PREVENT HAIs Healthcare-Associated Infections

Resident Physicians as Champions in Preventing Device-Associated Infections

Focus on Reducing Catheter-Associated Urinary Tract Infections

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Preamble

This toolkit was prepared to help physicians in training (a.k.a. resident physicians) improve their approach when evaluating the infectious risk of and need for invasive devices in the hospital. The devices addressed include central and peripheral venous catheters, urinary catheters, and ventilators. We hope it will be used to guide quality improvement efforts at facilities with physician training programs. The toolkit underscores the importance of resident physicians as champions for safety efforts, particularly device safety. Because CAUTI is effectively addressed in the context of general device safety, an overview of common devices and safety issues is provided in the first sections. Although the toolkit provides a frame to "optimize venous catheter, urinary catheter, and ventilator use," it is not meant to replace policies or guidelines related to the topic.

Intended Audience

Resident physicians

Purpose

Define an approach to evaluate the infectious risk and need for invasive devices in hospitalized patients

Learning Objectives

By the end of this learning activity, participants will be able to—

1. Summarize complications associated with the use of invasive devices
2. Describe the impact of the role of the patient safety champion
3. Explain the benefits of incorporating device safety practices in the workflow of the resident physician

Directions for Use

This toolkit can be used as a self-learning module or as an adjunct to existing educational or orientation programs. Contained within this toolkit are curricula, short case studies, a checklist, and a pocket guide.

Summary

Invasive devices are commonly used in the hospital setting. Patients are exposed to them as soon as they reach the emergency department (ED). Nationally, peripheral venous catheters (PVCs) are used in up to 90 percent of patients, and central venous catheter (CVC) use averages 35–50 percent of intensive care unit (ICU) and 10–20 percent of non-ICU patients based on unit type. The average use of urinary catheters (UCs) in adults varies between 50 and 80 percent of ICU patients and between 12 and 24 percent of non-ICU patients. Finally, 25–45 percent of ICU patients are on ventilator support, depending on unit type. The risk of infection starts at the time of exposure to the device and continues until after removal. The risk of device-associated infection is mitigated by using the devices only when necessary, complying with appropriate use and proper device placement and maintenance, and removing promptly when no longer necessary.

Resident physicians (RPs) are an integral part of the clinical team in an academic setting. They are often the first physician responder to clinical situations and the most informed physicians regarding device presence and use. We present a plan to help teams that include RPs address risks related to invasive devices in the hospital setting, with a focus on reducing central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), and ventilator-associated complications (VACs) including pneumonia. We also describe different approaches that RPs may choose to improve the care on their units and encourage other health care workers to adopt best practices. Each facility/unit may have special characteristics, and the implementation of the process needs to be in harmony with the existing work structure. The long-term goal is to have a safer process that is integrated into the RP's daily routine.

Epidemiology of Invasive Devices and Complications

Invasive devices are commonly used in the hospital setting and are associated with infectious and noninfectious complications. As soon as the patient enters the hospital, he or she is evaluated for venous access need. In the vast majority of cases, venous access is seen as a necessity to provide care. In addition, patients who are critically ill or those with urinary retention may have a urinary catheter placed. Finally, those patients with respiratory failure may require support through mechanical ventilation. Patients with more severe illness are more likely to be exposed to invasive devices and therefore are at a greater risk for infectious complications. In addition, procedures performed in emergency situations may be less compliant with aseptic techniques.

Peripheral Venous Catheters

PVCs are the most commonly used catheter in the hospital setting, with up to 90 percent of patients having one during their stay. PVCs are associated with mechanical, chemical, and infectious complications. Mechanical complications include hematoma and infiltration. Phlebitis (inflammation of the vein) can also occur, either related to chemical irritation of the vein or secondary to infection. The occurrence of bacteremia in the presence of phlebitis and signs of sepsis is consistent with septic thrombophlebitis, a disease that is associated with significant morbidity and mortality. Multiple studies reported poor compliance with PVC care and serious events related to infectious complications. Although serious events related to PVC use occur less commonly than do those related to central venous catheters, over duration of use, the number of PVC complications becomes significant because of the high utilization.

Central Venous Catheters

CVCs are used in the hospital setting to provide patients with venous access and are more commonly used in the critically ill. Tunneled CVCs or implanted ports are used in patients who need long-term venous access and are usually placed in a sterile procedure area. Short-term CVCs are placed either by specialized teams, physicians, or physicians-in-training. Peripherally inserted central venous catheters (PICCs) are also considered CVCs, and are usually placed by specialized nursing teams or interventional radiology staff. CVCs are associated with mechanical and infectious complications. The mechanical complications include hematoma, deep venous thrombosis, and in some situations, pneumothorax. CLABSIs are linked to increased morbidity and mortality, and many of the infections are preventable if the process adheres to aseptic insertion and maintenance. Some CVCs have a higher complication risk than others. For example, a femoral CVC has a high risk of infection (especially in obese adults) and thrombosis, whereas a subclavian CVC has lower infection risk but poses an increased risk for pneumothorax. Our focus will be on short-term CVCs, including PICCs.

Urinary Catheters

UCs are commonly placed in the hospital, particularly in the ED, ICU, and ORs. UCs may have mechanical and infectious complications. Mechanical complications include urethral trauma, hematuria, immobility, and fall risk. Infectious complications include asymptomatic bacteriuria, symptomatic CAUTI, and bacteremia related to CAUTI. Reducing UC-associated risk includes using the catheter only for an appropriate indication, and removing it promptly when no longer necessary. In addition, proper (aseptic) insertion technique and maintenance reduce the risk of introducing organisms into the UC closed system.

Ventilators

Endotracheal tubes are used to intubate patients with respiratory failure to provide mechanical ventilation. Contrary to UCs, the placement is rarely unnecessary; however, continued mechanical ventilation requires close evaluation to reduce the patient risk of developing VACs, including ventilator-associated pneumonia (VAP). A VAP results from aspiration of organisms into the lungs, leading to pneumonia. The risk of VAP increases with the duration of ventilation, and may be modified by other factors such as head-of-bed elevation and oral care. VAP is associated with significant morbidity and mortality.

Examples of Patient Harm Related to Invasive Devices

Several examples of severe patient injury related to invasive devices are presented below. The following case studies illustrate the opportunities to reduce the risk and prevent complications related to the use of invasive devices.

Case 1

A 75-year-old man was admitted to the hospital with shortness of breath and bilateral leg swelling. He was diagnosed with congestive heart failure exacerbation. The PVC site was found to be swollen and tender on the third day of use. Purulence at the site was noted, and the PVC was removed. The patient was started on intravenous antibiotics, then switched to oral antibiotics, and eventually sent home. In the next few days, his right upper extremity became more swollen, tender to palpation, and erythematous. The patient was readmitted to the hospital and started on intravenous antibiotics again. His blood cultures grew methicillin- resistant *Staphylococcus aureus* (MRSA). His blood cultures continued to be positive for MRSA for more than 2 weeks, and a transesophageal echocardiogram showed vegetation on the aortic valve consistent with endocarditis. The patient cleared his bacteremia with antibiotics and was discharged home to finish his treatment.

A month later, the patient was readmitted because of several days of back pain and inability to get out of bed on the day of admission. The patient was evaluated and found to have an epidural abscess compressing his spinal cord and leading to paraplegia.

Summarizing this case, we found that the patient developed multiple complications related to his PVC infection. These included—

- Bacteremia and sepsis
- Septic thrombophlebitis
- Endocarditis
- Epidural abscess
- Paraplegia (inability to walk)

Ultimately, the patient underwent back surgery to decompress the pressure on the spinal cord caused by the abscess, and he was in the hospital for about 3 months to treat the infection and all other complications.

What led to these complications? Organisms colonizing the skin may have been introduced at the time of PVC placement or in maintenance of the catheter. The virulent organism caused a severe infection and irreversible injury to the patient.

Case 2

An 82-year-old woman was admitted to the cardiac intensive care unit for congestive heart failure. She had a UC placed and was started on diuretics. She appeared frail. Her physician and nurses felt that keeping the urinary catheter in place would make her more comfortable. On the fifth day after admission, the patient started complaining of chills. She was found to have a fever of 102 °F, and her blood pressure dropped to 90 systolic. Blood and urine cultures grew *Escherichia coli*. She was diagnosed with a CAUTI and associated septicemia and was treated with intravenous antibiotics for 5 additional days.

Summarizing this case, we found that the patient developed complications related to urinary catheter presence. These included—

- Bacteremia and sepsis
- CAUTI
- Prolonged hospital stay

What led to these complications? Organisms from the perineal area ascend into the bladder and may lead to symptomatic CAUTI. The risk increases with longer duration of UC use. Avoiding inappropriate use of the UC will reduce the risk.

Case 3

A 38-year-old man was admitted to the hospital because of a left leg infection. The patient had had a right internal jugular CVC placed on admission. He developed a high-grade fever, chills, sweats, and confusion 4 days after admission. Blood cultures grew *Staphylococcus aureus*, and the catheter tip grew the same organism. The patient was treated with intravenous vancomycin; infectious diseases and neurology consultations were obtained. The patient's bacteremia persisted, and his repeat blood cultures continued to be positive for more than a week. An ultrasound of the internal jugular vein was also positive for thrombosis.

Summarizing this case, we found that the patient developed multiple complications related to the infection of his central venous catheter. These included—

- Bacteremia and sepsis
- Internal jugular vein thrombosis

This necessitated additional consultations by infectious disease and urology, placement of another invasive devise to administer intravenous antimicrobial therapy and ultimately resulted in a prolonged length of stay.

What led to all these complications? Organisms colonizing the skin when the CVC was placed were likely introduced at the time of placement.

How do we reduce the risk of a similar event happening? The use of proper insertion technique and maintenance can reduce the risk. The process should include all of the components needed to place a CVC in an aseptic manner.

Case 4

A 60-year-old man with chronic obstructive pulmonary disease was admitted to the hospital because of increased shortness of breath. In the ED, he was cyanotic and was intubated. The patient was admitted to the medical intensive care unit and was given intravenous steroids and respiratory treatments. He continued to be ventilator dependent and failed multiple weaning attempts. After 10 days of being on ventilator support, he had worsening of his oxygenation, and a chest radiograph showed a right lower lobe consolidation. His sputum culture grew *Pseudomonas aeruginosa*. A computed tomography scan of the chest showed a necrotizing pneumonia in the right lower lobe. The patient was treated with two antibiotics targeting *Pseudomonas* species, but continued to deteriorate and died a week later.

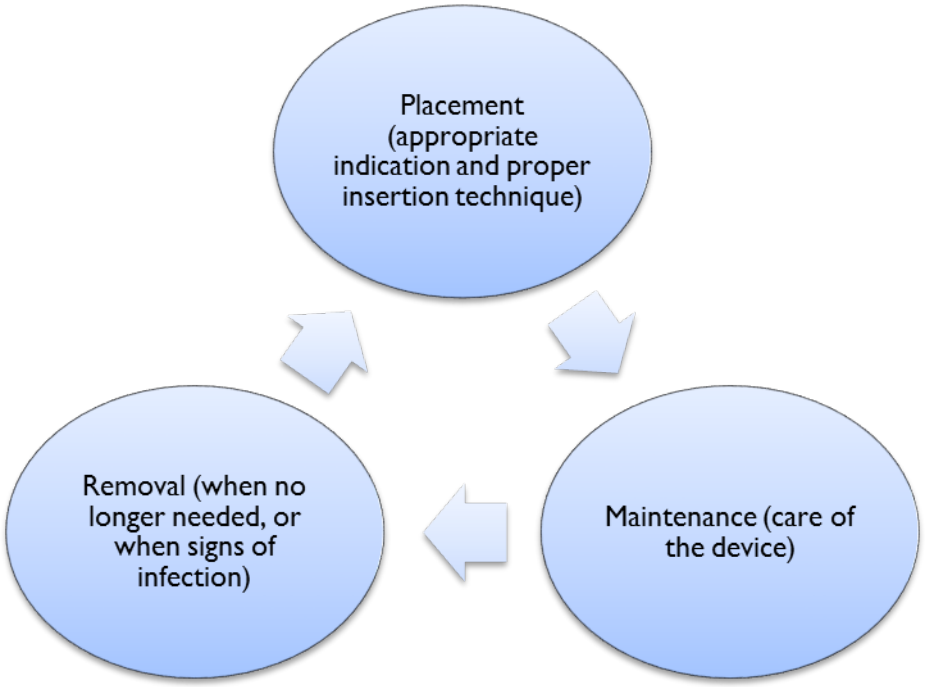
Summarizing this case, we found that the patient developed ventilator-associated pneumonia with the complication of death. This patient had low respiratory function reserve due to his underlying chronic lung disease. Potential interventions to reduce the risk of VAP include keeping the head of the bed elevated and practicing proper oral care.

Preventing Device-Associated Infections

Placement, Maintenance, and Removal

Before any procedure, the individual inserting the device needs to evaluate the indication and the potential risk associated with the device use. The device (PVC, CVC, UC, ventilator) placement should follow proper insertion technique. All devices are removed as soon as they are no longer needed or when a complication is identified (if at all possible). Evaluating the device daily for necessity will reduce unnecessary use, thus reducing the infection risk. Figure 1 illustrates the three areas of focus in reducing invasive device risk.

Figure 1. The three areas of focus to reduce device risk: placement, maintenance, and removal



Peripheral Venous Catheters

Before a PVC is inserted, an evaluation of necessity (**indication**) should be done. That is, does the care require intravenous access? Then, proper **insertion** includes the health care worker (1) performing hand hygiene before contact with patient, (2) cleansing the area where the PVC will be placed for 30 seconds with antiseptic (chlorhexidine-alcohol), (3) allowing 30 seconds for the antiseptic to dry (without fanning or blowing), (4) not contaminating the cleansed area during procedure, and (5) applying a sterile dressing securely. Complying with the five steps during the procedure will reduce the risk of introducing organisms to the PVC site, thus reducing the risk for infection. Proper **maintenance** of the PVC includes hand hygiene and scrubbing the hub with alcohol for 15

seconds before accessing the PVC or infusion of medications. Another important component of PVC maintenance is ensuring that the site does not show signs of infection or mechanical problems (phlebitis or infiltration). The PVC dressing should be intact at all times. Minimizing the risk of infectious and noninfectious complications hinges on the daily evaluation for continued need and assessment for any local signs of mechanical or infectious complications. While RPs do not routinely place PVCs, they are greatly involved in the direct daily care of patients and therefore should pay close attention to PVC sites and any related patient complaints. All PVCs placed under aseptic conditions should be changed after 96 hours of use (or per hospital policies), or if signs of mechanical or infectious problems occur. PVCs emergently placed (placed under suboptimal conditions where asepsis was not maintained during insertion) should be documented and labeled to reflect their state, then removed within 24 hours of placement. Finally, if the catheter is not needed, it should be **removed**.

Team members involved: Nurse, resident physician, intravenous therapy team, and attending physician

Central Venous Catheters

Before a CVC is placed, an evaluation of necessity (**indication**) should be done. That is, *does the care require central venous access?* Indications include (1) no feasible peripheral venous access, (2) the use of pressors and hemodynamic monitoring, and (3) the use of medications that are phlebitogenic or require central access for infusion. More recently, PICCs have become popular in the hospital setting and are used in patients who may require intravenous access for more than a week (e.g., intravenous antibiotics or total parenteral nutrition). Many CVCs are used for longer than needed, often for convenience. A CVC should be **inserted** under full barrier precautions and aseptically. Components of the insertion procedure include practicing hand hygiene, wearing a cap, mask, gown, and sterile gloves, and creating a sterile field using a large drape. The antiseptic used should be chlorhexidine-alcohol (superior to betadine for antisepsis). A chlorhexidine disc or gel may also be applied at the CVC exit site to reduce colonization risk in hospitals with persistently elevated observed CLABSI events. Using ultrasound guidance for internal jugular CVC insertion is associated with lower mechanical complications. Emergently placed CVCs (those not placed under aseptic conditions) should be labeled with plans to remove within 24 hours. **Maintenance** of the CVC includes at least daily evaluation by the RP for any local signs of infectious or noninfectious complications. Whenever the CVC is accessed, the site should be evaluated (for example, nursing should regularly evaluate the site when infusing medications). When accessing the CVC, scrubbing the hub with alcohol for 15 seconds is recommended to reduce the risk of intraluminal contamination. Another important maintenance element is ensuring the dressing is intact. The risk of CVC infection increases the longer the catheter is used. Routine catheter change is not recommended, has not been shown to reduce infection risk, and may be associated with mechanical complications. CVCs should be assessed daily (Ask: *What is the line being used for?*) and **removed** if no longer needed. In addition, high-risk lines (emergently placed or femoral site [especially in obese patients]) should be removed and lower risk alternatives used. Another opportunity to

evaluate the continued need for a CVC is at the time of transfer from the ICU to other hospital units.

Team members involved: Resident physician, nurse, intravenous therapy team, and attending physician

Urinary Catheters

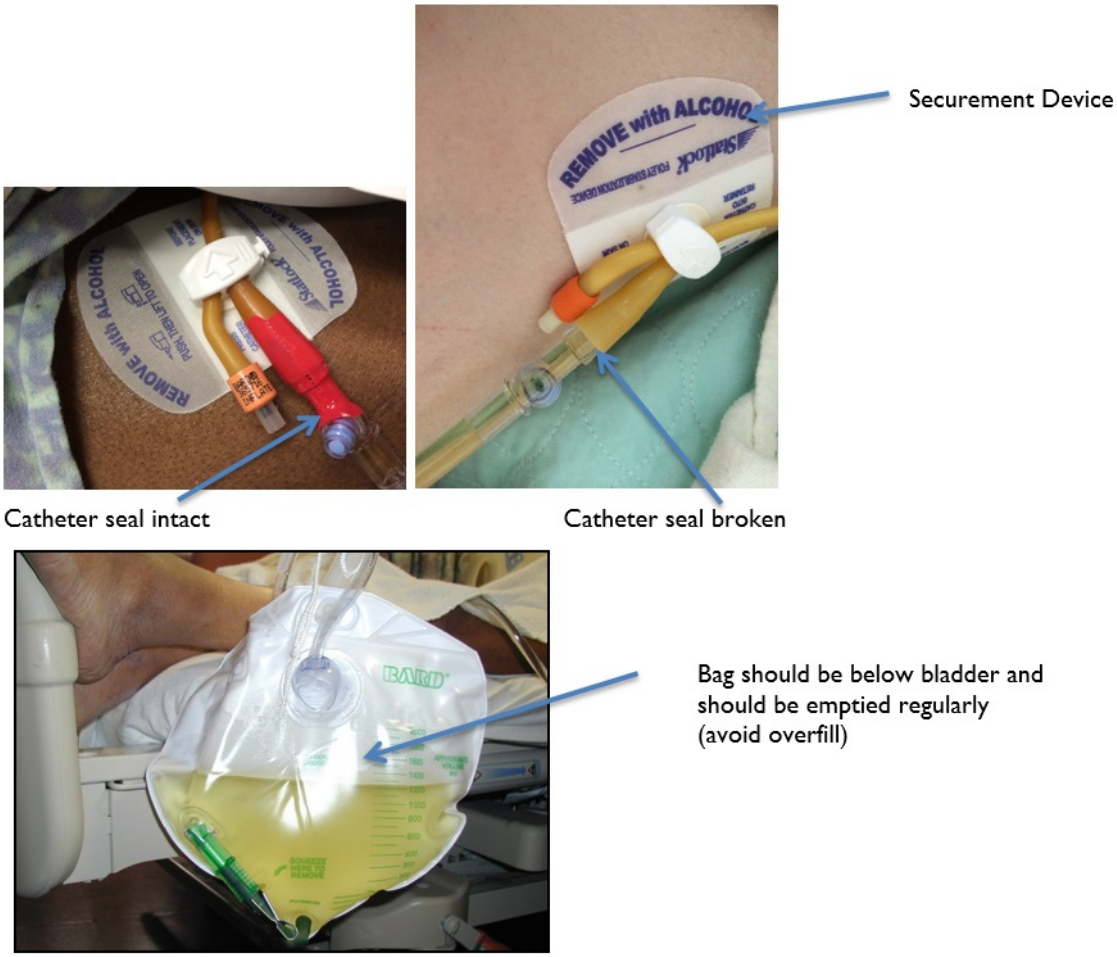
Before a UC is placed, an evaluation of necessity (**indication**) should be done (i.e., *does the patient need a urinary catheter?*). The appropriate indications are based on Centers for Disease Control and Prevention and Healthcare Infection Control Practices Advisory Committee guidelines. Appropriate indications include—

1. **Acute urinary retention or obstruction.** This includes outflow obstruction. Examples include prostatic hypertrophy with obstruction, urethral obstruction related to severe anasarca, and urinary blood clots with obstruction. Acute urinary retention may be medication induced, medical (neurogenic bladder), or related to trauma to the spinal cord.
2. **Perioperative use in selected surgeries.** Urologic surgery or other surgery on contiguous structures of the genitourinary tract are appropriate indications. In addition, anticipated prolonged duration of surgery, large volume infusions during surgery, or need for intraoperative urinary output monitoring are also acceptable. Spinal or epidural anesthesia may lead to urinary retention (prompt discontinuation of this type of anesthesia should prevent the need for urinary catheter placement).
3. **Assistance with healing of perineal and sacral wounds in incontinent patients.** This is an indication when there is concern that urinary incontinence is leading to worsening skin integrity in areas of skin breakdown.
4. **End-of-life care (hospice/comfort/palliative care).** This addresses patient comfort at end of life. Some patients may not want the catheter.
5. **Required immobilization for trauma or surgery.** Examples include an unstable thoracic or lumbar spine, multiple traumatic injuries such as pelvic fractures, and acute hip fracture with risk of displacement with movement.
6. **Accurate measurement of urinary output in critically ill patients.** This applies to patients who are critically ill and are expected to be cared for in the intensive care setting. It is important to clearly identify what is considered to be an indication for fluid monitoring in a critically ill person. A recent update of the indications published by the Society for Healthcare Epidemiology of America clarified the need as "*hourly assessment of urine output in patients in an ICU.*"

The ED, through which more than half of hospitalized patients are admitted, represents an attractive unit to prevent inappropriate placement of UCs. Before deciding on the insertion of a UC, noninvasive devices (ultrasound, a.k.a. bladder scan) may be used to evaluate for retention or bladder volume. In addition, alternatives to the UC (e.g., condom catheter or frequent toileting) may help avoid inappropriate use. If the patient has an appropriate indication for UC use, an indwelling UC is placed under aseptic conditions. Proper **insertion** includes (1) performing hand hygiene before and after placement, (2) maintaining aseptic technique and use of sterile equipment, (3) using sterile gloves, drape, an antiseptic solution for periurethral cleaning, and a single packet of lubricant for insertion, (4) using the appropriate catheter size, and (5) having all the elements needed for procedure in one

kit. **Maintenance** includes keeping a closed urinary drainage system, an unobstructed urinary flow (no kinks, urinary bag placement below bladder, and regular emptying of the urinary bag), a securement device (to reduce catheter movement and trauma risk), and an unbroken catheter seal. Figure 2 illustrates the recommendations above.

Figure 2. Urinary catheter maintenance elements to reduce complication risk



The indwelling UC may be associated with many infectious and noninfectious complications including immobility (with potential pressure ulcers and increased risk for thromboembolism), trauma, and debility. The best risk reduction strategy is to evaluate the continued need for the UC daily and promptly **remove** the device when no longer indicated. ICUs have about three to four times as high utilization of UCs compared with non-ICUs. Patient transfers from the ICU to a non-ICU represent an important opportunity to evaluate and remove UCs.

Team members involved: Resident physician, nurse, certified nurse's assistant or technician, and attending physician

Ventilators

Mechanical ventilation is **indicated** when the patient's clinical and laboratory assessments indicate the inability to sustain adequate oxygenation or ventilation. The decision to intubate and mechanically ventilate the patient is made if noninvasive positive pressure ventilation is not an option or has failed. Common indications include respiratory failure, cardiac or pulmonary arrest, laryngeal trauma or edema, and deep coma with the risk of aspiration. For intubated patients, the Society for Healthcare Epidemiology of America recommendations for VAP reduction (**maintenance**) include (1) minimizing sedation through sedation interruption *daily* with spontaneous awakening trials, *daily* assessment of readiness for extubation, and pairing breathing and awakening trials, (2) improving physical conditioning with early mobility, (3) reducing pooling of secretions above the endotracheal tube cuff using subglottic secretion drainage in high-risk patients, (4) keeping the head of the bed elevated 30–45 degrees, (5) reducing the risk of contamination and pooling in the ventilator circuit, and (6) performing regular oral care. Finally, the risk of ventilator-associated complications (infectious and noninfectious) is best mitigated by limiting the duration of mechanical ventilation (i.e., extubation [**removal**] when the patient is able to breathe without support).

Team members involved: Resident physician, attending physician, nurse, and respiratory therapist

Resident Physicians as Safety Champions

Patients may be exposed to multiple devices (PVCs, CVCs, UCs, and ventilators) at any time. We underscore the importance of collaboration among the interprofessional team to create a safer environment for patients. Engagement of the interprofessional team at the hospital level is essential to improve patient safety and reduce hospital-acquired infections and other safety events. Team members may include resident physicians, attending physicians, nurse leaders, staff nurses, infection preventionists, respiratory therapists, and ancillary personnel.

RPs play an essential role as champions for device safety by promoting best practices, identifying barriers, and developing solutions with various stakeholders. Modeling behaviors to minimize device risk is crucial.

The goal is for every RP to own the process of evaluating the daily need and risk of all invasive devices as part of their patient care.

Resident Physicians as Champions

Successful champions are those who believe in safety efforts, have recognition and respect from and for their co-workers, and are early adopters of change. RPs play a pivotal role in patient management and safety in U.S. teaching hospitals. They are likely to be very involved in the decision to use invasive devices, place them, and decide on the duration of use.

The Clinical Learning Environment Review (CLER), RPs, and safety: The recently implemented CLER underscores the importance of both quality and safety in the RP's learning environment. CLER was established by the Accreditation Council for Graduate Medical Education and is designed to provide institutions with periodic feedback that addresses patient safety, health care quality, care transitions, supervision, duty hours and fatigue management and mitigation, and professionalism for resident training. The seven pathways of the safety components include education on patient safety, promotion of a culture of safety, resident and fellow experience in patient safety investigations, and monitoring of resident, fellow, and faculty engagement in patient safety.

In addition to learning disease management and methods to optimize clinical outcomes, RPs are expected to learn, promote, and enhance safe care. Part of the RPs' training is to be educated on best practices. Examples include appropriate indications for devices, proper placement techniques, maintenance, and regular evaluation of device risk and necessity. Engaging their faculty, nurses, and other supporting services will improve the RPs' learning experience, solidify their approach to safety, and favorably influence other health care workers' behaviors.

RPs have the opportunity to be the quality and safety champions for every patient they care for by integrating patient safety and disease management into the daily workflow of clinical care. Integration of concepts and tools from Team Strategies to Enhance Performance and

Patient Safety (TeamSTEPPS®) and the Comprehensive Unit-based Safety Program (CUSP) provide the RP with strategies for addressing patient issues. Some of the RP (as a champion) *functions* include—

Leading Teams

Team leaders are well-informed team members who make decisions and take actions. Team leaders establish the goals of the team and help maintain its focus. The RP can—

- Monitor the plan of care and the surrounding situation to better anticipate the patients' and staffs' needs
- Facilitate information sharing among team members by—
    - Sharing patient stories about where harm was averted
    - Explaining the significant risks associated with devices
    - Providing examples of poor patient outcomes related to not following best practices
    - Conducting a brief at the beginning of a shift to communicate with team members the goals for each patient and the plan of care
    - Convening a huddle to communicate adjustments to a plan of care
- Encourage team members to assist one another when needed
- Facilitate conflict resolution
- Model effective teamwork

Coaching

Coaches play a critical role in the success of patient safety implementation and sustainment efforts. The RP can—

- Build consensus among key stakeholders to support use of best practices
- Observe and provide feedback to staff
- Offer support when challenges are encountered
- Facilitate sustained motivation for the implemented changes
- Identify barriers to implementing best practices
- Develop solutions by partnering with other stakeholders

Communicating

Effective communication skills are vital for patient safety and interplay directly with leading teams and coaching. Failure to communicate effectively significantly increases the risk of error. The RP can—

- Use the check-back method to verify and validate information is exchanged in the way in which it is intended
- Implement a patient handoff to ensure continuity of care is maintained
- Utilize a standard framework for communicating pertinent patient information such as Situation-Background-Assessment-Recommendation (SBAR)

Situation Monitoring

Situation monitoring is a way for team members to be aware of what is going on around them, enabling individuals to adapt to changes in the situation. The RP can—

- Maintain the focus on patient safety through reducing device risk
- Observe actions of fellow team members to gain an accurate understanding of the care environment

Mutual Support

Mutual support provides a safety net to help prevent errors, increase effectiveness, and minimize individual pressure. The RP can—

- Engage in dialogue with the members of the care team as a means to provide feedback and establish patient care goals
- Foster a climate that allows for open communication about unsafe situations

Incorporating Device Evaluation Into Daily Work

Resident Physicians

RPs should incorporate the presence of invasive devices (PVCs, CVCs, UCs, or ventilators) into their daily patient care, including the evaluation of risk and necessity. The evaluation of devices should be similar to the evaluation of respiratory or cardiac function, or the evaluation of the daily laboratory values. Including this in daily patient evaluation highlights the importance of promptly addressing device utilization and any safety issues related to device use.

The two main unit types in the hospital are ICUs and non-ICUs. Device use is higher in the ICU setting due to the severity of illness, which translates to a potentially greater risk of safety events in that environment.

There are at least two opportunities every day for RPs to evaluate devices for use and risk. The first opportunity is during morning patient evaluation. **The junior RP** typically does this as part of clinical care, during evaluation of any changes in condition, review of medications, vital signs, and laboratory results. During patient evaluation, any device which is no longer necessary or which poses a high risk for infection or complications should be considered for removal.

The other opportunity is during daily team or multidisciplinary rounds. This occurs in the presence of the attending physician or intensivist, the nursing staff, and other supporting services. Creating an environment that supports situation monitoring will enable the team to anticipate and predict the needs of the patient and fellow team members.

During rounds, **the senior RP** may act as the champion by asking questions such as, "Are there any devices in use? Is there a continued need for the device? Do we have any safer alternatives?"

This mutual understanding provides team members with a common understanding of who is responsible for what task and what information is necessary to guide care decisions, which creates accountability at the individual and team level. For example, a CVC placed in the femoral area or inserted without asepsis or under suboptimal conditions (i.e., "emergently placed") needs to be removed promptly, thereby eliminating the risk whenever possible. The senior RP makes sure all RPs involved in placing CVCs adhere to complete barrier precautions, ensuring aseptic insertion. Intubated patients should be evaluated daily for readiness to wean from the ventilator and extubation. Finally, the senior RP will trigger the questions during multidisciplinary rounds about whether there are appropriate indications for continued UC use in patients who show signs of improvement. If a senior RP is not part of the multidisciplinary team, the attending physician needs to ask the questions about these devices (CVCs, ventilators, PVCs, and UCs). In that case, the RP should communicate with the attending about device use and indications before multidisciplinary rounds.

Supporters of Resident Physicians

Engaging members of the interprofessional team will help sustain the effects and success of the device evaluation initiative. An actively involved team is essential to spread the intervention and sustain the gains.

Intensivists and **attending physicians (or faculty)** ensure that RPs are supported in their role to reduce device risk. They oversee the RPs' performance and education, and they are the "captain of the ship" and have the ultimate responsibility for care. Participating in the daily rounds, the intensivist or other faculty needs to evaluate all CVCs, ETs, PVCs, and UCs as part of the routine daily care.

The **nurse leader** (nursing director or manager) partners with the different stakeholders and addresses the processes that ensure the risk of infection is reduced in the unit. For example, the nurse leader will evaluate the competencies of the nursing staff who place and maintain PVCs and UCs. Other examples include evaluations of compliance with infection risk reduction strategies (e.g., use of low-risk catheters, dressing intactness, head-of-bed elevation).

Nurses are responsible for placement of PVCs and UCs and maintenance of all devices, including CVCs and ventilators. Nurses are very important in supporting compliance with correct processes and practices.

1. CVC placement: The nurse documents that the operator placing the CVC complies with all the steps of the central line checklist (i.e., adherence to complete barrier precautions). S/he will maintain situation awareness during the CVC insertion, stop the procedure if there is a break in sterile technique, and assert the proper technique to reduce risk.
2. PVC placement: PVC placement is generally a nursing function. Compliance with all of the steps to ensure that the procedure is done aseptically is very important to reduce risk.

3. Maintenance of venous catheters: CVCs and PVCs are accessed multiple times daily. With each access there is a risk of introducing organisms. Ensuring appropriate line care and dressing intactness are nursing functions that are important to reduce infection risk.
4. UC placement: Nurses or technicians (with the nurse's oversight) may place UCs. Compliance with proper insertion technique is important to reduce the risk.
5. UC maintenance: Nurses and technicians maintain the UCs. Compliance with proper maintenance (keeping the system closed with a securement device) is important to reduce the risk of introducing organisms.
6. Ventilator maintenance: The ICU nurse maintains the closed ventilator system of intubated patients. In addition, the ICU nurse should champion oral care-related work and keep the head of the bed elevated to reduce the risk of aspiration (lower risk of VAP).

Infection prevention plays a consulting and facilitating role to support the effort. Infection preventionists are considered content experts in infection prevention and play a role in educating physicians, nurses, respiratory therapists, and other disciplines on following standard processes and reducing infection risks. They may consider unannounced audits to evaluate compliance with processes of care. They use various sources of information to review outcomes, compare to benchmarks of care, and identify potential areas for improvement as well as share feedback with the team regularly.

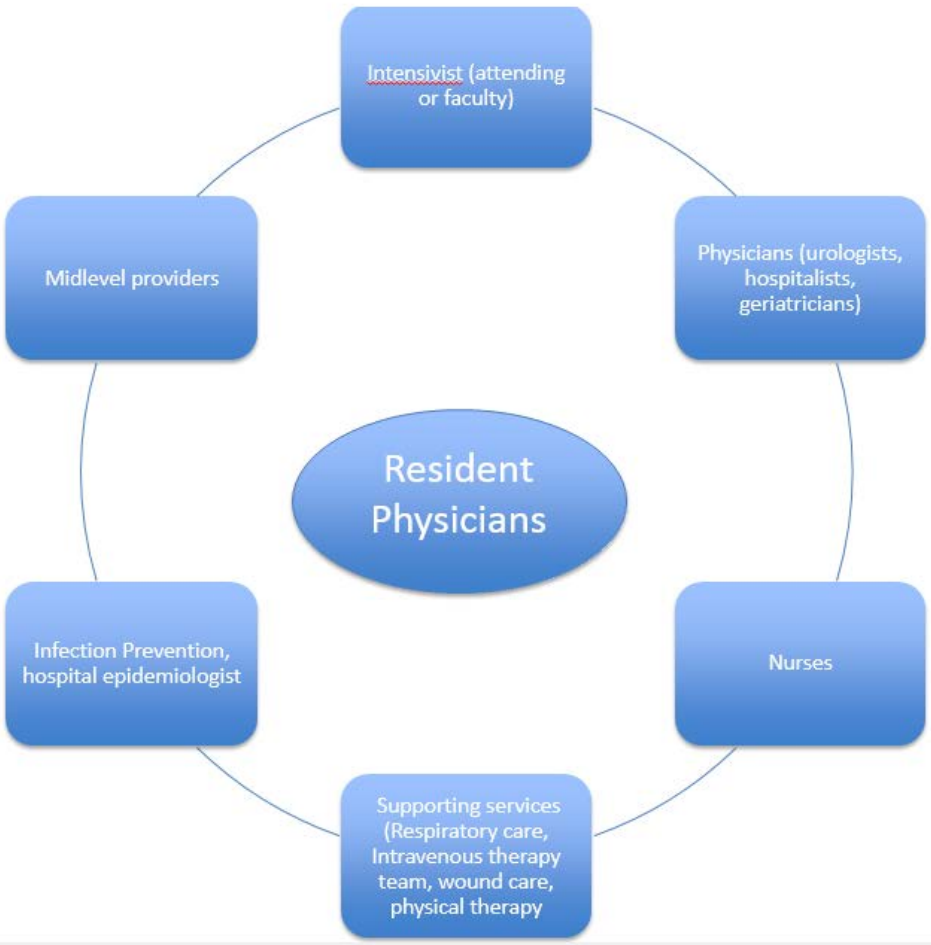
Respiratory care: The respiratory care leader will work with respiratory therapists to support evaluating the intubated patients for the possibility of weaning and readiness to extubate, in addition to promoting mechanisms to keep the ventilator closed system intact.

Other physicians: All physicians need to evaluate their patients daily for the presence of and need for devices. The structure of ICUs differs depending on the hospital. Some hospitals have a closed ICU, where the intensivist is key to implement changes, but others are open ICUs. In open ICUs, many physicians may be able to affect patient care. Hospitalists or other attending physicians play a very important role in daily device evaluations outside of the ICU. They will advocate for the use of lower risk devices or removal of unnecessary devices. Urologists may play a supporting role especially in discouraging unnecessary UC use (urologists are important stakeholders who end up addressing many noninfectious adverse outcomes of the UC).

Other supporting services: Other supporting services may help the effort to reduce device risk by encouraging health care workers to evaluate need. For example, wound care nurses and physical therapists would discourage UC use to reduce the risk for immobility and falls. The intravenous therapy team may help identify areas for improvement related to venous catheters and support nursing education. Respiratory therapists may trigger assessments for weaning of mechanical ventilation. Supply chain personnel can help with product selection.

Figure 3 below summarizes how the RP as a safety champion interacts with other stakeholders (or supporters) to reduce device infection risk in the different units.

Figure 3. Interaction between RP and other stakeholders



Differences Between the Units

Intensive Care Units

ICUs have high prevalence of device use (CVCs, UCs, and ventilators). Equally important is the use of PVCs in the ICUs, although often PVCs are not given much attention because surveillance is not required for PVCs. Many ICUs may have dedicated teams responsible for the care of the patients ("closed units"). Often, multidisciplinary rounds function to evaluate risk reduction efforts and device need. RPs, an integral part of the multidisciplinary rounds, may function as the champions to evaluate the device risk and need and promptly remove devices that are no longer needed. Additional stakeholders,

including the intensivists, nurses, other physicians and ancillary services, may play the role of the RP supporters.

Non-Intensive Care Units

The non-ICU setting usually represents 70–80 percent of the inpatient units. Although the prevalence of device use (CVCs, UCs) is lower than in the ICU, it is still significant in determining total device days. In addition, the non-ICU typically does not have physicians who are responsible for individual units (as opposed to the ICU). At some hospitals, unit-based multidisciplinary rounds may not include physicians. The RP should ensure that non-ICU patients are evaluated for device safety as part of their routine care. This includes evaluating the device risk and necessity.

Other Units To Evaluate

Other units where devices are placed and maintained include the **ED** and the **OR**. Up to 50 percent of admissions to the hospital are through the ED, and PVCs are universally placed there. In addition, short-term CVCs may also be placed, many of them under suboptimal conditions. The ED, too, represents an area where large numbers of UCs are placed, and many of them may not be appropriately indicated. ED process improvements may positively affect patient outcomes hospitalwide. When working with the ED, engaging both physician and nurse leaders is essential to success. RPs in the ED can ensure both device appropriateness and proper insertion.

The OR represents another area where CVCs and UCs are commonly placed. Ensuring appropriate use of UCs and proper insertion techniques for both CVCs and UCs is important to reduce the risk. For interventions in the OR, engaging the surgical RPs, the attending surgeons, and anesthesiologists will help improve care and outcomes.

Sustainability

Sustainability is defined as maintaining and improving the desired benefits of the program. This is achieved when the program becomes institutionalized and loses its separate identity. Device safety evaluation becomes part of the regular activities of all RPs and would be incorporated into their training and competencies. How would this be achieved?

1. Educate faculty on the importance of device safety and risk
2. Incorporate education about device safety into resident training (yearly for all RPs)
3. Incorporate the evaluation of device risk and need into the rounding process for all teams that involve RPs
4. Provide regular feedback to RPs and faculty on device use and device complications (at least quarterly)
5. Collaborate to identify defects. Consider using the Learn From Defects tool from the CUSP Toolkit to assess where defects occur and to develop an action plan to correct them
6. Provide RPs with information on adverse outcomes associated with their placement of devices (e.g., a CLABSI after an RP places a CVC)
7. Provide infection prevention orientation monthly for all RPs working in high-risk units (i.e., ICU)
8. Encourage partnership of RPs with all other stakeholders regarding device safety
9. Implement a patient handoff to ensure continuity of care is maintained
10. Include a standard framework for communicating pertinent patient information

Preventing CAUTI: Focus on Culturing Stewardship

When evaluating patients for infection, it is essential to first consider potential sources of infection. Many clinical sites (sputum, urine, wounds, or ulcers) are not sterile. Isolating an organism from a nonsterile site does not equate to infection and may lead to inappropriate antimicrobial use. For example, a positive sputum culture reflects the organism's colonization of the respiratory tract and not pneumonia, unless it is associated with other clinical and radiographic findings. Similarly, obtaining a blood culture from a CVC poses the risk of isolating a contaminant or colonizing a catheter hub (unless paired blood cultures are done with an evaluation of time to positive blood cultures). Similarly, many patients may have asymptomatic bacteriuria (especially the elderly), and a positive urine culture is not necessarily indicative of a urinary tract infection especially in patients with indwelling UCs.

Obtaining any culture needs to be based on a suspicion of infection of the site cultured. Cultures from nonsterile sites may trigger inappropriate antimicrobial use and risk patient harm.

Why Send Urine Cultures Only When Necessary?

Obtaining urine cultures in patients with indwelling UCs can lead to inadvertent increased antimicrobial use, thus resulting in more antimicrobial resistance, *Clostridium difficile* infection, and adverse drug effects. Thus, the appropriate use of urine cultures enhances patient safety. In addition, the inappropriate use of urine cultures may lead to an increase in observed CAUTI events based on surveillance definitions, although not clinically relevant. Since the presence of bacteriuria is one of the elements necessary for the National Healthcare Safety Network (NHSN) definition of CAUTI, obtaining unnecessary urine cultures in the presence of fever attributed to another source may falsely increase the NHSN CAUTI rate, thereby overestimating CAUTI events. In addition, CAUTI is publicly reported, and patients will be able to compare hospitals based on their CAUTI rates. Patients may perceive hospitals with higher CAUTI rates as providing less than optimal care. The practice of obtaining urine cultures without appropriate indications may falsely increase the publicly reported CAUTI rates, even if the patients do not have clinical signs and symptoms.

Indications for Urine Cultures

Many clinicians order urine cultures in catheterized patients who are asymptomatic. There are very few indications for urine cultures in asymptomatic catheterized patients. The Infectious Diseases Society of America (IDSA) indications for screening patients for bacteriuria are (1) prior to transurethral resection of the prostate, (2) before urologic procedures in which mucosal bleeding is anticipated, and (3) in pregnant women (once in early pregnancy). Obtaining urine cultures in other groups of asymptomatic patients is not recommended. For example, urine cultures should not be done on asymptomatic nonpregnant women, patients with diabetes, elderly patients, patients with a spinal cord

injury, or patients with an indwelling UC. Certain groups of patients have a high incidence of asymptomatic bacteriuria (but do not have an active infection). For example, up to 15 percent of elderly women in the community have asymptomatic bacteriuria; this increases to 25–50 percent in elderly female residents of long-term care facilities. In addition, bacteriuria is universal in patients with an indwelling UC for more than 1 month. The high prevalence of bacteriuria in certain populations may be associated with a misdiagnosis of CAUTI and inappropriate antimicrobial use if urine cultures are obtained without a pertinent reason.

What Triggers Urine Cultures?

Obtaining urine cultures depends on the current practice at the hospital. Practices such as "screening culture on admission" and "standing orders" or "reflex orders" for urine cultures based on urinalysis results may lead to inappropriate urine culture and unnecessary antimicrobial use. These practices may increase utilization of additional resources (testing, antibiotics, consultations), and adversely affect patients by exposing them to inappropriate testing and treatments. Physicians tend to treat for CAUTI inappropriately in older patients and in those with gram-negative organisms in the urine or higher numbers of white cells. The IDSA guidelines discourage the use of pyuria, urine odor, color, or turbidity to trigger urine cultures. Multiple studies have shown no relationship between pyuria and symptomatic CAUTI, making the presence of white cells in urine **not** useful in evaluating for catheter-associated bacteriuria or CAUTI. On the other hand, a urinalysis devoid of white cells may be a good predictor of the absence of bacteriuria in catheterized patients.

How To Reduce Unnecessary Urine Cultures?

We suggest doing the following:

1. Discourage automatic or reflex culturing. Ordering cultures should be based on the clinical evaluation of the patients for potential sources of sepsis.
2. Provide education about when it is appropriate to obtain urine cultures in patients with an indwelling UC to physicians, midlevel providers, and nurses (see suggestions in table below).
3. Have periodic audits on urine culture use in the ICUs to look for trends, especially if CAUTI rates are not dropping with interventions focused on improving insertion and maintenance.
4. Promote appropriate UC use to reduce risk of bacteriuria and symptomatic CAUTI (no catheter, no CAUTI).
5. Use UCs only based on appropriate indications (with prompt removal when they are no longer needed). The absence of the catheter reduces the risk of bacteriuria and the likelihood of obtaining a urine culture without an appropriate reason.

What To Do With Positive Urine Cultures?

The best way to avoid inappropriate antimicrobial use is not to obtain a urine culture unless indicated. Treatment with antimicrobials should be discouraged in cases where a urine culture turns positive in a catheterized patient who has no symptoms or signs of

infection. The IDSA guidelines strongly discourage the use of antimicrobials for asymptomatic bacteriuria except for patients undergoing urologic procedures or who are pregnant.

In patients with symptoms, the IDSA guidelines list "signs and symptoms compatible with CAUTI include new onset or worsening of fever, rigors, altered mental status, malaise, or lethargy with no other identified cause; flank pain; costovertebral angle tenderness; acute hematuria; pelvic discomfort; and in those whose catheters have been removed, dysuria, urgent or frequent urination, or suprapubic pain or tenderness." Local signs are rarely documented, which makes the clinical diagnosis of CAUTI mainly a diagnosis by exclusion of other sources of infection.

Table 1 below summarizes situations when urine cultures should or should not be obtained in the catheterized patient.

Table 1. When To Obtain or Not Obtain a Urine Culture in a Patient With an Indwelling Urinary Catheter

Discourage Urine Culture Use	Appropriate Urine Culture Use
Urine quality: color, smell, sediments, turbidity (these characteristics *do not* constitute signs of infection)	Part of an evaluation of sepsis without a clear source (CAUTI is often a diagnosis by exclusion)
Screening urine cultures (whether on admission or before nonurologic surgeries)	Based on local findings suggestive of CAUTI (example, pelvic discomfort or flank pain)
Standing orders for urinalysis or urine cultures without an appropriate indication	Prior to urologic surgeries where mucosal bleeding anticipated or transurethral resection of prostate
Automatic or reflex culturing (mindfulness in evaluating source is key)	Early pregnancy (avoid urinary catheters if possible)
Obtaining urine cultures based on pyuria in an *asymptomatic* patient	
Asymptomatic elderly and diabetics (high prevalence of asymptomatic bacteriuria)	
Repeat urine culture to document clearing of bacteriuria (no clinical benefit to patients)	

Tools To Help Mitigate Device Risk

Resident Physician Device Risk Checklist

Device			Action Taken (if necessary)
Urinary Catheter			
Appropriately indicated?[a]	Yes	No	
Catheter secured?	Yes	No	
Bag below bladder?	Yes	No	
Mechanical Ventilation			
Head of bed elevated ≥ 30°?	Yes	No	
Evaluated for a sedation vacation trial today?	Yes	No	
Evaluated for a weaning trial today?	Yes	No	
Ready to be extubated today?	Yes	No	
Peripheral Venous Catheter (PVC)			
Dressing intact?	Yes	No	
Site: no redness or drainage?	Yes	No	
Need: line still necessary?	Yes	No	
Central Venous Catheter (CVC)			
Dressing intact?	Yes	No	
Site: dry and no erythema?	Yes	No	
Need: line still necessary?	Yes	No	
For High-Risk PVCs and CVCs			
Emergently placed line?[b]	Yes	No	
Femoral line?[b]	Yes	No	

[a]The appropriate indications for urinary catheter include: urinary flow obstruction or retention, perioperative use in selected surgeries, need for prolonged immobilization, monitoring fluids in critically ill patients, assist healing of sacral and perineal wounds in those with incontinence, or improve comfort at end of life care.

[b]Femoral lines or emergently placed (not aseptically) CVCs need to be promptly removed to reduce infection risk.

Resident Physician Device Risk Pocket Card

PREVENT DEVICE-ASSOCIATED INFECTIONS

EVALUATE ALL DEVICES DAILY!

Indwelling devices that HEAL may also HARM! Use them only when necessary.

ask ?

- What is the INDICATION for the device?
- Can the device be DISCONTINUED?
- Is there a less risky ALTERNATIVE?

Urinary Catheters

Appropriate Urinary Catheter Indications

1. Acute urinary retention or obstruction
2. Perioperative use in selected surgeries
3. Assist healing of severe perineal and sacral wounds in incontinent patients
4. End-of-life care for comfort
5. Required strict immobilization for trauma or surgery
6. Accurate measurement of hourly urinary output in critically ill patients (ICU only)

Placement and Maintenance

1. Use aseptic technique when inserting urinary catheters
2. Avoid opening the closed urinary catheter system
3. Make sure the urinary catheter has a securement device
4. Avoid looping or kinking of catheter

Keep the urinary bag lower than the patient's bladder

PREVENT DEVICE-ASSOCIATED INFECTIONS

EVALUATE ALL DEVICES DAILY!

Central Venous Catheters

1. Use complete sterile barrier precautions (CAP, GOWN, MASK, & FULL DRAPE) and chlorhexidine-alcohol antisepsis for central line insertion
2. Scrub the hub with an alcohol swab for 15 seconds EVERY TIME you access the line
3. Keep dressings intact at all times
4. Avoid femoral lines and remove them ASAP
5. Remove emergently placed lines within 24 hours

Mechanical Ventilation

1. Evaluate for sedation vacation and weaning trials for patients on mechanical ventilation DAILY
2. Keep the head of the bed elevated at least 30 degrees on all intubated patients
3. Perform oral care for your patients every 12 hours

Culturing Stewardship

- No automatic or reflex culturing Catheterized patients: cloudy, dark, smelly urine ≠ CAUTI
- Intubated patients: do not obtain sputum culture unless signs suggestive of pneumonia

CUSP Toolkit

The CUSP Toolkit includes training tools to make care safer by improving the foundation of how physicians, nurses, and other clinical team members work together. It builds the capacity to address safety issues by combining clinical best practices and the science of safety.

Specific tools that may be helpful are—

- Learning From Defects Tool
- Coordinating a Morning Briefing
- Team Checkup Tool

The CUSP toolkit can be accessed via the Agency for Healthcare Research and Quality (AHRQ) Web site.

TeamSTEPPS

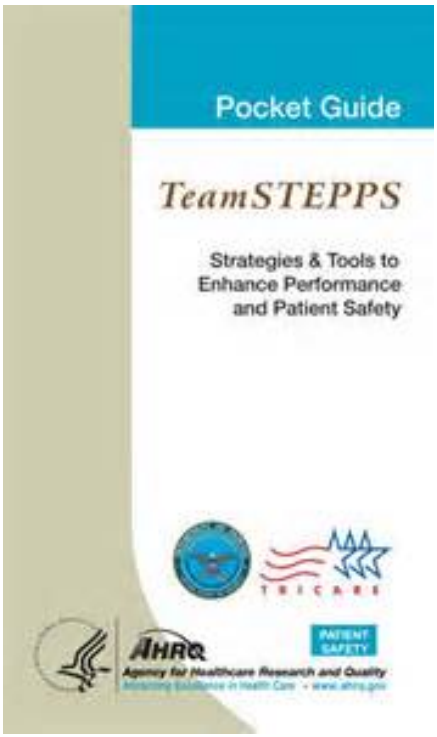
The Department of Defense and AHRQ developed TeamSTEPPS as a means to improve efficiency, quality and safety in health care.

Specific tools that may be helpful are—

- TeamSTEPPS Pocket Guide (see below)
- The Quick Reference Guide to TeamSTEPPS Action Planning

The TeamSTEPPS materials can be accessed via the AHRQ Web site.

Example of TeamSTEPPS Pocket Guide



Leadership

Team Events

Planning

- **Brief** - short session prior to start to discuss team formation; assign essential roles; establish expectations and climate; anticipate outcomes and likely contingencies

Problem Solving

- **Huddle** - Ad hoc planning to reestablish situation awareness; reinforcing plans already in place; and assessing the need to adjust the plan

Process Improvement

- **Debrief** - Informal information exchange session designed to improve team performance and effectiveness; after action review

Brief Checklist

During the brief, the team should address the following questions:

- ☐ Who is on the team?
- ☐ All members understand and agree upon goals?
- ☐ Roles and responsibilities are understood?
- ☐ What is our plan of care?
- ☐ Staff and provider's availability throughout the shift?
- ☐ Workload among team members?
- ☐ Availability of resources?

11

Leadership

Plan To Help Incorporate the Role of Champions for Resident Physicians

1. Engage program directors of the different specialties and discuss the importance of addressing device safety as an integral aspect of RP training
2. Identify faculty interested in supporting the education
3. Distribute the toolkit to all RPs and faculty
4. Provide formal lectures to address device risk, especially the UC, for both RPs and faculty
5. Encourage incorporating daily device evaluation into team rounds (i.e., when both residents and faculty discuss patient care)
6. Provide regular feedback to RPs on their performance (both device use and adverse outcomes associated)

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Teamwork and Communication

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Appendix A. Teamwork and Communication Definitions and Tools

Definitions

Brief: A short session prior to discuss team formation, assign essential roles, establish expectations and climate, and anticipate outcomes and contingencies.

Check-Back: Closed-loop communication strategy to verify and validate information exchanged. This strategy involves the sender initiating a message, the receiver accepting the message and confirming what was communicated, and the sender verifying that the message was received.

Handoff: The transfer of information (along with authority and responsibility) during transitions in care across the continuum; includes an opportunity to ask questions, clarify, and confirm.

Huddle: Ad hoc planning to reestablish situation awareness, reinforce the plan already in place, and assess the need to adjust the plan.

Mutual Support: Ability to anticipate and support other team members' needs through accurate knowledge about their responsibilities and workload.

SBAR: A communication technique that provides a standard framework for information sharing.

S	Situation – What is happening with the patient? A concise statement of the problem.
B	Background – What is the background information that is pertinent to the situation?
A	Assessment – What did you find? Analysis and considerations of options and risks.
R	Recommendation/Request – What action/recommendation is needed to correct the problem? What do you want to happen by when?

Situation Monitoring: Process of actively scanning and assessing situational elements to gain information and understanding, or maintain awareness to support functioning of the team.

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