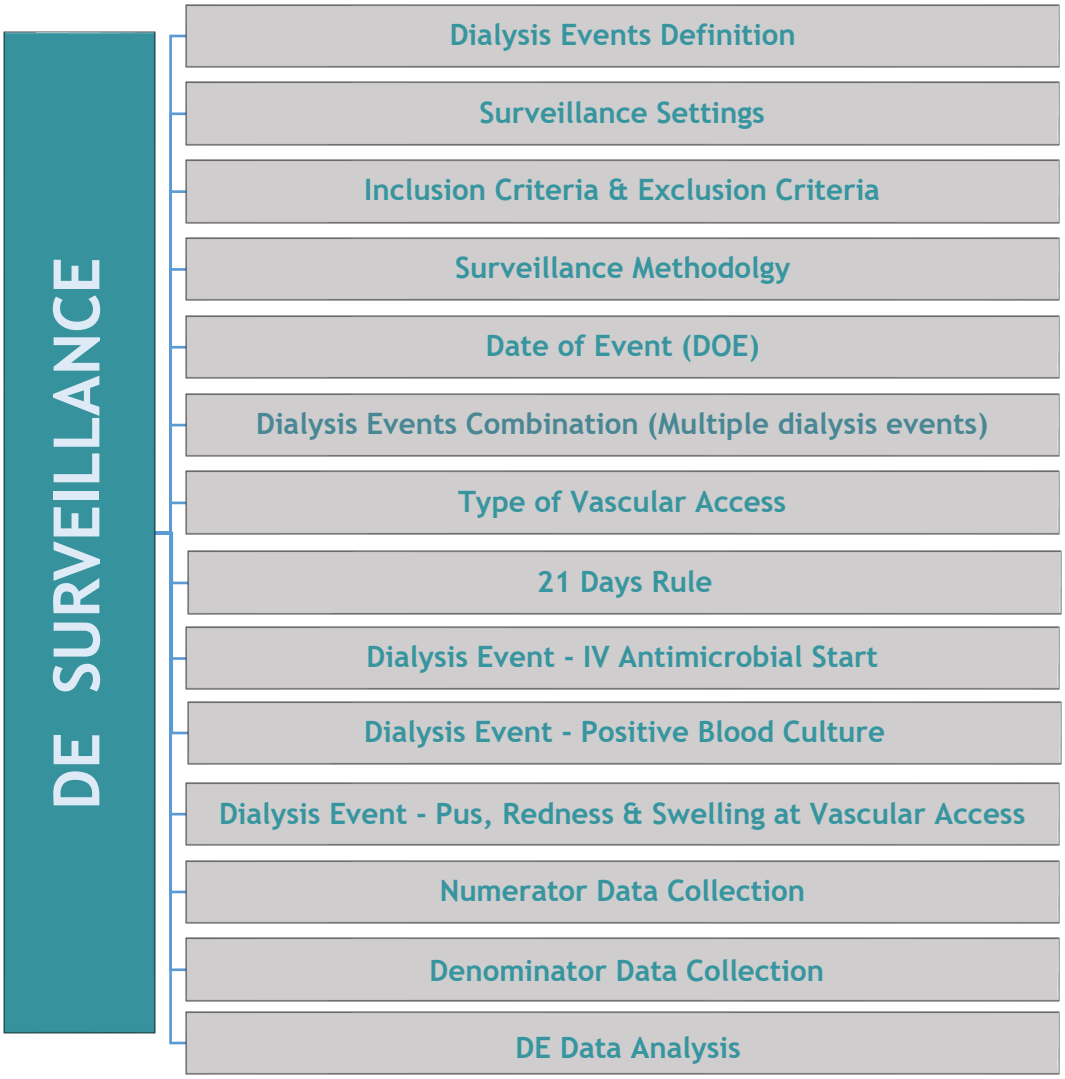
1. Initiate DE Surveillance for all hemodialysis patients including transient patients in outpatinet settings ONLY.

2. Exclude non-hemodialysis patients and exclude inpatients.

SURVEILLANCE OF DIALYSIS EVENTS (DE SURVEILLANCE)

DE SURVEILLANCE

- Dialysis Events Definition
- Surveillance Settings
- Inclusion Criteria & Exclusion Criteria
- Surveillance Methodolgy
- Date of Event (DOE)
- Dialysis Events Combination (Multiple dialysis events)
- Type of Vascular Access
- 21 Days Rule
- Dialysis Event - IV Antimicrobial Start
- Dialysis Event - Positive Blood Culture
- Dialysis Event - Pus, Redness & Swelling at Vascular Access
- Numerator Data Collection
- Denominator Data Collection
- DE Data Analysis



Dialysis Events (DE) Surveillance

DE could be one or more of the following types:

- **In-unit IV Antimicrobial Start:** Include all IV antimicrobial starts, not just those with vancomycin or for a vascular access problem.
- **Positive Blood Culture:** Include all patients with a positive blood culture even if they did not have an associated hospitalization or in-unit IV antimicrobial start. Include blood cultures taken as an outpatient or within 1 day after a hospital admission. Access-associated bacteremia is a positive blood culture with source identified as the vascular access site or unknown.
- **Pus, redness, or increased swelling at the vascular access site:** Pus is always reportable. Report redness or swelling if it is greater than expected and suspicious for infection.

Surveillance Settings:

- Surveillance occurs in outpatient hemodialysis centers.
- These centers may be attached to or affiliated with a hospital but should serve hemodialysis outpatients.
- If other patients (e.g., inpatients, peritoneal dialysis patients) are present, exclude them from Dialysis Event numerator and denominator reporting.

Inclusion Criteria:

- In-center hemodialysis outpatients.
- Transient Patient: patients transferred from another facility and received in-center hemodialysis at our location on the first two working days of the month, patients receiving dialysis for less than 30 days) should be included in DE surveillance.
- Peritoneal dialysis and transplant patients if they are on temporary hemodialysis.

Acute Kidney Injury (AKI) patients are included and defined by the following criteria:

- ✓ *No End-Stage Renal Disease (ESRD) diagnosis.*
- ✓ *Physician-diagnosed AKI in the medical record.*
- ✓ *< 6 months since starting outpatient hemodialysis.*

Exclusion Criteria:

- If the reverse happens, our patient was transferred to another facility we do not count him/her in our denominator unless he/she received in-center hemodialysis at our location on the first two working days of the month.
- Non-hemodialysis (peritoneal dialysis) patients and inpatients are excluded.

Surveillance Methodology

- Active
- Patient based
- Prospective
- Priority-directed targeted
- Yield risk-adjusted incidence rates
  - ✓ Rates are controlled for variations in the distribution of major risk factors associated with an event's occurrence (e.g. type of event and type of access)
  - ✓ Such rates allow inter- and intra-facility rate comparisons

Date of Event (DOE):

It is the date when the FIRST element used to meet the DE criterion occurs

Event Type	Date of Event Criterion
IV antimicrobial start	Date of first outpatient dose of an antimicrobial course
Positive blood culture	Date of specimen collection
Pus, redness, or increased swelling at the vascular access site	Date of onset of symptoms
Combination	Earliest date of the three types

21-Days Rule:

- An event reporting rule which reduces reporting of events that are likely to be related to the same patient problem.
- The rule is that 21 or more days must exist between two dialysis events of the *same* type for the second occurrence to be reported as a separate dialysis event.
- If fewer than 21 days have passed since the last reported event of the same type, the subsequent event of the same type is NOT considered a new dialysis event and therefore, it is not reported.
- The 21-day rule applies across calendar months. Refer to each event definition for instructions on applying the 21-day by event type.

Dialysis Events Combination
(Multiple Dialysis Events)

- Events can occur separately (unrelated to the same problem of the patient), or combined (more than one type of event related to each other).
- Events are related if they occur because of the same problem (assumingly same infection episode), for example, a patient developed a fever during a Dialysis session, for that reason blood culture was taken, and for that reason, an IV antimicrobial was started.
- Determining if events should be reported together can be subjective, ICPs Should use their judgment to reduce subjectivity (e.g., Nephrologist or treating doctor consultation might be needed)

Purpose:

- Improves clinical usefulness and interpretability of surveillance data.
- It helps in studying the frequency of some combinations of events (e.g., No of DDIV antibiotics based on Blood culture results versus IV antibiotics without Blood culture results).

Example: Dialysis Center A has reported 1 DE forms for patient X as follows

Patient X has the following scenario:

- On July 4: Patient X has pus, redness, and swelling on her graft, which is suspicious of infection, oral antibiotic is prescribed
- On July 6: Redness and swelling are still present; the patient is febrile, and blood culture samples were collected. IV vancomycin is started
- On July 10: Blood culture results positive for staphylococcus aureus.

Explanation:

Multiple dialysis events occurred together, as a part of the same patient problem, Redness and swelling were the reason Blood cultures were collected and also the reason IV antimicrobial started

There is a combination of events (PRS, PBC, IV AMS) for patient X:

Date of PRS onset: July 4, date of PBC: July 6, date of IVAM start July 6

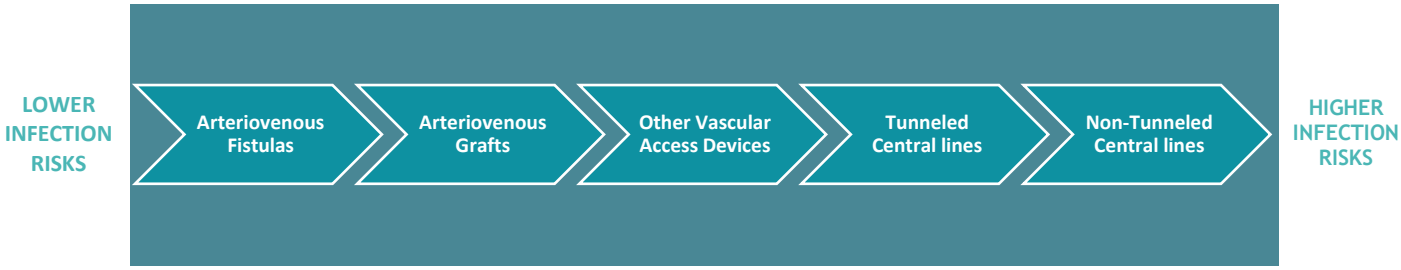
All the above-mentioned events should be registered in the same DE form, the DOE will be July 4 because it is the earliest date.

Facility	Month	Overall DEs Per DE forms	Total Number of PBC	Total Number of PRS	Total Number of IV AMs
HD Center A	July	1	1	1	1

All Vascular Access:

Consider all vascular accesses for hemodialysis and all central venous catheters that are present at the time of the event in Dialysis Event reporting, even if they are not used for dialysis and even if they are abandoned/ non-functional. Do not include peritoneal dialysis catheters in vascular access type reporting.

Hemodialysis vascular access types, in order of increasing risk of infection, include:



1: Non-Tunneled Central Line:

a central venous catheter that is fixed in place at the point of insertion and travels directly from the skin entry site to a vein and terminates close to the heart or one of the great vessels, typically intended for short term use (e.g., triple lumen catheters or temporary dialysis catheter).

2: Tunneled Central Line:

Central venous catheter that travels a distance under the skin from the point of insertion before entering a vein, and terminates at or close to the heart or one of the great vessels (e.g., Hickman® or Broviac® catheters)

3: Arteriovenous Graft:

Surgically created connection between an artery and a vein using implanted material (typically synthetic tubing) to provide a permanent vascular access for hemodialysis.

4: Arteriovenous Fistula:

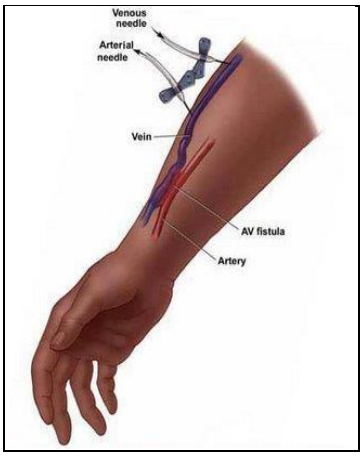
a surgically created direct connection between an artery and a vein to provide a permanent vascular access for hemodialysis. Buttonhole: a cannulation technique where a blunt needle (cannula) is inserted into the fistula at the same location each time using an established track. Report the way in which a patient is primarily cannulated.

Other Vascular Access Device:

includes catheter-graft hybrid vascular access devices, ports, and any other vascular access devices that do not meet the above definitions. Do not use this field to report vascular accesses that are grafts, central venous catheters or fistulas. Do not use this field to report peritoneal dialysis catheters.

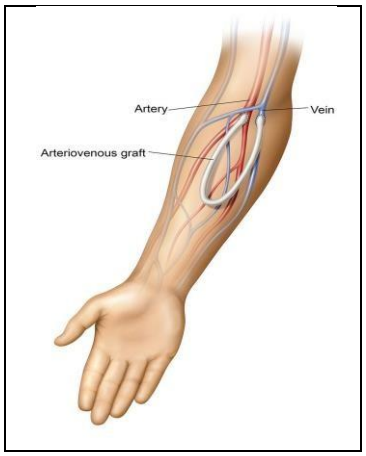
1: Catheter-Graft Hybrid:

Subcutaneous surgical implant with both a catheter and a graft component that provides blood flow directly from the target artery to the heart, bypassing the patient's central venous system (e.g., HeRo vascular access device).



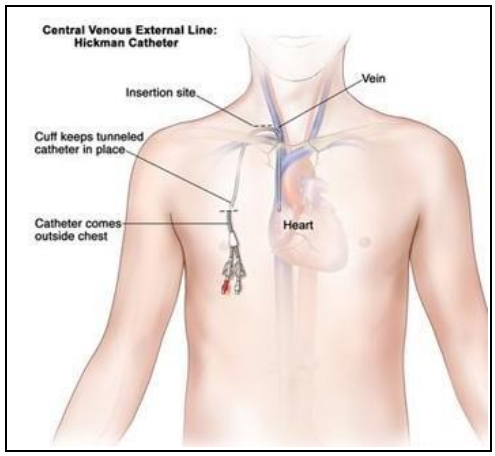
Arterio-venous fistula

A surgically created direct connection between an artery and a vein to provide vascular access



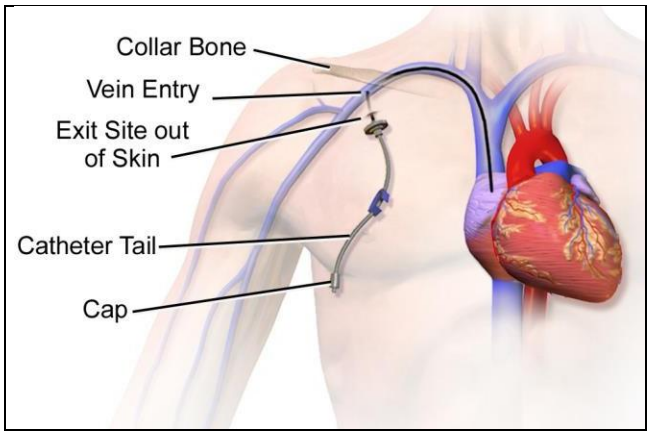
Arterio-venous graft

A surgically created connection between an artery and a vein using implanted synthetic tubing for the purpose to provide a permanent vascular access



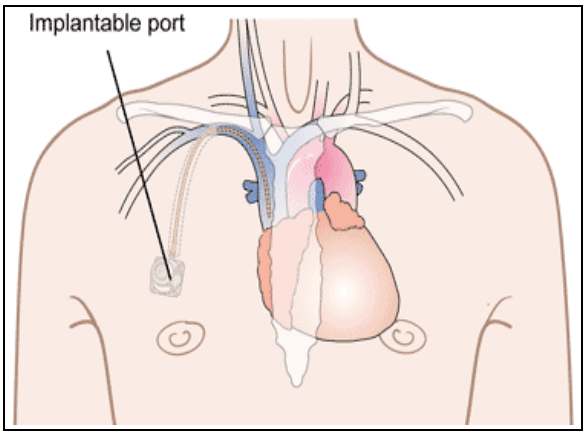
Permanent central line

A central venous catheter that travels a distance under the skin from the point of insertion before terminating at or close to the heart or one of the great vessels (e.g., Hickman® or Broviac® catheters).



Temporary central line

A central venous catheter that travels directly from the skin entry site to a vein and terminates close to the heart or one of the great vessels, typically intended for short term use.



Port access device

A fully implantable access device e.g., Life site

Type of Dialysis Events

I: IV Antimicrobial Start:

- Report all starts of intravenous (IV) antibiotics or antifungals administered in an outpatient setting, regardless of the reason for administration (i.e., include IV antimicrobial starts unrelated to vascular access problems) and regardless of the duration of treatment.
- A start is defined as a single outpatient dose or first outpatient dose of a course.
- Report outpatient starts that are continuations of inpatient treatment or another outpatient dialysis facility.
- Do not report IV antiviral starts.
- There must be 21 or more days from the end of the first IV antimicrobial start to the beginning of a second IV antimicrobial start for two starts to be considered separate dialysis events, even if different antimicrobials are used.
- If IV antimicrobials are stopped for less than 21 days and then restarted, the second start is NOT considered a new dialysis event.
- To apply the 21-day rule to outpatient IV antimicrobial starts that are continuations of inpatient treatment, consider the start day to be the first day of outpatient treatment.
- Inter-facility patient transfers: If a patient at a dialysis facility has an IV antimicrobial start and then transfers to another facility (as a transient or permanent patient) where the antimicrobial is continued, the second facility would report the IV antimicrobial start in their facility as well.

21-Day Rule:

- There must be 21 or more days from the **end** of one reported IV antimicrobial course to the **beginning** of a second IV antimicrobial start for two starts to be reported as separate dialysis events, even if different antimicrobials are used.
- If IV antimicrobials are stopped for fewer than 21 days and then restarted, the second start is NOT considered a new dialysis event and therefore, is not reported.

II: Positive Blood Culture:

- Report all positive blood cultures collected as an outpatient or collected within the first 2 calendar days after a hospital admission, regardless of whether or not a true infection is suspected, infection is thought to be related to hemodialysis, or treatment is received.
- The date of a blood culture result is based on the date the blood specimen was collected, not the date the laboratory reported the result.
- There must be 21 or more days between positive blood cultures for each positive blood culture to be considered a separate dialysis event, even if organisms are different.
- If positive blood cultures occur less than 21 days apart, the second positive blood culture(s) is NOT considered a new dialysis event: add new organisms from these subsequent positive blood cultures to the first report.

21-Day Rule:

- There must be 21 or more days between positive blood cultures for each positive blood culture to be considered a separate dialysis event, even if organisms are different.
- If two positive blood cultures (the first of which is reported) occur less than 21 days apart, the second positive blood culture is NOT considered a new dialysis event and therefore, is not reported.
- If different organisms grow from the subsequent positive blood cultures, add the new organisms to the first reported event.

Suspected Source of the Positive Blood Culture:

- **Vascular Access:**
  - ✓ If there is objective evidence of vascular access infection and the vascular access is thought to be the source of the positive blood culture.

- **A source other than the vascular access:**
  - ✓ If either (a) or (b) is true:
  - ✓ a) a culture from another site (e.g., infected leg wound, urine) shows the same organism found in the blood and the site is thought to be the source of the positive blood culture.
  - ✓ b) there is clinical evidence of infection at another site which is thought to be the source of the positive blood culture, but the site was not sampled for culture.

- **Contamination:**
  - ✓ If the organism isolated from the blood culture is thought by the physician, infection preventionist, or head nurse to be a contaminant.
  - ✓ Contamination is more likely if the organism is a common commensal and is isolated from only one blood culture.

Uncertain:

- ✓ Only if there is insufficient evidence to decide among the three previous suspected source categories.

III: Pus, Redness, or Increased Swelling at the Vascular Access Site:

- Report each new outpatient episode where the patient has one or more symptoms of pus, greater than expected redness or greater than expected swelling at a vascular access site, regardless of whether the patient received treatment.
- There must be 21 or more days between the onset of a first episode and onset of
- a second episode of pus, redness, or increased swelling at a vascular access site to be considered separate dialysis events.
- If an episode of pus, redness, or increased swelling at a vascular access site
- resolves and then recurs within 21 days, the recurrence is NOT considered a new dialysis event.

21-day Rule:

- There must be 21 or more days between the **onset** of one episode and the **onset** of a second episode of pus, redness, or increased swelling at a vascular access site to be considered separate dialysis events.
- If a reported episode of pus, redness, or increased swelling at a vascular access site resolves and then recurs within 21 days of the first onset, the recurrence is NOT considered a new dialysis event and therefore, is not reported.

Multiple Dialysis Events:

If multiple dialysis events occur together, for a single patient, the events should be reported on the same *Dialysis Event* form. For example, if a patient has a positive blood culture and begins IV antimicrobials, these two events are recorded together on one form. When reporting multiple dialysis events together, the “date of event” is always the date that the first event occurred. Do not report unrelated dialysis events on the same form. Events are considered related if fewer than 21 days have passed since the last reported event of the same type. Refer to an explanation of the “21-day rule”.

Calculated Dialysis Events

- **Bloodstream infection (BSI):**
  - ✓ Any positive blood culture.

- **Access-related bloodstream infection (ARBSI):**
  - ✓ Positive blood culture with the suspected source identified as the vascular access site or uncertain.

- **Local access site infection (LASI):**
  - ✓ Pus, redness, or swelling of the vascular access site and bloodstream infection is not present.

- **Vascular access infection (VAI):**
  - ✓ Either a local access site infection (LASI) or an access-related bloodstream infection (ARBSI).

Numerator Data:

- Complete a Dialysis Event form only if a maintenance hemodialysis outpatient has one or more of the following:
  - ✓ *IV antimicrobial start*
  - ✓ *Positive blood culture*
  - ✓ *Pus, redness or increased swelling at the vascular access site*

- If a patient has a positive blood culture and begins IV antimicrobials, these two events would be recorded together on one form.

When reporting multiple dialysis events together, always use the date from the first event that occurred.

- Refer to dialysis event definitions for the 21-day rule.
- Do not report unrelated dialysis events on the same form.

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DENOMINATOR DATA COLLECTION FORM
(Outpatient Dialysis Units)

Denominator Form for Outpatient Dialysis Units				
Vascular Access Type (in increasing risk)		*Number of Chronic Hemodialysis Patients		
		DAY 1	DAY 2	Total
1	***Arterio-Venous Fistulas**: created from the patient's own blood vessels*			
2	***Arterio-Venous Graft**: constructed from synthetic materials*			
3	***Permanent Central Line**: tunneled cuffed catheters*			
4	***Temporary Central Line**: non-tunneled non-cuffed catheter*			
5	***Port Access Device**: a fully implantable access device e.g. Life site*			
Total Patients: Sum of all Patients listed above				

- *Record the number of chronic hemodialysis patients with each of the above 5 access types (individually and total) who received hemodialysis at your center on the first two working days of the month.*
- *Count each patient only once.*
- *Only chronic hemodialysis outpatients are included, including transient patients.*
- *A patient must be physically present for in-center hemodialysis on one of these two days to be counted on this form (exclude patients who are hospitalized).*
- *Exclude also non-hemodialysis patients and inpatients.*
- *If the patient has multiple vascular accesses (even if not all used), record that *patient once, reporting only their vascular access with the highest risk of infection.*
- *Therefore, if a patient has both an implanted access (graft or fistula) and a catheter, count this patient as having the catheter.*
- *If there are no patients in a given vascular access category, enter 0.*
- *Accurate data is strictly required in order to produce reliable rates.*

Analysis of DE

Measure	Calculation	Application
DE Rates*	The number of DEs (separately or total) / The number of patients - months	Location specific measure
DE SIR	The number of observed DEs / The number of predicted DEs	Both location specific and summarized measure

SIR, standardized infection ratio

***This formula can be used to calculate the rate of dialysis events as follows:**

- DE rates could be calculated by overall DE rates.
- DE rates should be calculated by type of DE events:
  - ✓ In-unit IV antimicrobial start
  - ✓ Positive blood culture
  - ✓ Local infection signs
- DE rates should be stratified by access type:
  - ✓ Catheter (temporary and permanent)
  - ✓ AVF
  - ✓ AVG
- Additional measurements:
  - ✓ Access-Related Bloodstream Infection Rate
  - ✓ Vascular Access Infection Rate

DE SIR can be presented for single locations and can be summarized across multiple locations, adjusting for differences in the incidence of infection or device utilization (respectively) between different location types.

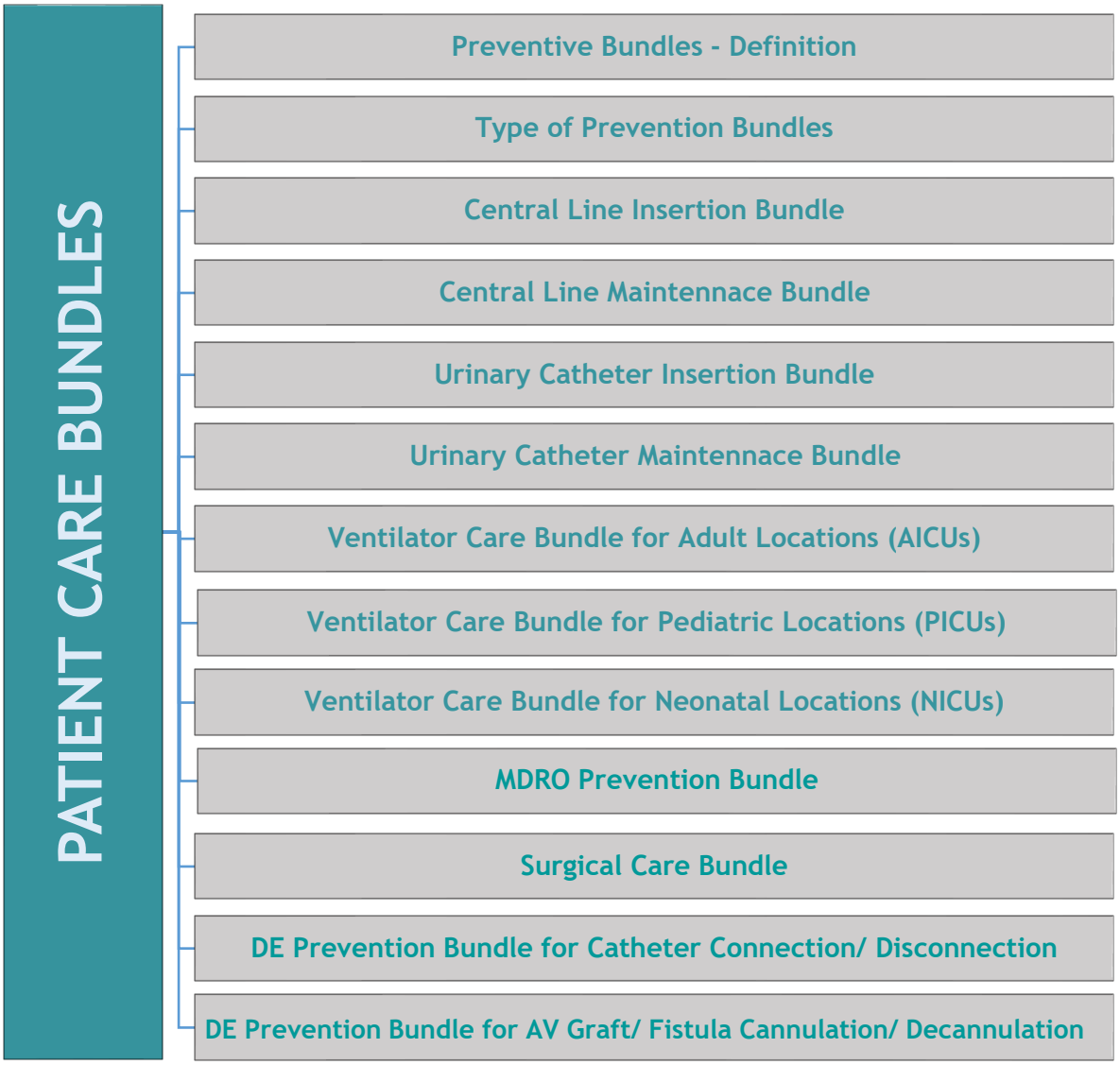
DE SIR can be additionally summarized across different accesses, adjusting for differences in the incidence of infection between different accesses.

CHAPTER - III

Patient's Care Bundles for Prevention of HAIs & MDROs

- Central Line Care Bundle
- Ventilator Care Bundle
- Urinary Catheter Care Bundle
- Surgcial Care Bundle
- MDRO Prevention Bundle
- Dialysis Events Prevention Bundle

PATIENT'S CARE BUNDLES FOR PREVENTION OF HAIs & MDROs



CHAPTER - III

Patient's Care Bundles for Prevention of HAIs & MDROs

Preventive Bundle:

- A bundle is a structured way of improving the processes of care and patient outcomes
- It is a small, straightforward set of evidence-based practices, generally three to five that, when performed collectively and reliably, have been proven to improve patient outcomes.

Type of Preventive Bundles:

- *Central Line Insertion Bundle*
- *Central Line Maintenance Bundle*
- *Adult Ventilator Bundle*
- *Pediatric Ventilator Bundle*
- *Neonatal Ventilator Bundle*
- *Urinary Catheter Insertion Bundle*
- *Urinary Catheter Maintenance Bundle*
- *MDRO Prevention Bundle*
- *Surgical Care Bundle*
- *Dialysis Events Prevention Bundle*

NOTE: ***The consistent application of evidence-based patient care bundles/Prevention Process Measures is essential for the prevention of healthcare-associated infections (HAIs) and multidrug-resistant organisms (MDROs). These bundles should be implemented for every patient receiving care, regardless of whether they are included in the facility's surveillance system or not.***

Central Line Insertion Bundle

It is a group of evidence-based interventions for patients with intravascular central catheters that, when implemented together, result in better outcomes (reduce CLABSI) than when implemented individually.

Objective:

- To reduce the risk of developing CLABSI.

Setting:

- Inpatient areas (including long term care) where patients with one or more central lines are hospitalized.
- However, the central line bundle was designed to apply in ICUs only (where temporary central line is common).

Sampling:

- Sampling is allowed at the level of days but not the patients.
- Therefore, review all patients in a specific unit with central line for one or two days a week.

Components of Central Line Insertion Bundle:

1- Hand Hygiene
2- Maximal Barrier Precautions
3- Chlorhexidine Skin Antisepsis
4- Optimal catheter site selection, with Subclavian Vein as the preferred site for non-tunneled catheters
5- Ultrasound Guidance to place Central Venous Catheters (CVCs)

1. Hand Hygiene:

Washing hands or using an alcohol-based waterless hand sanitizer helps prevent contamination of central line sites and resultant bloodstream infections. When caring for central lines, indications for hand hygiene include:

- *Before and after palpating catheter insertion sites (Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained).*
- *Before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter.*
- *When hands are visibly soiled or if contamination is suspected.*
- *Before and after any invasive procedures are done.*
- *In between the patient.*
- *Before donning and after removing gloves.*

2. Maximal Barrier Precautions:

A key change to decrease the likelihood of central line infections is to apply maximal barrier precautions in preparation for line insertion.

For the operator placing the central line and for those assisting in the procedure, maximal barrier precautions mean strict compliance with hand hygiene and wearing a cap, mask, sterile gown, and sterile gloves. The cap should cover all hair and the mask should cover the nose and mouth tightly. These precautions are the same as for any other surgical procedure that carries a risk of infection.

For the patient, applying maximal barrier precautions means covering the patient from head to toe with a sterile drape, with a small opening for the site of insertion.

3. Chlorhexidine Skin Antisepsis:

Chlorhexidine skin antisepsis has been proven to provide better skin antisepsis than other antiseptic agents such as povidone-iodine solutions.

The technique, for most kits, is as follows:

- *Prepare skin with antiseptic - chlorhexidine 2% in 70% isopropyl alcohol.*
- *Pinch wings on the chlorhexidine applicator to break open the ampule (when ampule is included). Hold the applicator down to allow the solution to saturate the pad.*
- *Press sponge against skin, and apply chlorhexidine solution using a back-and- forth friction scrub for at least 30 seconds. Do not wipe or blot.*
- *Allow antiseptic solution time to dry completely before puncturing the site (~ 2 minutes).*

Type of antiseptic solution:

***Adults and pediatrics**: Use 2% chlorhexidine gluconate in 70% alcohol for skin antisepsis before central venous catheter (CVC) insertion.*

***Neonate**:*

- *For infants ≥8 weeks of age: use 2% chlorhexidine gluconate (CHG) in 70% alcohol.*
- *For infants <8 weeks of age: clinical experience has demonstrated that a CHG-containing product can be used safely, but with care.*
- *For infants born at <28 weeks' gestation, especially when ≤7 days of age: NICUs may consider use of aqueous 2% CHG for skin antisepsis.*

Note:** **Skin maturation should be assessed by the treating physician before chlorhexidine use.

4. Optimal Catheter Site Selection, with avoidance of Using the Femoral Vein for Central Venous Access in Adult Patients:

- Several non-randomized studies show that the subclavian vein site is associated with a lower risk of CLABSI than the internal jugular vein.

- The femoral site is associated with greater risk of infection in adults; specially in overweight adult patients.
- The bundle requirement for optimal site selection suggests that other factors (e.g., the potential for mechanical complications, the risk of subclavian vein stenosis, and catheter-operator skill) should be considered when deciding where to place the catheter.
- In these instances, teams are considered compliant with the bundle element as long as they use a rationale construct to choose the site.
- The physician must determine the risks and benefits of using any vein.
- Absolute contraindications to subclavian approach.
  - Trauma to the ipsilateral clavicle, anterior proximal rib, or subclavian vessels
  - Anticoagulation therapy or bleeding disorder (Inability to do direct pressure to stop bleeding)
  - Distorted local anatomy (e.g., vascular injury, prior surgery, radiation history)
  - Infection at insertion site
  - Inexperienced operator
  - Uncooperative patient
  - Patients with higher risks for pneumothorax or inability to tolerate pneumothorax

5. Ultrasound Guidance to Place Central Venous Catheters:

- High-quality evidence suggested that the use of ultrasound guidance to place central venous catheters can reduce the number of cannulation attempts and mechanical complications.
- Ultrasound guidance should only be implemented when the ultrasound devices are

available and the staff are fully trained in its technique.

Steps of Performing Ultrasound-Guided Central Venous Catheter Placement:

1. **Identify anatomy of the insertion site and localization of the vein.**
   - Identify vein, artery, anatomic structures.
   - Check for anatomic variations.
   - Use short axis (transverse; A) and long axis (longitudinal; B) view.
   - Perform this step before prepping and draping of the puncture site.
2. **Confirm Patency of the vein.**
   - Use compression ultrasound to exclude venous thrombosis.
   - Use color Doppler imaging and Doppler flow measurements to confirm the patency of the vein and to quantify blood flow.
3. **Use real-time US guidance for puncture of the vein.**
   - Use an aseptic approach.
   - Use a short axis/out-of-plane (A) or a long axis/in-plane (B) approach.
   - Try to constantly identify the tip of the needle during the needle approach to the vein and puncture of the vein.
4. **Confirm needle position in the vein.**
   - Confirm that the needle tip is placed centrally in the vein before approaching the guide wire.
5. **Confirm wire position in the vein.**
   - Confirm the correct position of the guide wire in a short axis (A) and a long axis (B) view.
6. **Confirm catheter position in the vein.**
   - Confirm the correct position of the central venous catheter in the vein in a short axis (A) and a long axis (B) view.

Central Line Maintenance Bundle

It is a group of evidence-based interventions for patients with intravascular central catheters that, when implemented together, result in better outcomes (reduce CLABSI) than when implemented individually.

Objective:

- To reduce the risk of developing CLABSI.

Setting:

- Inpatient areas (including long term care) where patients with one or more central lines are hospitalized.
- However, the central line bundle was designed to apply in ICUs only (where temporary central line is common).

Sampling:

- Sampling is allowed at the level of days but not for the patients.
- Therefore, review all patients in a specific unit with central line for one or two days a week.

Components of Central Line Maintenance Bundle:

1. Hand Hygiene and Aseptic Technique:

- Hand hygiene before catheter access/manipulation.
- Scrub the access port with an appropriate antiseptic (chlorhexidine, povidone iodine, or 70% alcohol) and access the port only with sterile devices.
- Bathe ICU patients >2 months of age with a chlorhexidine preparation on a daily basis.

2. Daily Review / Assessment of Catheter Necessity: with prompt removal of unnecessary lines.

3. Proper Dressing Choice:

- Use chlorhexidine-impregnated dressings only for adult patients with short term non-tunneled catheters.
- Use transparent semipermeable dressing.
- Use gauze only if the site is bleeding or oozing or the patient is diaphoretic.

4. Proper Frequency of Dressing Change:

- Replace transparent dressing every 7 days *(except in those **pediatric patients** in which the risk for dislodging the catheter may outweigh the benefit of changing the dressing).*
- Replace gauze dressing every 2 days (48 hours).
- Replace immediately any dressing that becomes damp, loosened, or visibly soiled.
- CVC dressings in **neonates** should be changed only if soiled, damp, or loose, regardless of gestational age in order to reduce risk of dislodgement of CVC & skin barrier breakdown.
- The integrity of CVC dressing should be assessed by designated healthcare personnel at least daily.

5. Proper Replacement of Administrative Sets:

- In patients not receiving blood, blood products or fat emulsions, replace administration sets that are continuously used, including secondary sets and add-on devices no more frequently than every **4 days (96 hours)**, but at least every **7 days.**
- If blood or blood products or fat emulsions are administered, change tubing within **24 hours** of initiating the infusion.
- If propofol is administered, replace tubing used to administer propofol infusions every **6 or 12 hours** or when the vial is changed.

Central Line Bundle Data Analysis

Central Line Bundle Compliance

Central Line Insertion Bundle compliance Rate =	Total number of patients with all compliant applicable bundle components ---------- X100 Total number of patients reviewed for the bundle compliance

Central line Maintenance Bundle compliance Rate =	Total number of patients with all compliant applicable bundle components ---------- X 100 Total number of patients reviewed for the bundle compliance

Central Line Insertion Bundle Form

Adult ICUs (AICUs)

A: PATIENT'S INFORMATION								
Patient Name:			MRN:					
Age:	Gender:		Unit:			Bed No:		
Date of Admission:			Diagnosis:					
Central Line Insertion Date:								
Type of Central Line Catheter			CVC ☐		PICC ☐		Others: ☐	
Central Line Catheter Insertion Site			Subclavian ☐		Internal Jugular ☐		Femoral ☐	Others ☐

Central Line Insertion Bundle			
1:	***Hand Hygiene***	*Perform hand hygiene as per indication*	Yes ☐ No ☐
2:	***Maximal Barrier Precautions***	**a. For the operator:** *Cap, Mask, Sterile Gown, and Sterile Gloves*	Yes ☐ No ☐
		b. For the patient: *Covering the patient from head to toe with a sterile drape, with a small opening for the site of insertion.*	Yes ☐ No ☐
3:	***Chlorhexidine Skin Antisepsis***	**2% chlorhexidine in 70% alcohol** *for adults Populations.*	Yes ☐ No ☐
4:	***Optimal Catheter Site Selection, with subclavian vein as the preferred site for non-tunneled Catheters***	*Femoral site is associated with greater risks in adults.*	Yes ☐ No ☐ N/A ☐
5:	***Ultrasound Guidance to place central venous catheters***	*Reduces the number of cannulation attempts and mechanical complications. Ultrasound guidance should only be used by those fully trained in its technique.*	Yes ☐ No ☐ N/A ☐

Central Line Maintenance Bundle Form

Adult ICUs (AICUs)

Central Line Maintenance Bundle					
Date	Hand Hygiene & Aseptic Technique	Daily assessment of catheter necessity with prompt removal of unnecessary lines	Proper Dressing Choice [a,b]	Proper Frequency of Dressing change [c]	Proper replacement of administrative sets [d,e]
1	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
2	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
3	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
4	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
5	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
6	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
7	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
8	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
9	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
10	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
11	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
12	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
13	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
14	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
15	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
16	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
17	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
18	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
19	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
20	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
21	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
22	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
23	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
24	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
25	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
26	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
27	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
28	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
29	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
30	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
31	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐

a) *Use chlorhexidine-impregnated dressings for adult patients with short term non-tunneled catheters or use transparent semipermeable dressing as alternate if CHG is not available or contraindicated.*

b) *Use gauze **only** if the site is bleeding or oozing or the patient is diaphoretic.*

c) *Replace transparent dressing every **7 days**; Replace gauze dressing every **2 days (48 hours)**; Replace immediately any dressing that is soiled, dampened, or loosened.*

d) *Unless used for blood, blood products or fat emulsions, replace administration sets including secondary sets and add- on devices no more frequently than every **4 days (96 Hours)**, but at least every **7 days**.*

e) *If blood or blood products or fat emulsions are administered, change tubing within **24 hours** of initiating the infusion.*

Central Line Insertion Bundle Form

Pediatric ICUs (PICUs)

A: PATIENT'S INFORMATION					
Patient Name:		MRN:			
Age:	Gender:	Unit:		Bed No:	
Date of Admission:		Diagnosis:			
Central Line Insertion Date:					
Type of Central Line Catheter	CVC ☐	PICC ☐	Others: ☐		
Central Line Catheter Insertion Site	Subclavian ☐	Internal Jugular ☐	Femoral ☐	Others ☐	

Central Line Insertion Bundle			
1:	***Hand Hygiene***	*Perform hand hygiene per indication*	Yes ☐ No ☐
2:	***Maximal Barrier Precautions***	**a. For the operator:** *Cap, Mask, Sterile Gown, and Sterile Gloves*	Yes ☐ No ☐
		b. For the patient: *Covering the patient from head to toe with a sterile drape, with a small opening for the site of insertion.*	Yes ☐ No ☐
3:	***Chlorhexidine Skin Antisepsis***	**2% chlorhexidine in 70% alcohol** *for pediatric Populations.*	Yes ☐ No ☐
4:	***Optimal Catheter Site Selection*** *Site should be chosen based on risk of infection, risk of mechanical complications, Patient-specific factors (age, size, vein accessibility) etc.*	***Internal jugular - subclavian - femoral*** *Consider infection and mechanical risk balance i.e. weigh the risks and benefits of placing a central venous device at a recommended site to reduce infectious complications against the risk for mechanical complications (e.g., pneumothorax, subclavian artery puncture etc.*	Yes ☐ No ☐ N/A ☐
5:	***Ultrasound Guidance to place central venous catheters***	*Reduces the number of cannulation attempts and mechanical complications. Ultrasound guidance should only be used by those fully trained in its technique.*	Yes ☐ No ☐ N/A ☐

Central Line Maintenance Bundle Form

Pediatric ICUs (PICUs)

Central Line Maintenance Bundle					
Date	Hand Hygiene & Aseptic Technique	Daily assessment of catheter necessity with prompt removal of unnecessary lines	Proper Dressing Choice [a,b]	Proper Frequency of Dressing change[c,d]	Proper replacement of administrative sets[e,f]
1	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
2	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
3	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
4	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
5	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
6	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
7	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
8	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
9	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
10	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
11	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
12	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
13	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
14	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
15	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
16	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
17	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
18	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
19	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
20	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
21	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
22	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
23	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
24	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
25	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
26	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
27	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
28	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
29	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
30	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
31	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐

a) *Use transparent semipermeable dressing for pediatric CVCs.*

b) *Use gauze dressing* ***only*** *if the site is bleeding or oozing or the patient is diaphoretic.*

c) *Replace transparent dressing every* ***7 days****; Replace gauze dressing every* ***2 days (48 hours)****; (exception are those pediatric patients in which the risk for dislodging the catheter may outweigh the benefit of changing the dressing).*

d) *Replace immediately any dressing that is soiled, dampened, or loosened.*

e) *Unless used for blood, blood products or fat emulsions, replace administration sets including secondary sets and add- on devices no more frequently than every* ***4 days (96 Hours)****, but at least every* ***7 days****.*

f) *If blood or blood products or fat emulsions are administered, change tubing within* ***24 hours*** *of initiating the infusion.*

Central Line Insertion Bundle Form

Neonatal ICUs (NICUs)

A: PATIENT'S INFORMATION					
Patient Name:		MRN:		Bed No:	
Age:	Gender:	Diagnosis:			
Date of Admission:		Central Line Insertion Date:			
Type of Central Line:		PICC ☐	UVC ☐	UAC ☐	Others ☐
Birth Weight (gm)	< 750 ☐	751-1000 ☐	1001-1500 ☐	> 2500 ☐	

Central Line Insertion Bundle			
1:	***Hand Hygiene***	*Perform hand hygiene per indication*	Yes ☐ No ☐
2:	***Maximal Barrier Precautions***	**a. For the operator:** *Cap, Mask, Sterile Gown, and Sterile Gloves*	Yes ☐ No ☐
		b. For the patient: *Covering the patient from head to toe with a sterile drape, with a small opening for the site of insertion.*	Yes ☐ No ☐
3:	***Chlorhexidine Skin Antisepsis*** *(Gestational age, chronologic age, and skin maturity should be considered when assessing the risks and benefits of chlorhexidine containing agents in determining eligible patients)*	***a.* 2% chlorhexidine in 70% alcohol** *for Neonates ≥8 weeks of age*	Yes ☐ No ☐ N/A ☐
		***b.* CHG-containing product** *can be used safely, but with care for neonates <8 weeks of age*	
		c.* 2% aqueous chlorhexidine** ***for *infants born at <28 weeks' gestation, especially when ≤7 days of age*	
4:	***Optimal Catheter Site Selection*** *Use the most appropriate site as per clinical indication. Weigh the risk and benefits of placing the catheter at a recommended site to reduce infectious complications against the risk of mechanical complications.*	– **Umbilical Venous Catheter (UVC)** – **Peripherally Inserted Central Catheter (PICC)** *Use UVCs for short durations in neonates. For longer-term access, PICCs are preferred.*	Yes ☐ No ☐ N/A ☐
5:	***Ultrasound Guidance to place central venous catheters***	*Reduces the number of cannulation attempts and mechanical complications. Ultrasound guidance should only be used by those fully trained in its technique.*	Yes ☐ No ☐ N/A ☐

Central Line Maintenance Bundle Form

Neonatal ICUs (NICUs)

Central Line Maintenance Bundle					
Date	Hand Hygiene & Aseptic Technique	Daily assessment of catheter necessity with prompt removal of unnecessary lines	Proper Dressing Choice [a,b]	Proper frequency of dressing change[c]	Proper replacement of administrative sets[d,e]
1	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
2	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
3	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
4	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
5	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
6	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
7	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
8	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
9	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
10	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
11	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
12	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
13	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
14	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
15	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
16	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
17	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
18	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
19	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
20	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
21	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
22	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
23	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
24	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
25	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
26	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
27	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
28	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
29	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
30	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐
31	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐

a) *Use transparent semipermeable dressing. Use gauze dressing if skin integrity is a concern (e.g., prematurity, extreme low birth weight) or if the site is bleeding or oozing etc.*

b) *Chlorhexidine-impregnated dressings are **NOT** recommended to protect the site of short-term, non-tunneled central venous catheters for premature neonates < 2 months of age due to risk of serious adverse skin reactions.*

c) *CVC dressings in neonates should be changed **only** if soiled, damp, or loose, regardless of gestational age to protect fragile skin and avoid dislodgement of catheter.*

d) *Unless used for blood, blood products or fat emulsions, replace administration sets including secondary sets and add-on devices no more frequently than every **4 days (96 hours)**, but at least every **7 days**.*

e) *If blood or blood products or fat emulsions are administered, change tubing within **24 hours** of initiating the infusion.*

Adult Ventilator Bundle

Ventilator Bundle:

A ventilator bundle is a group of evidence-based interventions for adult patients with ventilators that, when implemented together, result in better outcomes (reduce VAE/ PVAP) than when implemented individually.

Objective:

- To reduce the risk of developing VAE/ PVAP

Setting:

- Inpatient areas (including long term care) where adult patients with ventilator are hospitalized.

Sampling:

- Sampling is allowed at the level of days but not the patients.
- Therefore, review all patients in a specific unit with ventilator for one or two days a week.

Components of Adult Ventilator Bundle:

1- Head of Bed Elevation (30-45 degrees)
2- Daily “sedation interruption” & daily assessment of readiness to extubate
3- Deep venous thrombosis (DVT) prophylaxis (unless contraindicated)
4- Early Mobility & Exercise
5- Daily Oral Hygiene Care

1. Head of Bed Elevation:

- Elevation of the head of the bed is an integral part of the ventilator bundle and has been correlated with a reduction in the rate of ventilator-associated pneumonia.
- The recommended elevation is 30-45 degrees. This help to:
  - *Reduce potential for aspiration*
  - *Potential to improve ventilation*
- However, elevation of the head of the bed issues and concerns
  - *It is uncomfortable for the patient*
  - *Causes the patient to slide down in bed*
  - *Potential for skin-shearing*

2. Daily Sedation Interruption and Daily Assessment of Readiness to Extubate:

- Using daily sedative interruptions and assessing the patient's readiness to extubate are an integral part of the ventilator bundle and have been correlated with reduction in the rate of ventilator-associated pneumonia.
- Include this intervention on the bundle form for initiation and weaning of mechanical ventilation, delivery of tube feedings, and provision of oral care.
- Seven distinct complications associated with mechanical ventilation and critical illness were identified:
  - *Ventilator-associated pneumonia*
  - *Upper gastrointestinal hemorrhage*
  - *Bacteremia*
  - *Barotrauma*
  - *Venous thromboembolic disease*
  - *Cholestasis*

- *Sinusitis requiring surgical intervention*

3. Deep Venous Thrombosis (DVT) Prophylaxis:

- Applying deep venous thrombosis prophylaxis is an appropriate intervention in all patients who are sedentary.

- The risk of venous thromboembolism is reduced if antithrombotic and thrombolytic therapy is recommended for the prophylaxis of patients undergoing surgery, trauma patients, acutely ill medical patients, and patients admitted to the intensive care unit.

- While it is unclear if there is any association between DVT prophylaxis and decreasing rates of PVAP, our experience is that PVAP rates decreased most dramatically in hospitals where all elements of the ventilator bundle were implemented, including this one. The intervention remains excellent practice in the general care of ventilated patients.

- Important considerations include that the risk of bleeding may increase if anticoagulants are used to accomplish prophylaxis.

- When prophylactic anticoagulation cannot be used because of high risk of bleeding, sequential compression devices may be used. Often, sequential compression devices are not applied reliably to patients when they go to or return from procedures negating their effectiveness.

4. Early Mobility and Exercise:

- Provide early exercise and mobilization as it may shorten the duration of mechanical ventilation, reduce ICU length of stay, lower VAE rates, and increase the rate of return to independent function.

5. Daily Oral Hygiene Care:

- Oral care for **ventilated patients** is a critical aspect of ICU care because these patients are at increased risk of **ventilator-associated pneumonia (VAP)** due to colonization of the oropharynx and dental plaque with pathogenic organisms.

- The oral cavity with poor hygiene is a reservoir of a complex community of commensal and pathogenic bacteria.

- Oral health quickly deteriorates in mechanically ventilated patients. Some patients sustain injuries to the oral mucosa during the intubation procedure, and after intubation, patients are prone to dry mouth. These factors, in addition to a severely compromised immune system, can cause an increase in bacteria colonization in the oral mucosa, with the endotracheal tube serving as a direct route to the lungs.

- Dental plaque develops in patients who are mechanically ventilated because of the lack of mechanical chewing and the absence of saliva, which minimizes the development of biofilm on the teeth.

- Dental plaque biofilms are colonized by respiratory pathogens in mechanically ventilated patients that can be a significant reservoir for potential respiratory pathogens that cause PVAP.

- Appropriate oral hygiene care can significantly reduce the incidence of PVAP & contributes to shorter hospital stays, reduced mortality rates, and overall better patient outcomes.

Key Components of Oral Hygiene Care in Intubated Patients:

- **Mechanical Cleaning (Tooth brushing):**

  Physically removes dental plaque and oral biofilm, reducing bacterial load. All mechanically ventilated patients should receive regular oral care, with a soft toothbrush being the preferred method for cleaning the oral mucosa. *Following is recommended as per best available evidence:*

  a) *Use **soft-bristled toothbrush** that helps prevents trauma to oral mucosa.*
  b) *Use **normal saline or sterile water** to moisten tooth brush during brushing.*
  c) ***Frequency**: Brush at least every 12 hours (twice daily) or more frequently as per unit protocols to remove plaque and debris. (including teeth, gums, tongue)*
  d) ***Moisturize** the oral Mucosa and lips every 2-4 hours in order to prevent drying, cracking which can increase the risk of infection.*
  e) ***Perform suctioning of oral secretions** during and after brushing to prevent pooling of secretions that can lead to aspiration.*

- **Use of Chlorhexidine Gluconate:**

  ***Routine chlorhexidine oral care for** all ventilated patients **is no longer strongly supported** by good-quality evidence for general ICU patients. Evidence on the effectiveness of oral hygiene care with **CHX** is inconclusive & inconsistent.*

- **Individualized Patient Care Approach:**

  a) *Oral hygiene care should be individualized based on clinical judgment/decision tailored according to patient needs.*
  b) *Adjust the **frequency and type of oral hygiene care** based on the patient's individual needs and risk factors.*
  c) *Evaluate **risks vs. benefits** of oral care solutions.*

Summary of Oral Hygiene Care in Ventilated Patients:

- *Proper oral hygiene care, including toothbrushing, can significantly reduce the risk of VAP, shorten the duration of mechanical ventilation, and decrease the length of stay in the ICU.[11]*
- *Regular toothbrushing with a soft toothbrush, combined with other oral hygiene practices and a comprehensive approach to patient care, is a vital strategy for preventing VAP in ventilated patients.*
- *Individualized patient care approach need to be adopted for oral hygiene care of ventilated patients based on clinical judgement.*

Adult Ventilator Bundle Form

A: PATIENT'S INFORMATION							
Patient Name:				MRN:			
Age:		Gender:		Unit:		Bed No:	
Date of Admission:				Diagnosis:			
Ventilator Insertion Date:				Place of Insertion:			

Adult Ventilator Bundle

Date	Head of Bed Elevation *(30-45 degrees)*	Daily "sedative interruption" & daily assessment of readiness to extubate	Early Mobility & exercise	Deep Venous Thrombosis (DVT) prophylaxis (Unless Contraindicated)	Daily Oral Hygiene Care
1	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
2	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
3	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
4	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
5	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
6	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
7	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
8	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
9	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
10	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
11	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
12	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
13	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
14	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
15	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
16	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
17	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
18	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
19	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
20	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
21	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
22	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
23	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
24	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
25	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
26	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
27	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
28	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
29	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
30	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
31	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐

Pediatric Ventilator Bundle

Ventilator Bundle:

Ventilator bundle is a group of evidence-based interventions for pediatric or neonatal patients with ventilator that, when implemented together, result in better outcomes (reduce PedVAE) than when implemented individually.

Objective:

- To reduce the risk of developing PedVAE.

Setting:

- Inpatient areas where pediatric (including long term care) or neonatal patients with ventilator are hospitalized.

Sampling:

- Sampling is allowed but at the level of days not the patients.
- Therefore, review all patients in a specific unit with ventilator for one or two days a week.

Components of Pediatric/Neonatal Ventilator Bundle:

1- Hand Hygiene.
2- Head of Bed Elevation
3- Daily Oral Hygiene Care and Suctioning.
4- Closed Ventilator Circuit Management.
5- Daily assessment of readiness to extubate.

1. Hand Hygiene:

- Hand hygiene before contact with the ventilator.

2. Head of Bed Elevation:

- Elevation of the head of the bed to keep the patient in semi-recumbent position is necessary to reduce the risk of aspiration of gastric content to the airway.
- The recommended elevation is 15-30 degrees for neonates and 30-45 degrees for infants or older children.

3. Daily Oral Hygiene Care and Suctioning:

Oral bacteria can colonize the endotracheal tube and lungs. Proper oral Hygiene care reduces the microbial load, decreasing the risk of aspiration pneumonia. In addition it maintains oral mucosal integrity and prevents secondary infections from mucosal injury.

Key components of oral hygiene care in pediatric & neonatal age groups include:

Pediatric patients:

- Use sterile water or normal saline swabs for oral hygiene care.
- Daily toothbrushing is recommended as an essential practice in ventilated pediatric patients in the updated SHEA/IDSA Compendium. Use soft pediatric toothbrushes (age-sized)
- Wipe the gums with a gauze pad after each feeding to remove plaque and residual formula that could harm erupting teeth.
- After oral hygiene, rinse and suction the mouth. Keep the oral mucosa and lips clean, moist, and intact using sponge-tipped applicators dipped in a non-alcohol, non-peroxide mouth rinse.

Neonatal patients:

- Maternal colostrum (if available) or sterile water.
- Maternal colostrum is preferred choice for mouthrinses due to its potential immune-boosting properties.

Individualized Patient Care Approach:

The frequency and specific interventions should be tailored to the individual patient's needs, taking into account their overall medical condition, risk factors for oral complications, and any specific orders from the medical team & their clinical judgment.

4. Closed Ventilator Circuit Management:

- **Limit the change of the ventilator circuit** only when visibly soiled or malfunctioning or per manufacturers' instructions.

- **Draining ventilator condensate away:**

– Keep the ventilator tubing clear of condensation.

– Drain ventilator condensate away every 4 hours and before repositioning.

– Ensure proper sterilization of reusable respiratory care equipment, using sterile water in humidification system, and periodic drainage of condensate from the breathing circuit, and hand hygiene before and after contact with respiratory equipment.

5. Daily Assessment of Readiness to Extubate:

– Daily assessment of readiness to extubate is recommended to minimize ventilator days.

– However, daily "sedative interruption" is not recommended in pediatric and neonatal patients due to the high risk of unplanned extubation.

Ventilator Bundle Data Analysis

Ventilator Bundle Compliance

(Adult Locations, PICUs & NICUs)

Ventilator bundle compliance Rate	Total number of patients compliant with all bundles components ----------X 100 Total number of patients reviewed for the bundle compliance

Pediatric Ventilator Bundle Form

Pediatric ICUs

A: PATIENT'S INFORMATION							
Patient Name:				MRN:			
Age:		Gender:		Unit:		Bed No:	
Date of Admission:				Diagnosis:			
Ventilator Insertion Date:				Place of Insertion:			

Pediatric Ventilator Bundle Form

Date	Hand Hygiene	Head of Bed Elevation *(30 - 45 degrees)*	Daily Oral Hygiene Care & Suctioning	Appropriate ventilator circuit care	Daily assessment of readiness to extubate
1	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
2	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
3	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
4	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
5	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
6	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
7	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
8	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
9	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
10	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
11	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
12	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
13	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
14	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
15	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
16	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
17	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
18	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
19	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
20	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
21	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
22	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
23	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
24	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
25	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
26	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
27	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
28	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
29	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
30	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
31	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐

Neonatal Ventilator Bundle Form

Neonatal ICUs

A: PATIENT'S INFORMATION							
Patient Name:				MRN:			
Age:		Gender:		Unit:		Bed No:	
Date of Admission:				Diagnosis:			
Ventilator Insertion Date:				Place of Insertion:			
Birth Weight (gm)	< 750 ☐	751-1000 ☐		1001-1500 ☐		> 2500 ☐	

Neonatal Ventilator Bundle Form

Date	Hand Hygiene	Head of Bed Elevation *(15-30 degrees)*	Daily Oral Hygiene Care & Suctioning	Appropriate ventilator circuit care	Daily assessment of readiness to extubate
1	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
2	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
3	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
4	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
5	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
6	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
7	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
8	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
9	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
10	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
11	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
12	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
13	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
14	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
15	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
16	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
17	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
18	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
19	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
20	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
21	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
22	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
23	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
24	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
25	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
26	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
27	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
28	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
29	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
30	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
31	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐

Urinary Catheter Bundle

Urinary Catheter Bundle:

Urinary catheter bundle is a group of evidence-based interventions for patients with urinary catheter that, when implemented together, result in better outcomes (reduce CAUTI) than when implemented individually.

Objective:

- To reduce the risk of developing CAUTI.

Setting:

- Inpatient areas (including long term care) where patients with urinary catheter are hospitalized.
- Implementation of these four components of urinary catheter bundle requires a multidisciplinary approach involving physicians, nurses, leaders, and experts in infection prevention and urological care.

Sampling:

- Sampling is allowed at the level of days but not the patients.
- Therefore, review all patients in a specific unit with urinary catheter for one or two days a week.

Components of Urinary Catheter Bundle:

1- Avoid unnecessary urinary catheters.

2- Insert catheter using aseptic technique.

3- Maintain catheters based on recommended guidelines (daily care).

4- Review catheter necessity daily and remove promptly.

1. Avoid Unnecessary Urinary Catheters:

- No invasive device should ever be used unless absolutely necessary, including urinary catheters.
- **Following are the indications for placement of urinary catheters:**
  - *Perioperative use for selected surgical procedures*
  - *Urine output monitoring in critically ill patients*
  - *Management of acute urinary retention and urinary obstruction*
  - *Assistance in pressure ulcer healing for incontinent patients*
  - *As an exception, at patient request to improve comfort (SHEA-IDSA) or for comfort during end-of-life care (CDC)*
- **Perioperative use for Selected Surgical Procedures:**
  - *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 post-anesthesia care unit)*
  - *Patients anticipated to receive large-volume infusions or diuretics during surgery*
  - *Need for intraoperative monitoring of urinary output.*
- **Alternatives to indwelling catheters include the following:**
  - *External condom catheters for male patients without urinary retention or bladder outlet obstruction have been shown to have lower risk of bacteriuria or symptomatic UTI. Such catheters are reported by patients to be more comfortable and limit mobility less than indwelling catheters.*
  - *Intermittent catheterization several times per day may have the same or lower risk of infection, yet provide the patient with greater mobility and ensure an indwelling catheter is not left in place longer than necessary.*
- Placement of catheters for convenience should be avoided at all times, and nursing personnel should be fully educated about all risks associated with catheters, including infections, decreased mobility, and urethral trauma. Patient preference and comfort is an important consideration.

2. Insert Urinary Catheters Using Aseptic Technique:

Make sure that the catheter is inserted only by trained personnel following aseptic technique. Note the following basic elements for insertion:

- Utilize appropriate hand hygiene practice, immediately before insertion of the catheter.
- Insert catheters using aseptic technique and sterile equipment, by using:

  - *Gloves, Drape, and sponges*
  - *Sterile or antiseptic solution for cleaning the urethral meatus*
  - *Single-use packet of sterile lubricant for insertion.*

- Use appropriate technique for catheter insertion
- Use as small a catheter as possible that is consistent with proper drainage, to minimize urethral trauma.
- A checklist may be a helpful tool for staff at the time of insertion and may also serve as a data collection tool to assess compliance.
- Education and training of staff are fundamental. Organizations should train and verify **competency** of all clinical staff (nurses, physicians, residents, etc.) who may insert urinary catheters.

3. Maintain Catheters Based on Recommended Guidelines:

- Appropriate hand hygiene practices are a basic standard of care and should be followed before and after any patient care activity. Standard precautions, including the use of gloves as appropriate, should be used during manipulation of the catheter site or apparatus. Catheter maintenance can be classified in two general categories: routine maintenance and practices that should be avoided.

- **Routine Maintenance includes:**

- *Maintain a sterile, continuously closed drainage system.*
- *Keep catheter properly secured to prevent movement and urethral traction.*
- *Keep collection bag below the level of the bladder at all times.*
- *Maintain unobstructed urine flow.*
- *Empty collection bag regularly, using a separate collecting container for each patient, and avoid allowing the draining spigot to touch the collecting container.*
- *Routine hygiene (e.g., cleansing of the meatal surface during daily bathing) is appropriate. Do not clean the periurethral area with antiseptics to prevent CAUTI while the catheter is in place.*
- *Collection of urine samples should be done by aspirating urine from the needleless sampling port with a sterile syringe/cannula.*

- Some practices actually increase the risk of infection or other complications and should be avoided:

- *Irrigating catheters, except in cases of catheter obstruction;*
- *Disconnecting the catheter from the drainage tubing;*
- *Replacing catheters routinely (in the absence of obstruction or infection); and*
- *Use aseptic technique to replace the collection system.*

- Educating all staff and physicians about practices that should occur routinely and those that should be avoided is a fundamental first step.

4. Review Urinary Catheter Necessity Daily and Remove Promptly:

- "The duration of catheterization is the most important risk factor for development of infection."

- If use of an indwelling catheter is necessary, the most important strategy is removing the catheter as soon as possible.

- Daily review of catheter necessity should be conducted for all patients with urinary catheters.

Urinary Catheter Bundle Data Analysis

Urinary Catheter Bundle Compliance

Urinary Catheter Insertion Bundle compliance Rate =	Total number of patients compliant with all applicable bundle components ---------- X100 Total number of patients reviewed for the bundle compliance

Urinary Catheter Maintenance Bundle compliance Rate =	Total number of patients compliant with all applicable bundle components ----------X 100 Total number of patients reviewed for the bundle compliance

Urinary Catheter Insertion Bundle Form

(Adult and Pediatric Locations)

A: PATIENT'S INFORMATION					
Patient Name:		MRN:			
Age:	Gender:	Unit:		Bed No:	
Date of Admission:		Diagnosis:			
Urinary Catheter Insertion Date:					
Place of Insertion:					

Urinary Catheter Insertion Bundle		
1:	**Avoid Unnecessary Urinary Catheters**	Yes ☐ No ☐
2:	**Insert Using Aseptic Technique:**	Yes ☐ No ☐
a)	***Hand Hygiene before insertion of Urinary Catheter***	Yes ☐ No ☐
b)	***Use Sterile Equipment:*** – *Sterile Gloves, Drape & Sponges* – *Sterile antiseptic solution for cleaning the Urethral Meatus* – *Sterile single-use Packet of lubricant jelly for insertion*	Yes ☐ No ☐
c)	**Use of Small Catheter as possible that is consistent with proper drainage, to minimize urethral trauma.**	Yes ☐ No ☐

Urinary Catheter Maintenance Bundle Form

(Adult and Pediatric Locations)

Urinary Catheter Maintenance Bundle			
Date	Hand Hygiene	Maintain Catheters Based on Recommended Guidelines*	Review Urinary Catheter Necessity Daily and Remove Promptly
1	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
2	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
3	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
4	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
5	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
6	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
7	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
8	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
9	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
10	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
11	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
12	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
13	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
14	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
15	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
16	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
17	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
18	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
19	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
20	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
21	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
22	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
23	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
24	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
25	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
26	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
27	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
28	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
29	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
30	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐
31	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐ N/A ☐

**Recommended Guidelines	
Maintain a sterile, continuously closed drainage system.	Yes ☐ No ☐
Keep catheter properly secured to prevent movement and urethral traction.	Yes ☐ No ☐
Keep collection bag below the level of the bladder at all times.	Yes ☐ No ☐
Maintain unobstructed urine flow.	Yes ☐ No ☐
Empty collection bag regularly.	Yes ☐ No ☐
Routine hygiene (e.g., cleansing of the meatal surface during daily bathing) is appropriate.	Yes ☐ No ☐
Collection of urine samples should follow aseptic technique.	Yes ☐ No ☐

Multidrug Resistant Organisms (MDROs) Prevention Bundle

MDRO Bundle:

MDRO bundle is a group of evidence-based interventions for patients with **Positive MDRO** status that, when implemented together, result in better outcomes than when implemented individually.

Objective:

- To reduce the risk of MDRO Transmission & Antimicrobial Resistance

Setting:

- Critical Care Locations
- Inpatient areas (including long term care) where patients with MDROs are hospitalized.
- The implementation of these components of MDRO bundle requires a multidisciplinary approach involving physicians, nurses, leaders, and experts in infection prevention and control.

Sampling:

- Sampling is allowed at the level of days but not the patients.
- Therefore, review all patients in a specific unit with MDRO for one or two days a week.

MDRO Prevention Bundle Components:

1. Standard Precautions:
    - *Strict adherence to Hand Hygiene*
    - *Use of appropriate Personal Protective Equipment (PPE)*
2. Contact Isolation Precautions:
    - *Patient placement in single room*
    - *Contact Isolation signage posted to alert staff & precautions applied*
3. Enhanced Environmental Measures:
    - *Increased cleaning and disinfection of high touched surfaces & medical Equipment*
    - *Dedicated Non Critical Patient Care Equipment e.g. stethoscope, BP cuffs etc.*
4. Judicious use of Antimicrobials

1) Standard Precautions:

- *Standard Precautions play essential role in preventing MDRO transmission, even in facilities that use Contact Precautions for patients with an identified MDRO.*
- *Colonization with MDROs is frequently undetected; even surveillance cultures may fail to identify colonized persons due to lack of sensitivity, laboratory deficiencies, or intermittent colonization due to antimicrobial therapy.*
- *Therefore, Standard Precautions must be used in order to prevent transmission from potentially colonized patients.*
- *Standard precautions are a basic method of infection control designed to reduce risk of transmission of infectious agents from both recognized and unrecognized sources. This applies to all patients, regardless of their medical diagnosis.*
- *Standard precautions entails Hand Hygiene & the use of PPE, such as gowns, gloves, masks, face shields, and goggles to protect health care personnel when anticipating contact with blood, body fluids, secretions, and excretions (except sweat), Non-intact skin & Mucous membranes. In addition environmental cleaning, proper waste management & safe handling of sharps, are essential components of MRO prevention.*

2: Contact Isolation Precautions:

- *Contact Precautions are intended to prevent transmission of infectious agents, including epidemiologically important microorganisms, which are transmitted by direct or indirect contact with the patient or the patient's environment.*
- *A single-patient room is preferred for patients who require Contact Precautions.*
- *When a single-patient room is not available, consultation with infection control is necessary to assess the various risks associated with other patient placement options (e.g., cohorting, keeping the patient with an existing roommate).*
- *Health Care Worker caring for patients on Contact Precautions should wear a gown and gloves for all interactions that may involve contact with the patient or potentially contaminated areas in the patient's environment. Donning gown and gloves upon room entry and discarding before exiting the patient room is done to contain pathogens, especially those that have been implicated in transmission through environmental contamination (e.g., VRE, C. difficile etc.)*

3: Enhanced Environmental Measures:

- ***Increased cleaning and disinfection of frequently-touched surfaces*** *& medical equipment(e.g., bedrails, bedside monitors, doorknobs) using approved disinfectants. Therefore, monitoring for adherence to recommended environmental cleaning practices is an important determinant for success in controlling transmission of MDROs and other pathogens in the environment*
- ***Use single-use or dedicate non-critical medical items*** *for patients with a known MDRO infection e.g. blood pressure cuffs, stethoscopes etc.*
- *The potential role of environmental reservoirs, such as surfaces and medical equipment, in the transmission of VRE and other MDROs has led to interventions that included the use of dedicated noncritical medical equipment assignment of dedicated cleaning personnel to the affected patient care unit.*
- *Perform terminal cleaning and disinfection after patient discharge or transfer, ensuring all reusable equipment and environmental surfaces are disinfected.*

4: Judicious use of Antimicrobials:

- *Use local antibiogram to effectively treat infections*
- *Treat infection, not contamination*
- *Treat infection, not colonization*
- *Stop treatment when infection is cured or unlikely*
- *Avoid excessive duration of treatment*
- *Use narrow spectrum agent and put restriction on broad spectrum and potent antibiotics.*
- *Strict implementation of antimicrobial Policy*

Additional Critical MDROs Prevention Practices:

1: Administrative Measures:

Administrative measures are critical to the success in combating multidrug-resistant organisms (MDROs). It facilitates the allocation of resources for essential components such as a robust MDRO alert system, availability and accessibility of IPC supplies (e.g., personal protective equipment, hand hygiene products), and human resources measures—including appropriate staffing levels, ongoing staff training, and workforce competency assessments. These measures not only strengthen daily IPC practices but also enable rapid response to MDROs outbreaks.

a: MDRO Alerts:

- *Flagging File of MDRO Positive Patient*
- *Computer alerts to identify patients previously known to be colonized/infected with MDROs*

b: IPC Supply Availability:

- *Adequate number of Hand washing sinks*
- *Adequate number of Alcohol based hand rub dispensers,*
- *Adequate availability of PPE items Glove, Gowns etc.*

C: Human Resource:

- *Trained Infection control Practitioners (ICPs)*
- *Maintaining staffing levels appropriate to the intensity of care required.*

2: Education, Training & Monitoring Measures:

- *Providing healthcare workers with ongoing education about MDROs, their transmission, and prevention strategies.*
- *Auditing practices such as hand hygiene and PPE use and providing follow-up and feedback to health care personnel to improve processes.*

3: MDRO Surveillance:

- *Surveillance for MDROs isolated from routine clinical cultures*
- *Identifying trends in MDRO incidence rates.*
- ***Antibiograms**: Antimicrobial susceptibility reports reflecting pathogen-specific prevalence of resistance among clinical isolates.*
- *Provides clinicians with information to guide antimicrobial prescribing practices*
- *Surveillance for MDROs by detecting asymptomatic colonization*

- ***Flagging** the file of an MDRO (multidrug-resistant organism) patient refers to marking their medical record or electronic health record to alert healthcare providers about their MDRO status*
- *Flagging serves as a visual and automatic reminder that helps healthcare professionals to recognize and take necessary precautions when caring for patients who are infected or colonized with MDROs, such as MRSA or other antibiotic-resistant bacteria to prevent the spread of the MDRO.*
- ***For detecting asymptomatic colonization,** target specific patient populations considered at **high risk for MDRO colonization** based on factors such as location (e.g. ICU with high MDRO rates), antibiotic exposure history, presence of underlying diseases, prolonged duration of stay, exposure to other MDRO- colonized patients, patients transferred from other facilities known to have a high prevalence of MDRO carriage, or having a history of recent hospitalization.*
  Obtain cultures on a periodic basis [e.g., weekly] to detect silent transmission.

***MDRO surveillance:** A critical component of any MDRO control program*
- *Important patient safety component.*
- *Allows detection of newly emerging resistance pattern.*
- *Monitors epidemiologic trends in incidence of MDROs over time.*

Measures the effectiveness of interventions.
Education:

- *Facility-wide, unit-targeted, and informal, educational interventions for prevention of MDRO transmission.*
- *Provide basic education on preventive measures to patients and visitors.*

Multi Drug Resistant Organisms (MDROs)
Prevention Bundle

A: PATIENT'S INFORMATION						
Patient Name:	Age:	Gender:	Unit:	Bed No:	MRN:	File Flagged:
Type of MDRO Isolated :		Specimen:		Date of Culture:		Date MDRO Isolated:
Primary Diagnosis:		**Source of MDRO**: Hospital Onset ≥ 4 Days ☐				Community Onset ≤3 days ☐

MDRO Bundle Form

Date	Standard Precautions[1]		Patient Placed under Contact Isolation[2]	Environmental Measures[3]		Judicious Use of Antimicrobial Agents[4]
	*Hand Hygiene**	*Appropriate use of PPE **		Enhanced cleaning and disinfection of high touched surfaces & medical Equipment	Dedicated Non Critical Patient Care Equipment	
1	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
2	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
3	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
4	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
5	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
6	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
7	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
8	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
9	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
10	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
11	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
12	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
13	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
14	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
16	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
17	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
18	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
19	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
20	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
21	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
22	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
23	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
24	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
25	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
26	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
27	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
28	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
29	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
30	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐

Additional Critical MDROs Prevention Process Measures

A: Administrative Measures

Administrative measures are important and crucial for the successful control of the targeted MDROs

1:	***MDRO Alerts:*** – *Flag File of MDRO Positive Patient* – *Computer alerts to identify patients previously known to be colonized/infected with MDROs*	Yes ☐ No ☐
2:	***IC Supply availability:*** – *Adequate number of Hand washing sinks* – *Adequate number of Alcohol based hand rub dispensers,* – *Adequate availability of PPE items Glove, Gowns etc.*	Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐
3:	***Human Resource:*** – *Trained infection control practitioners (ICPs)* – *Maintaining staffing levels appropriate to the intensity of care required.*	Yes ☐ No ☐

B: Education, Training & Monitoring Measures

Facility-wide, unit-targeted, and informal, educational interventions to encourage a behavior change through improved understanding of the problem MDRO

4:	– *Provide healthcare workers with ongoing education about MDROs, their transmission, and prevention strategies.* – *Auditing practices such as hand hygiene and PPE use and providing follow-up and feedback to health care personnel to improve processes.*	Yes ☐ No ☐

C: MDRO Surveillance

Surveillance is a critically important component of any MDRO control program, allowing detection of newly emerging pathogens, monitoring epidemiologic trends, and measuring the effectiveness of interventions.

5:	– *Surveillance for MDROs isolated from routine clinical cultures* – *Identifying trends in MDRO incidence rates.*	Yes ☐ No ☐
6:	– ***Antibiograms**: Antimicrobial susceptibility reports reflecting pathogen-specific prevalence of resistance among clinical isolates.* – *Provides clinicians with information to guide antimicrobial prescribing practices*	Yes ☐ No ☐
7:	– *Surveillance for MDROs by detecting asymptomatic colonization*	Yes ☐ No ☐

MDRO Bundle Data Analysis

MDRO Bundle Compliance

MDRO Bundle Compliance Rate	$\frac{\text{Total number of patients with all compliant applicable bundle components}}{\text{Total number of patients reviewed for the bundle compliance}} \times 100$

Surgical Care Bundle

Surgical Bundle:

The surgical bundle is a group of evidence-based interventions for patients undergoing surgery that, when implemented together, result in better outcomes (reduce SSI) than when implemented individually.

Objective:

- To reduce the risk of developing SSI.

Setting:

- Inpatient or outpatient areas where patients are undergoing surgeries.

Sampling:

- Sampling is allowed at the level of procedures.

Number of Surgeries done	Number of Surgical bundle forms
>555	20% (maximum 111 form)
140-555	20%
28-140	Minimum 28 forms
<28	No sampling, review all

Components of Surgical Bundle:

1- Appropriate use of prophylactic antibiotics:

- Selection
- Timely administration
- Timely discontinuation

2- Appropriate hair removal.

3- Immediate postoperative control of blood-glucose levels in all patients.

4- Maintain normothermia during the perioperative period.

5- Use appropriate antiseptic solution.

1. Appropriate Use of Prophylactic Antibiotics:

a) Appropriate Antibiotic Selection:

Prophylactic antibiotic selection for surgical patients consistent with national guidelines. See MOH list of antibiotics for surgical prophylaxis

b) Timely Administration:

- Prophylactic antibiotic received within 1 hour prior to surgical incision. Superior efficacy is observed if prophylactic antibiotic is administered in less than half an hour.
- Due to the longer infusion time required for Vancomycin and fluoroquinolones, it is acceptable to start these antibiotics within 2 hours prior to incision.
- A single dose of antibiotics is considered sufficient for most procedures.
- Repeat doses are indicated for procedures lasting more than 4 hours (2 half- lives antimicrobial of agents) or those with significant blood loss (>1,500 mL).
- Always give at least a full therapeutic dose of antibiotic.
- Increase dosing of prophylactic antimicrobial agent for morbidly obese patients. Adjust dosing based on patient weight.

c) Timely Discontinuation:

- Prophylactic antibiotics should be discontinued after incisional closure in the operating room.
- Antibiotics given after closure contribute to increased antimicrobial resistance and increased risk of Clostridium difficile infection and acute kidney injury.

2. Appropriate Hair Removal:

- Do not remove unless hair will interfere with the operation; if hair removal is necessary, remove outside of the operating room by clipping.
- The use of razors prior to surgery increases the incidence of wound infection when compared to clipping, depilatory use, or no hair removal at all.
- Staff must be trained in the proper use of clippers because an untrained user can damage the skin.

3. Immediate Postoperative control of blood-glucose levels in all patients:

- The degree of hyperglycemia in the postoperative period is correlated with the rate of SSI in patients undergoing major cardiac surgery.
- Maintain postoperative blood-glucose level between 110 and 150 mg/dl in each of the first two postoperative days.
- Glucose control postoperatively should target all patients especially those with diabetes.

4. Maintain Normothermia during the Perioperative Period:

- For procedures not requiring hypothermia, maintain normothermia (temperature 35.5°C) during the perioperative period.
- Studies showed the benefits of both preoperative and intraoperative warming in reducing SSI rates and intraoperative blood loss.
- Preoperative normothermia may be most beneficial; patients who received 30 minutes of preoperative warming had lower intraoperative hypothermia rates.
- Patients who are hypothermic at the end of surgery may remain hypothermic for up to 5 hours. Although there is no standardized duration of postoperative warming, one study used 2 hours of postoperative warming and showed reduced rates of SSI.

5. Use Appropriate Antiseptic Solution:

Patient Preparation:

- The most effective antiseptic combination is chlorhexidine-alcohol and to a lesser extent povidone-iodine-alcohol.
- Preoperative skin preparation using alcohol-containing antiseptic skin agents.
- Preoperative vaginal preparation using alcohol-containing antiseptic vaginal preparation agents for patients undergoing cesarean delivery or hysterectomy.

Surgeon Preparation:

- Use appropriate antiseptic agent to perform preoperative surgical scrub.
- For most products, scrub the hands and forearms for 2–5 minutes.

NOTE:

- ***Preoperative shower or bathe*** *prior to surgery is a good clinical practice for patients who will undergo surgery in the healthcare facilities.*
- *Many studies have recommended for patients who will undergo surgery to have preoperative bath with* ***4% Chlorhexidine Gluconate (CHG) soap*** *on at least the night before the operative day or on day of surgery.* ***(patients >2 months and above)****.*
- *Preoperative antiseptic showers with* ***Chlorhexidine Gluconate*** *is a risk reduction strategy that reduces skin microbial colony counts nine-fold compared with other cleaning measures therefore lowering risk of surgical site infections.*

Surgical Bundle Data Analysis

Surgical Bundle Compliance

Surgical Bundle Compliance Rate	Total number of patients with all compliant bundle Components ----------x 100 Total number of patients reviewed for the bundle compliance

SURGICAL CARE BUNDLE FORM

A: PATIENT'S INFORMATION							
Patient Name:				MRN:			
Age:		Gender:		Unit:		Bed No:	
Type of Procedure:				Date of Procedure:			

Surgical Care Bundle Form			
1:	***Appropriate Use Prophylactic Antibiotics***	***a) Appropriate Selection:*** *As per MOH Antibiotics for Surgical prophylaxis)*	Yes ☐ No ☐ NA ☐
		b) Timely Administration: *a. 30 mins to 1 hour before incision Vancomycin and fluoroquinolones, within 2 hours prior to incision*	Yes ☐ No ☐ NA ☐
		c) Timely discontinuation: *After incisional closure*	Yes ☐ No ☐ NA ☐
2:	***Appropriate Hair Removal***	*Do not remove hair unless needed. If needed, remove outside OR by clipping*	Yes ☐ No ☐ NA ☐
3:	***Immediate post-operative control of blood glucose levels in all patients***	*Maintain first 2 days Post-operative glucose: 110 – 150mg/dl*	Yes ☐ No ☐ N/A ☐
4:	***Maintain normothermia during the perioperative period***	*Temperature must be > 35.5 ^{0} C*	Yes ☐ No ☐ N/A ☐
5:	***Use Appropriate Antiseptic Solution***	***Most effective antiseptic combinations:*** – *Chlorhexidine - Alcohol* – *Povidone-Iodine - Alcohol*	Yes ☐ No ☐ NA ☐

Dialysis Events Prevention Bundle

Hemodialysis bundle:

The tool can be used by the staff of hemodialysis facilities to help guide their practices.

Objective:

- To reduce the risk of developing bacteremia.

Setting:

- Outpatient hemodialysis facilities.

Sampling:

- Sampling is allowed at the level of days but not the patients.
- Review all patients with dialysis access in a specific hemodialysis unit for one or two days a week.

Components of Hemodialysis Bundle for Catheter:

1- Appropriate hemodialysis catheter connection.

2- Appropriate hemodialysis catheter disconnection.

3- Appropriate hemodialysis catheter exit site care.

4- Appropriate dialysis station routine disinfection.

5- Appropriate hemodialysis injectable medication preparation.

6- Appropriate hemodialysis injectable medication administration.

Components of Hemodialysis Bundle for Fistula/Graft:

1- Appropriate arteriovenous fistula/graft cannulation.

2- Appropriate arteriovenous fistula/graft decannulation.

3- Appropriate dialysis station routine disinfection.

4- Appropriate hemodialysis injectable medication preparation.

5- Appropriate hemodialysis injectable medication administration.

➢ Appropriate Hemodialysis Catheter Connection:

- Perform hand hygiene.
- Don proper PPE (mask with face shield or mask with goggles, plus gown & gloves).
- Provide a mask for the patient.
- Scrub dialysis catheter hub and lumens using appropriate disinfectant (chlorhexidine >0.5% with/or 70% isopropyl alcohol) for the recommended time duration (10-15 seconds) and allow to dry before each access.
- Connect catheter to blood lines aseptically.
- Attach new caps aseptically whenever remove.
- Remove gloves and perform hand hygiene.

➢ Appropriate Hemodialysis Catheter Disconnection:

- Perform hand hygiene.
- Don proper PPE (mask with face shield or mask with goggles, plus gown & gloves).
- Provide mask for the patient.
- Scrub catheter hub with appropriate disinfectant (chlorhexidine >0.5% with/or 70% isopropyl alcohol) and allow to dry.
- Disconnect catheter from blood lines aseptically.
- Discard tubing in a leak-proof container.
- Remove gloves and perform hand hygiene.

➢ Appropriate Hemodialysis Catheter Exit Site Care:

- Perform hand hygiene.
- Apply skin antiseptic.
- Allow the skin antiseptic to dry.
- Apply dressing aseptically.

➢ Appropriate Arteriovenous Fistula/Graft cannulation:

- Perform hand hygiene.
- Don proper PPE (mask with face shield or mask with goggles, plus gown & gloves).
- Clean site with 2% Chlorhexidine gluconate wipes or Soap and water.
- Apply appropriate skin antiseptic (chlorhexidine > 0.5%, 70% isopropyl alcohol or 10% povidone iodine) & allow it to dry.
- Do not contaminate the needle insertion site (after antisepsis).
- Insert needles & connect to blood lines aseptically.
- Remove gloves and perform hand hygiene.

➢ Appropriate arteriovenous fistula/graft decannulation:

- Perform hand hygiene.
- Don proper PPE (mask with face shield or mask with goggles, plus gown & gloves).
- Disconnect from blood lines aseptically.
- Remove needles aseptically.
- Discard tubing in a leak-proof container.
- Wear clean gloves (patient and/or staff) to compress site.
- Apply clean gauze/bandage to site.
- Remove gloves and perform hand hygiene.

➢ Appropriate dialysis station routine disinfection:

- Don proper PPE (as per indication but at least use gloves).
- Ensure that the patient has left the dialysis station before cleaning.
- Discard all single-use supplies, clean and disinfect reusable equipment.
- Nursing: Clean and disinfect dialysis station (dialysis machine and bedside table).
- Housekeeping: Clean and disinfect dialysis chair or bed (rails, arm rests & mattresses).
- Remove gloves and perform hand hygiene.

➢ Appropriate hemodialysis injectable medication preparation:

- Perform hand hygiene.
- Prepare medications in clean designated areas.
- Inspect all vials.
- Prepare medications using aseptic techniques.
- Use new needle and new syringe to enter all vials.
- Discard all single dose vial (s).
- Discard or properly store all multi dose vial (s).

➢ Appropriate hemodialysis injectable medication administration:

- Perform hand hygiene (before and after).
- Use proper PPE (gloves).
- Properly transport medication to patient station.
- Disinfect injection port with appropriate antiseptic.
- Administer medications using aseptic techniques.
- Discard syringe at point of use.

DE Bundles Data Analysis

Dialysis Events (DE) Prevention Bundle Compliance for Catheters

Dialysis Bundle (DE) Compliance Rate for Catheter	$\frac{\text{Total number of patients with all compliant applicable bundle components}}{\text{Total number of patients reviewed for the bundle compliance}} \times 100$

Dialysis Events (DE) Prevention Bundle Compliance for AV Fistula/Graft

Dialysis Bundle (DE) Compliance Rate for AV Fistula / Graft	$\frac{\text{Total number of patients with all compliant applicable bundle components}}{\text{Total number of patients reviewed for the bundle compliance}} \times 100$

Hemodialysis Bundle for Catheter

(Outpatient Dialysis Units)

A: PATIENT'S INFORMATION			
Patient Name:	Age:	Gender	MRN:
Surveillance Month:		Diagnosis:	
Type of Vascular Access:		Permanent CL ☐	Temporary CL ☐

Hemodialysis Catheter Bundle						
#	Catheter Connection	Catheter Disconnection	Exit Site Care	Dialysis Station Disinfection	Medication Preparation	Medication Administration
1	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
2	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
3	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
4	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
5	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
6	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
7	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
8	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
9	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
10	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
11	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
12	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
13	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
14	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
15	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐

Hemodialysis Bundle Components for Catheter:

1: Appropriate Hemodialysis Catheter Connection:

- Perform hand hygiene
- Don proper PPE (mask with face shield or mask with goggles, plus gown & gloves)
- Provide a mask for the patient
- Scrub the catheter hub with appropriate disinfectant (chlorhexidine >0.5% with/or 70% isopropyl alcohol) for the recommended time duration (10-15 seconds) and allow it to dry before each access
- Connect catheter to bloodlines aseptically
- Attach new caps aseptically whenever remove
- Remove gloves and perform hand hygiene.

2: Appropriate hemodialysis catheter disconnection

- Perform hand hygiene
- Don proper PPE (mask with face shield or mask with goggles, plus gown & gloves)
- Provide a mask for the patient
- Scrub catheter hub with appropriate disinfectant (chlorhexidine >0.5% with/or 70% isopropyl alcohol) and allow to dry
- Disconnect the catheter from bloodlines aseptically
- Discard tubing in a leak-proof container
- Remove gloves and perform hand hygiene.

3: Appropriate hemodialysis catheter exit site care:

- Perform hand hygiene
- Apply skin antiseptic
- Allow skin antiseptic to dry
- Apply dressing aseptically

4: Appropriate dialysis station routine disinfection:

- Don proper PPE (as per indication but at least use gloves)
- Ensure that the patient has left the dialysis station before cleaning
- Discard all single-use supplies, clean and disinfect reusable equipment
- Nursing: Clean and disinfect the dialysis station (dialysis machine and bedside table)
- Housekeeping: Clean and disinfect dialysis chair or bed (rails, armrests & mattresses)

5: Appropriate hemodialysis injectable medication preparation:

- Perform hand hygiene
- Prepare medications in clean designated areas
- Inspect all vials
- Prepare medications using aseptic techniques
- Use a new needle and new syringe to enter all vials
- Discard all single dose vial(s)
- Discard or properly store all multi-dose vial(s)

6: Appropriate hemodialysis injectable medication administration:

- Perform hand hygiene (before and after)
- Use proper PPE (gloves)
- Properly transport medication to the patient station
- Disinfect the injection port with an appropriate antiseptic
- Administer medications using aseptic techniques
- Discard syringe at point of use

Hemodialysis Bundle for Fistula/Graft

(Outpatient Dialysis Units)

A: PATIENT'S INFORMATION			
Patient Name:	Age:	Gender	MRN:
Surveillance Month:		Diagnosis:	
Type of Vascular Access:		AV Fistula ☐	AV Graft ☐

Hemodialysis Fistula/Graft Bundle						
#	Fistula / Graft Cannulation	Fistula/Graft De-cannulation	Exit Site Care	Dialysis Station Disinfection	Medication Preparation	Medication Administration
1	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
2	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
3	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
4	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
5	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
6	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
7	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
8	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
9	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
10	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
11	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
12	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
13	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
14	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐
15	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐	Yes ☐ No ☐ N/A ☐

Hemodialysis Bundle Components for Fistula/Graft:

1- Appropriate Arteriovenous Fistula/Graft Cannulation:

- Perform hand hygiene
- Don proper PPE (mask with face shield or mask with goggles, plus gown & gloves)
- Clean the site with 2% Chlorhexidine gluconate wipes or Soap and water
- Apply appropriate skin antiseptic (chlorhexidine >0.5%, 70% isopropyl alcohol or 10% povidone-iodine) & allow it to dry
- Do not contaminate the needle insertion site (after antisepsis)
- Insert needles & connect to bloodlines aseptically

2- Appropriate arteriovenous fistula/graft decannulation:

- Perform hand hygiene
- Don proper PPE (mask with face shield or mask with goggles, plus gown & gloves)
- Disconnect from bloodlines aseptically
- Discard tubing in a leak-proof container
- Wear clean gloves (patient and staff) to compress the site
- Remove needles aseptically
- Apply clean gauze/bandage to the site

3- Appropriate dialysis station routine disinfection:

- Don proper PPE (as per indication but at least use gloves)
- Ensure that the patient has left the dialysis station before cleaning
- Discard all single-use supplies, clean and disinfect reusable equipment
- Nursing: Clean and disinfect the dialysis station (dialysis machine and bedside table)

  Housekeeping: Clean and disinfect dialysis chair or bed (rails, armrests & mattresses)

1. Appropriate hemodialysis injectable medication preparation:

- Perform hand hygiene
- Prepare medications in clean designated areas
- Inspect all vials
- Prepare medications using aseptic techniques
- Use a new needle and new syringe to enter all vials
- Discard all single-dose vial(s)
- Discard or properly store all multi-dose vial(s)

2. Appropriate hemodialysis injectable medication administration:

- Perform hand hygiene (before and after)
- Use proper PPE (gloves)
- Properly transport medication to the patient station
- Disinfect injection port with appropriate antiseptic
- Administer medications using aseptic techniques
- Discard syringe at point of use

CHAPTER – IV

HAI Surveillance Data Analysis & Interpretation

1: Basic Statistics

In healthcare-associated infections (HAIs) surveillance, statistics play a crucial role in analyzing infection trends, identifying risk factors, and evaluating control measures. There are two main types of statistics:

- **Descriptive Statistics** – Summarizes and organizes data (e.g., mean, frequency tables, histograms).
- **Inferential Statistics** – Draw conclusions about a population based on a sample (e.g., Z-test, t-test, chi-square test).

Types of Data in HAIs Surveillance:

Data collected in infection control programs can be classified into quantitative or categorical data.

- **Quantitative Data (Numerical values)**

Sub-type	Example
Continuous (can take any value within a range)	• Blood pressure • Height & weight • Age • Length of hospital stay
Discrete (countable values)	• Number of children • Number of attacks of asthma per week • Number of CLABSI cases per month

- **Categorical Data (Non-numerical values)**

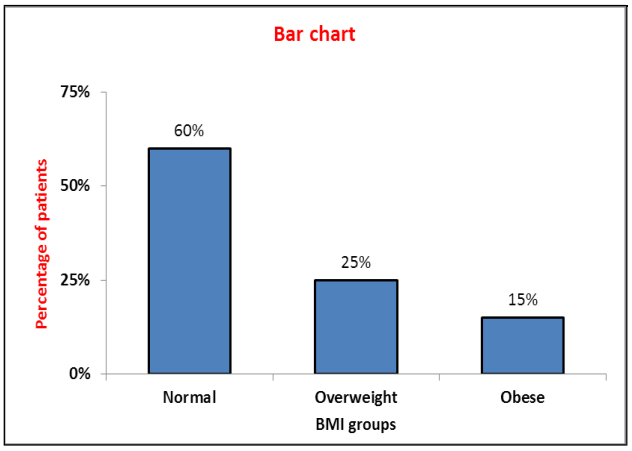
Sub-type	Example
Ordinal (Ordered categories)	• Grade of breast cancer • Small, medium, large • Educational level • Severity of infection (mild, moderate, severe)
Nominal (Unordered categories)	• Sex (male/female) • Alive or dead • Blood group O, A, B, AB • Type of infection (CLABSI, CAUTI, VAP)

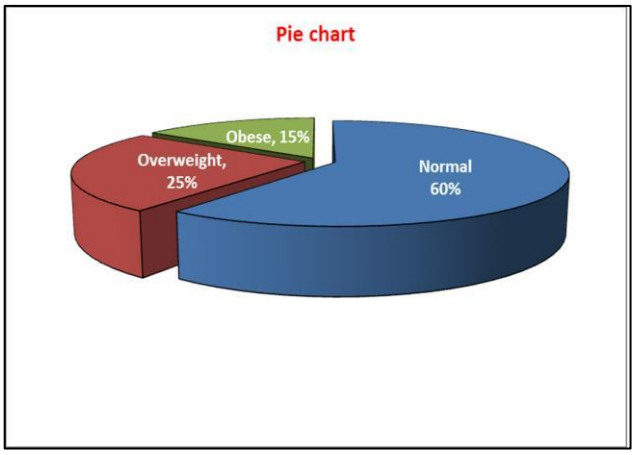
Descriptive Statistics:

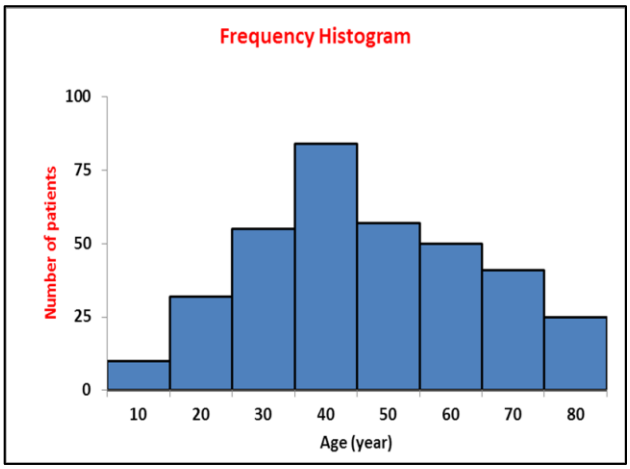
Common Methods of Data Presentation

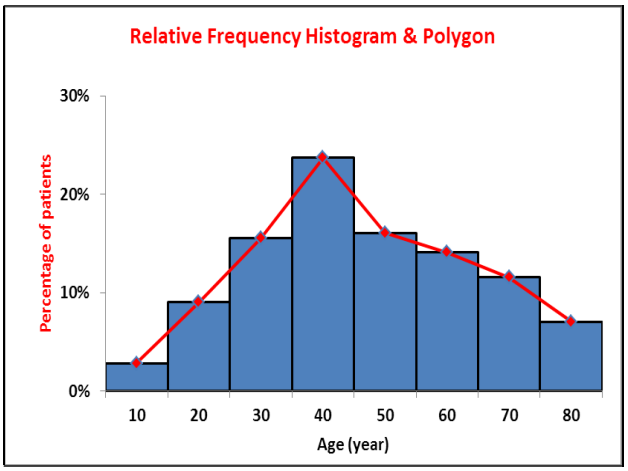
- Frequency table
- Frequency histogram, Relative frequency histogram
- Frequency polygon, Relative frequency polygon
- Bar chart, Pie chart
- Stem-and-leaf display
- Box plot, Scatter plot

Examples of Descriptive Statistics

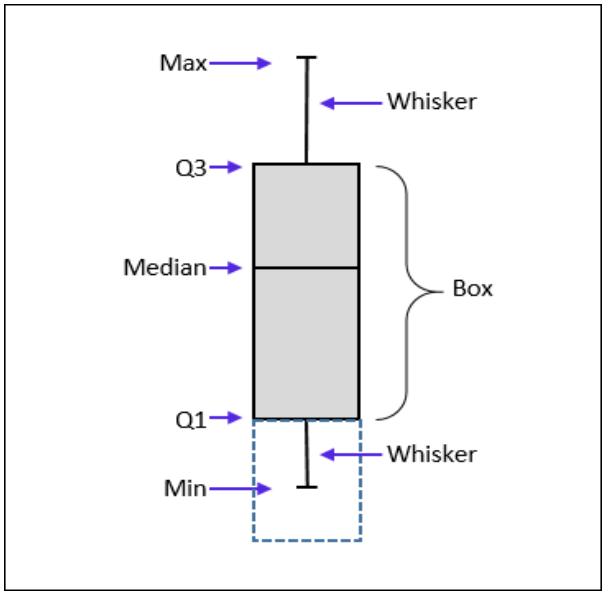








Box plot



Frequency Table

Age Groups	Frequency	Percentage
32 -36.99	2	6.7%
37- 41.99	3	10.0%
42-46.99	4	13.3%
47-51.99	3	10.0%
52-56.99	8	26.7%
57-61.99	3	10.0%
62-66.99	4	13.3%
67-72	3	10.0%
Total	**30**	100.0%

Measures of Central Tendency:

These measures summarize the central point of a dataset

	Advantages	Disadvantages
Arithmetic mean	• Uses all the data values • Algebraically defined and so mathematically manageable	• Distorted by outliers • Distorted by skewed data
Median	• Not distorted by outliers • Not distorted by skewed data	• Ignores most of the information • Not algebraically defined
Mode	• Easily determined for categorical data	• Ignores most of the information • Not algebraically defined

Measures of Variation:

These statistics describe how spread out the data values are

Measure	Definition
Range	The difference between the largest value and the smallest value.
Interquartile range (IQR)	The difference between Q1 andQ3 (25th and 75th percentiles)
Standard deviation (SD)	The mean differences of individual data from the arithmetic mean of all data. It is the square root of the variance.
Variance	The mean of the squares of the deviations from the arithmetic mean of a data set
Standard error of the mean (SEM)	It is calculated by dividing the standard deviation by the square root of the sample size.
Coefficient of Variation (CV)	It is the ratio of the sample standard deviation to the sample mean

Advantages and Disadvantages of Variation Measures

Items	Advantages	Disadvantages
Range	• Easily determined	• Uses only two observations • Distorted by outliers • Tends to increase with increasing sample size
Interquartile range	• Unaffected by outliers • Independent of sample size • Appropriate for skewed data	• Clumsy to calculate • Cannot be calculated for small samples • Uses only two observations • Not algebraically defined
Variance	• Uses every observation • Algebraically defined	• Units of measurement are the square of the units of the raw data • Sensitive to outliers • Inappropriate for skewed data
Standard Deviation	• Same advantages as the variance • Units of measurement are the same as those of the raw data • Easily interpreted	• Sensitive to outliers • Inappropriate for skewed data

Measures of Relative Standing:

Measure	Definition
Percentile	Data is divided into 100 equal parts by rank (i.e., the kth percentile is that value greater than k% of the others). Example, • 30th percentile means values more than 30% of the values • 90th percentile means values more than 90% of the values
Quartile	Data is divided into 4 equal parts by rank: • Q1 (first quartile) is greater than ¼; • Q2 is identical to the median • Q3 (third quartile) is the value greater than ¾ of the others
z score	Measures the distance from the mean in terms of standard deviation **Example: Z-score Interpretation** *A hospital's infection rate is 2 standard deviations above the national average, indicating a higher-than-expected infection risk.*

Measures of Frequency:

Rates, ratios, and proportions are used to measure the occurrence and risk of an event in a specific population during a given period.

1. **Rate:** an expression of the frequency with which an event occurs in a defined population, for example, CLABSI incidence rate is 5.3 per 1000 patient-days
2. **Ratio:** the value obtained by dividing one quantity by another, for example, the ratio of females to males is 2:1
3. **Proportion:** a type of ratio in which the values in the numerator are included in (i.e., are a subset of) the denominator, for example, 33% of the population is in risk category 1

Basic Inferential Statistics:

Inferential statistics allow us to draw conclusions about a population from sample data.

Common Inferential Tests in Infection Control

Test	Application
Chi-square test	Comparing infection rates between hospital units
t-test	Comparing mean infection duration between two groups
ANOVA	Comparing infection rates across multiple hospital wards
Regression analysis	Identifying risk factors for HAIs

Confidence intervals (CI)

- A 95% CI for an infection rate means we are 95% confident that the true rate falls within the interval.
- ***Example**: The hand hygiene compliance rate is 85% (95% CI: 82%-88%).*

Measures of Morbidity and Mortality

Surveillance should yield risk-adjusted incidence rates to allow inter- and intra-facility rate comparisons.

Risk-adjusted rates and crude rates

1. Risk-adjusted rates

- Rates are controlled for variations in the distribution of major risk factors associated with an event's occurrence
- Such rates allow inter- and intra-facility rate comparisons

2. Crude rates

- Rates assume equal distribution of risk factors for all events
- Such rates cannot be used for inter-facility comparisons

Measures of morbidity and mortality

1- Measures of morbidity:

- Incidence rate
- Prevalence rate

2- Measures of mortality:

- Mortality rate
- Case fatality
- Proportionate mortality

Measures of morbidity:

- **Incidence rate:** a measure of the frequency with which an event occurs in a population over a defined time period. The numerator is the number of new cases occurring during the defined time period, and the denominator is the population at risk.

- **Prevalence rate:** the proportion of persons in a population who have a particular disease or condition (new and previously existing) at a specified point in time or over a specified period of time.

Point prevalence =

$$\frac{\text{Number of all cases (old and new) in a given point in time}}{\text{Total population at risk at the given point in time}}$$

Period prevalence =

$$\frac{\text{Number of all cases (old and new) in a given period of time}}{\text{Total population at risk at the given period in time}}$$

Cumulative incidence =

$$\frac{\text{Number of new cases in a given period of time}}{\text{Total population at risk during that time}}$$

Measures of mortality:

- **Mortality rate**: The frequency of occurrence of death in a defined population during a specified interval.
- **Case fatality:** The proportion of deaths from a certain disease compared to the total number of people diagnosed with the disease for a particular period
- **Proportionate mortality:** It describes the proportion of deaths in a specified population over a period of time attributable to different causes. Each cause is expressed as a percentage of all deaths, and the sum of the causes must add to 100%

$$\text{Mortality rate} = \frac{\text{Deaths in a given period of time}}{\text{Total population in the given period of time}}$$

$$\text{Case fatality} = \frac{\text{Deaths from a certain disease}}{\text{All patients diagnosed with that disease}}$$

$$\text{Proportionate mortality} = \frac{\text{Deaths from a certain disease in a given period of time}}{\text{Deaths from all causes in the given period of time}}$$

2: Calculating Infection Rates and Ratios

CLABSI:

- The CLABSI rate per 1000 central line-days is calculated by dividing the number of CLABSI by the number of central line-days and multiplying the result by 1000.
- The Central Line Utilization Ratio is calculated by dividing the number of central line- days by the number of patient-days.
- These calculations will be performed separately for different types of ICUs, specialty care areas, and other locations in the institution.
- Separate rates and ratios will also be calculated for different types of catheters and birthweight categories in NICUs.

CAUTI:

- The CAUTI rate per 1000 urinary catheter-days is calculated by dividing the number of CAUTIs by the number of catheter-days and multiplying the result by 1000.
- The Urinary Catheter Utilization Ratio is calculated by dividing the number of urinary catheter-days by the number of patient-days.
- These calculations will be performed separately for the different types of ICUs, specialty care areas, and other locations in the institution.

VAE:

- The VAE rate per 1000 ventilator-days is calculated by dividing the number of VAEs by the number of ventilator-days and multiplying the result by 1000.
- The VAE rate per 100 episodes of mechanical ventilation is calculated by dividing the number of VAEs by the number of episodes of mechanical ventilation and multiplying the result by 100 (episodes of mechanical ventilation).
- The Ventilator Utilization Ratio is calculated by dividing the number of ventilator-days by the number of patient-days.
- These calculations will be performed separately for the different types of ICUs, specialty care areas, and other adult locations in the institution

DE:

- The numbers of various events (In-unit IV antimicrobial start, positive blood culture, or local infection) are tabulated, and rates of these events per 100 patient-months calculated by dividing the number of events by the number of patient-months and multiplying the result by 100.
- These rates are stratified by vascular access type and compared to the mean rate of all centers combined.

SSI:

- The SSI rates per 100 operative procedures are calculated by dividing the number of SSIs by the number of specific operative procedures and multiplying the results by 100.
- These calculations will be performed separately for the different types of operative procedures and stratified by risk index.
- Standardized infection ratios are also calculated using indirect standardization or multivariate models.

MDRO-Infection Surveillance:

- MDRO infection incidence rate is calculated by dividing the number of infections of a certain MDRO type by the number of patient days and multiplying the results by 1000.
- Rate is then stratified by time (e.g., month, quarter, etc.) and patient care location.

MDRO-Laboratory-Identified (LabID) Event:

- Numerator data are the Laboratory-identified MDRO Events while denominator data are the number of patient days, admissions, and encounters (for ER and outpatient locations).

- These data are used to calculate four distinct proxy measures including:
  - ✓ Admission prevalence rate and
  - ✓ Overall prevalence rate based on clinical testing (measures of exposure burden),
  - ✓ MDRO bloodstream infection incidence rate (measure of infection burden), and
  - ✓ Overall MDRO infection/ colonization incidence rate (measure of healthcare acquisition).
- LabID Events proxy measures are categorized as healthcare facility-onset (4 days or more days after admission to the facility) versus community-onset (≤ 3 days after admission to the facility).

3: Calculating SIR

The Standardized Infection Ratio (SIR):

- SIR is a summary measure used to track HAIs at a national, state, or local level over time.
- SIR provides improved risk adjustment and can replace risk-stratified HAI rates.

Calculation of SIR:

$$\frac{\textbf{Observed HAI Events}}{\textbf{Expected HAI Events}}$$

- The observed HAI events: It is the HAI events you detect during surveillance.
- The expected HAI events: It can be calculated from the published benchmarking reports of NHSN, INICC, GCC, or Saudi MOH.

- To allow for more precise comparisons, SIRs are calculated only if the number of expected HAIs is ≥1.

- When the expected HAI <1, this indicates that the denominator (e.g. number of device days or procedures) in the facility or location is too low to calculate a precise SIR and comparative statistics.

Interpretation of SIR:

- SIR <1 means that after adjusting for differences, fewer HAIs were observed than predicted

- SIR >1 means that after adjusting for differences, more HAIs were observed than predicted

- SIR =1 means that after adjusting for differences, Same HAIs were observed as predicted

Example of SIR calculation:

1- Abstract the published NHSN rates corresponding to the above four ICUs (e.g. medical cardiac ICU is 2.0 per 1000 central line days).

2- Calculate the expected CLABSI rates for each ICU separately by multiplying the observed central lines days in each unit with its corresponding published NHSN rates (e.g. in medical cardiac ICU 380 X 2.0 /1000 = 0.76).

3- Sum up expected CLABSI events in the four ICUs (e.g. 0.76 + 0.67 + 0.94 + 1.78 = 4.15).

4- Calculate the SIR by dividing observed CLABSI events by expected CLABSI events (e.g. 8 / 4.15 = 1.93).

5- Interpret the SIR: Your hospital had 93% more CLABSIs than expected assuming your ICUs have CLABSI rates similar to that of NHSN ICUs.

Type of ICU	Observed CLABSI Events	Observed central line days	Hospital rates	Published NHSN Rates	Expected CLABSI events
Medical cardiac	2	380	5.26	2.0	0.76
Medical	1	257	3.89	2.6	0.67
Medical Surgical	3	627	4.78	1.5	0.94
Neurosurgical	2	712	2.81	2.5	1.78
Total	8	1976	4.05		4.15

4: HAI Surveillance Data Validation

Surveillance Data Validation:

It is the process of confirming that surveillance data meets the requirements and the standards for which it was intended.

Purpose of Surveillance Data Validation:

- Ensure that surveillance data is of high quality: Complete, accurate, and timely.
- Ensure that surveillance data are suitable for fair comparison of HAI rates between hospitals.
- Provide insights into systematic weaknesses in the surveillance process and suggest how to correct them.
- Estimate the coefficient of underreporting.

Levels of Surveillance Data Validation:

Validation should strive to address data quality across several components that comprise HAI measures. This includes the completeness and accuracy of:

- The population denominator at risk for the HAI.
- Identified cases.
- Reported data elements, including those used for risk adjustment.

Types of Surveillance Data Validation:

1- Intrinsic Validation:

- It is an automated process built into a computer application that controls the values and types of data that are entered into the system.
- Point-of-entry validation is a process for routinely checking whether data are reasonable, complete, consistent, and formatted in accordance with system requirements.
- Intrinsic validation serves as a means for detecting and preventing some input errors However, intrinsic validation does not prevent all errors and does not assure the quality and completeness of HAI case ascertainment or the caliber of numerator and denominator data acquisition.

2- Internal Validation:

- It is a systematic process that enables facility personnel themselves to assess whether sound surveillance methods, optimal healthcare data sources, and the highest caliber data abstraction and entry are in use when numerator and denominator records are completed.
- Investigations of surveillance practices and analysis and follow-up of aberrant or

outlying results are the main methods of internal validation.

3- External Validation:

- It is a survey and audit process conducted by an agency outside the reporting facility (e.g. Ministry of health team), in which a facility's surveillance determinations and methods are assessed by one or more validators who work for the agency and who are trained to evaluate completeness and accuracy of reporting.

- Findings from external validation can be used to correct errors in event identifications.

4- Validation of Internal Data against the External dataset:

- This may involve the acquisition of data from an independent source, such as a microbiology laboratory database, and the cross-checking of these data with the surveillance data to check for missing infections.

- This could be undertaken on an intermittent basis (e.g. quarterly or annually) or undertaken on a continuous basis, especially if the process can be semi- automated.

5- Validation of ICP surveillance skills

- This may involve a person responsible for collecting surveillance data being externally examined using a standardized assessment tool by an accredited surveyor.

- This may involve case scenarios and require the person to correctly identify the classification of HAI data.

- This may involve inter-rater reliability between two ICPs using kappa statistic.

6- Denominator data validation

- The denominator data are usually provided by the medical statistics department of the hospital or unit staff.

- It is important that surveillance personnel are familiar with the way that these data are obtained; have documentary evidence that the extracted data meet the definitions for patient days and device days.

- This will usually involve direct communication with those responsible for generating the data extract.
- Comparing electronic and manually collected denominators.

Examples of some Validation Items in CLABSI Surveillance:

- Not all positive blood cultures reviewed by ICP (need a list from the laboratory)
- Not all patients on central line included in the surveillance
- Misclassification of primary and secondary BSI due to mismatch of pathogens
- Misclassification of primary and secondary BSI due to missing candida
- Misclassification of primary and secondary BSI due to failure to recognize infections at other sites (such as GIT infections)
- Misclassification of HAI and POA because of wrong window estimation
- Use of current weight group rather than birth weight group in neonatal ICU
- Wrong location of attribution after transfer
- Counting both CLABSI and MBI in the same patient
- Misclassification of the LCBI criterion due to failure to distinguish between the recognized pathogen and the skin contaminant
- Using the LCBI criterion 3 outside the neonatal ICU
- Central line days are more than patient days
- Central line days are extremely higher or lower than expected
- Data entry errors (need independent entry of about 5% of the cases)

5: Benchmarking

Benchmarking is the process of "comparing oneself to others performing similar activities, to continuously improve." Although it is very appealing to compare rates externally with others, comparisons should be made only after ensuring that several conditions are met.

Benchmarking conditions

- Using a standardized case definition
- Using similar data collection methods
- The population and time period for the study are well defined.
- The size of the population should be large enough, and the duration should be sufficient to allow fair comparisons
- Using the same data description methods, including:
  - ✓ Similar rate calculation
  - ✓ Similar rate stratification by risk factors
  - ✓ Similar rate stratification by hospital locations
  - ✓ Similar adjusting methods
- Using sound statistical comparison methods
- Patients' confidentialities are safeguarded

Benchmarking Reports

- The National Healthcare Safety Network (NHSN)
- The International Nosocomial Infection Control Consortium (INICC)
- European Centre for Disease Prevention and Control (ECDC)
- The World Health Organization (WHO) estimates
- Ministry of Health reports

6: Point Prevalence Survey

Point Prevalence Survey (PPS) of HAIs:

- PPS is a count of the number of patients with a particular condition (in this case a HAIs) at a particular time (in this case one day), as a proportion of the total number of patients who are hospitalized at that particular time.
- PPS only counts the condition if present at the time (on the day) of the survey, but does not count if it is present at other times during the patient stay in the hospital.

Objectives of PPS:

- To estimate the overall burden of HAIs.
- To describe specific types of HAIs and their causative organisms and associated antimicrobial use.
- To set priorities for future surveillance as regards types of HAIs and the units surveyed.
- To increase the surveillance skills of ICPs.
- Publications.

Duration/ date of PPS:

- One day
- Choose a day with no much staff leaves
- Avoid days with more scheduled procedures/admissions than usual

Steps of PPS:

1. Creating data collection form
2. Training of ICPs on PPS methodology
3. Training of ICPs on HAI definitions
4. Data collection during the day of the PPS and afterwards if needed
5. Data validation by reviewing positive cases with ID physicians
6. Data entry of validated cases
7. Analysis and report writing

Patients' selection criteria in PPS:

- Inpatients of any age are eligible for inclusion as long as he/she is admitted to the ward/unit before or at 8 a.m. and not discharged from the ward at the time of the survey.
- Patients in outpatient clinics, emergency departments (<1 day), same day surgery, and outpatient dialysis patients are excluded.

Outcome of PPS:

- The outcome is active HAI infections
- HAI infections: Infections that met the surveillance definition criteria of the National Healthcare Safety Network (NHSN), with onset ≥3 days from admission.
- Active infections: Infections that met NHSN surveillance definition criteria, with
  - ✓ Signs or symptoms of infection present on the survey date or
  - ✓ Antimicrobial therapy for an HAI is still being given on the survey date

Note that all types of HAI infections should be included not only the ones that we regularly do surveillance for as CLABSI or CAUTI.

Types of HAIs included in PPS

Pneumonia

□ PVAP of VAE □ Other HAI pneumonia

Blood stream infection

□ CLABSI □ Secondary BSI □ Dialysis □ Others

Urinary tract infection

□ CAUTI □ Others

Surgical site infection

□ Superficial □ Deep □ Organ Surgery: …….……..……..…..

Lower respiratory system infection, other than pneumonia: ……..……..……

Gastrointestinal system infection

□ Clostridium difficile Infection □ Intra-abdominal infection □ ……..…..…..……

Skin and soft tissue infection

□ Burn □ Decubitus ulcer □ Skin/wound □ Breast □ ……..……..……..……

Reproductive tract infection: ……..……..……..……

Bone and joint infection: ……..……..…..……..……

Central nervous system infection: ……..……..……

Cardiovascular system infection: ……..……..……..……

Upper respiratory tract infection (URI): ……..……..……..

Eye, ENT, or mouth infection other than URI: ……..……

Others: ……..…..

Exceptions of the ≥3 days rule in HAI:

- Onset ≤2 days BUT the patient was readmitted after discharge within the last 2 days.
- Onset ≤2 days BUT the patient was transferred from another hospital.
- Onset ≤2 days BUT the patient has *Clostridium difficile* infection where specimen was collected within 4 weeks from last discharge (community-onset healthcare-associated CDI).
- Onset ≤2 days BUT the patient has surgical site infection occurring after 30/90 days from a relevant surgery.

Recurrent HAIs in PPS:

- They are collected in PPS as long as meeting the definition of active infection.

Missing data at the date of PPS:

- We should not go prospectively after them.
- Results of tests/examinations that are not yet available on the survey date should neither be completed after the survey date nor taken into account when establishing whether the case definition criteria are fulfilled.
- This will probably cause some actual cases of HAI to be discarded, but this can be seen as compensation for the (potentially long) retrospective period preceding the start of the treatment when no more signs or symptoms are present on the survey date.

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List of HAI Surveillance Tools

A: HAI Surveillance Data Collection Tools:

a) Numerator Data Collection:

1) *Adult VAE Monitoring Form* *(Page # 83)*
2) *Pediatric VAE Monitoring Form (PICUs & NICUs)* *(Page # 89)*
3) *HAI Surveillance Data Collection & Event Identification Sheet* *(Excel Format)*
   (CLABSI, CAUTI, Adult VAE, Ped VAE, MDROs, SSIs & Dialysis Events)

b) Denominator Data Collection:

1) *Denominator Data Collection Form (Adult & Pediatric Locations)* *(Page # 84)*
2) *Denominator Data Collection Form - Neonatal Locations (NICUs)* *(Page # 91)*
3) *Dialysis Events Denominator Data Collection Form* *(Page # 155)*

c) Post Discharge SSI Surveillance (SSI Detection Form): *(Page # 139)*

B: Patient Care Bundle Forms:

1) ***CLABSI Prevention Bundle:***
   a) *Central Line Insertion & Maintenance Bundle Forms for Adult Locations **(AICUs)** - (Page # 168-169)*
   b) *Central Line Insertion & Maintenance Bundle Forms for Pediatric Locations **(PICUs)** - (Page # 170-171)*
   c) *Central Line Insertion & Maintenance Bundle Forms for Neonatal Locations **(NICUs)** - (Page # 172-173)*

2) ***VAE Prevention Bundle:***
   a) *Ventilator Care Bundle Form for Adult Locations- (Page # 179)*
   b) *Ventilator Care Bundle Form for Pediatric Locations (Page # 183)*
   c) *Ventilator Care Bundle Form for Neonatal Locations (Page # 184)*

3) ***CAUTI Prevention Bundle:***
   a) *Urinary Catheter Insertion Bundle Form for Adult & Pediatric Locations - (Page # 190)*
   b) *Urinary Catheter Maintenance Bundle Form for Adult & Pediatric Locations - (Page # 191)*

4) ***MDRO Prevention Bundle - (Page # 195)***

5) ***Surgical Care Bundle for Prevention of Surgical Site Infections (SSIs) - (Page # 202)***

6) ***Dialysis Events Prevention Bundle:***
   a) *DE Prevention Bundle Form for Catheter (Page # 208-209)*
   b) *DE Prevention Bundle for Form Fistula / Graft (Page # 210-211)*

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