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WY Infection Prevention Orientation Manual

Section #13, Current Infection Prevention Issues in Dialysis

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Table of Contents

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Objectives

At the completion of this module the IP will:

- Identify why dialysis patients are at high risk for infections, particularly blood stream infections.
- Identify an array of infection prevention practices aimed to prevent/decrease infections in the end-stage renal disease (ESRD) population including:
  - Hand hygiene
  - Personal protective equipment
  - Preventing bloodstream infections
  - Multi-Drug Resistant Organisms
  - Hepatitis Prevention
  - Environmental Hygiene
  - Injection Safety
  - Water Treatment
- Assemble a list of relevant and current materials related to the above, to serve as a resource for the dialysis facility.
- Visit the hemodialysis unit to understand the processes and procedures required for compliance with the current Centers for Medicare and Medicaid Services (CMS) Conditions for Coverage of ESRD Facilities.

Number of hours

- Key Concepts - 10 hours

Required Readings

- ESRD Program Interpretive Guidance, related to the Conditions for Coverage for ESRD Facilities. Review patient safety regulations related to infection control § 494.3-494.6. Available at: www.esrdnet15.org/InterpGuides_10_3_08.pdf
- Kallen AJ, Arduino MJ, Patel PR. Preventing Infections in Patients Undergoing Hemodialysis . *Expert Rev Anti Infect Ther.* 2010: 8 (6), 643-655. Available at: www.medscape.com/viewarticle/723600
- Centers for Disease Control and Prevention. Recommendations for preventing transmission of infections among chronic hemodialysis patients *MMWR Morb. Mortal. Wkly Rep*. 2001: 50(RR-5), 1-43. Available at: www.cdc.gov/mmwr/preview/mmwrhtml/rr5005a1.htm
- Infection Prevention in Dialysis Settings. Available at: www.cdc.gov/dialysis/clinician/CE/infection-prevent-outpatient-hemo.htm
- Grota P, Allen V, Boston KM, et al, eds. *APIC Text of Infection Control & Epidemiology. 4th Edition.* Washington, D.C.: Association for Professionals in Infection Control and Epidemiology, Inc.; 2014.
  - Chapter 39, Dialysis, by S Garcia-Houchins
  - Chapter 115, Water Systems Issues and prevention of waterborne Infectious Diseases in Healthcare Facilities, by L Dickey

- APIC Guide to the Elimination of Infections in Hemodialysis 2010 Recommendations. Available at: www.apic.org/Resource_/EliminationGuideForm/7966d850-0c5a-48ae-9090-a1da00bcf988/File/APIC-Hemodialysis.pdf

Hand Hygiene and Personal Protective Equipment (PPE)

- CDC. Guide to Infection Prevention For Outpatient Settings: Minimum Expectations for Safe Care. Available at: www.cdc.gov/HAI/pdfs/guidelines/standatds-of-ambulatory-care-7-2011.pdf

Environmental Hygiene

- Environmental Surface Disinfection in Dialysis Facilities: Notes for Clinical Managers. Available at: www.cdc.gov/dialysis/PDFs/collaborative/Env_notes_Feb13.pdf

Multi-Drug Resistance Organisms

- Infection Control Today, Primer on Hospital Pathogens: A Review of Key Bugs and the Need for Environmental Hygiene. Available at: sd.infectioncontroltoday.com/digital-issues/2014/01/hospital-pathogens.aspx?cmpid=SURFACEDIMA

Water Treatment

- ESRD Program Interpretive Guidance Conditions for Coverage for ESRD Facilities. Review § 494.4 related to water treatment. Available at: www.esrdnet15.org/InterpGuides_10_3_08.pdf
- Curtis, J. Dialysis Water Training Class. Available at: www.fmqai.com/library/attachment-library/7WaterSystems.pdf
- Water Treatment in the Dialysis Unit. *Renal Business Today*. Available at: www.renalbusiness.com/articles/2010/01/water-treatment-in-the-dialysis-unit.aspx?pg=3#content

Overview

The renal Networks are tasked with maintaining and updating the renal database for both the United States and its territories. Data from U.S. renal Networks show that the number of patients with ESRD treated by maintenance hemodialysis has increased sharply during the past 35 years. Patients undergoing dialysis are at high risk for healthcare-associated infections for a variety of reasons, including:

- Frequent manipulation of the vascular access used to perform dialysis
- Medications which lead to immunosuppression
- High incidence of diabetes as a co-morbidity
- Patient's propensity for malnourishment
- Patients may require frequent hospitalization which increases the opportunities for healthcare-associated infections
- Hemodialysis environment logistics
  - Open environment-one large area
  - Close proximity of other patients and staff during the dialysis procedure
  - Unit schedules-up to 4 shifts per day with patients following each other in the same chair, using the same machine with different disposables
  - Dialyzer reuse for the same patient

Person to person transmission of pathogens is the most frequent route of transmission of infection in the dialysis unit. This contact transmission occurs most frequently when staff members do not follow infection prevention precautions and procedures. In addition to standard infection prevention processes in place in the hospital setting, additional precautions are required in the dialysis setting due to the increased potential for contamination from blood and pathogenic organisms.

For patients receiving dialysis, fungal, viral, and bacterial infections are of concern. Historically, surveillance focused on viral hepatitis, specifically hepatitis B infections. In recent years, hepatitis C and HIV have emerged as ongoing concerns in the population of patients receiving hemodialysis. The Centers for Disease Control and Prevention (CDC) provides guidance on surveillance for these viral infections as well as precautions that the dialysis facility must take to protect patients and staff members.

Bacterial infections, particularly those involving the patient's vascular access, frequently cause the loss of the vascular access, hospitalization, and in some cases death. The increase use of central venous catheters (both temporary and permanent) correspondingly increases the patient's probability of bacterial infections and blood stream infections. Every effort should be made to convert the patient's temporary central venous catheter to a permanent vascular access as soon as possible.

The CMS Conditions for Coverage for Dialysis outline the responsibilities facilities must adhere to in order to prevent infections in the dialysis environment. By regulation, facilities must also follow the CDC recommendations for preventing transmission of infections among chronic hemodialysis patients. Rigorous adherence to infection prevention practices can greatly influence infection rates for patients undergoing dialysis.

Infections in the dialysis setting may be a significant cause of hospitalization and increased mortality. Encouraging staff, patients, and families to follow good infection prevention procedures will decrease potential adverse outcomes for patients.

A typical dialysis patient undergoes 156 dialysis treatments per year, during which they have two large bore needles inserted into their vascular access, putting them at risk for bloodborne pathogen exposure approximately 312 times. Multiply that by the number of patients receiving dialysis at a facility and the risk of patients or staff contracting a bloodborne pathogen increases exponentially.

Key Concepts

Hand Hygiene

Hand hygiene is widely recognized as the single most important intervention in preventing healthcare-associated infections. Hand hygiene is a general term that applies to hand washing, antiseptic hand-wash, antiseptic hand rub or surgical hand antisepsis. Hand hygiene is performed using either soap and running water (if hands are visibly soiled), or with alcohol rub (if hands appear clean). According to the CDC improved adherence to hand hygiene has been shown to reduce infection outbreaks, transmission of antimicrobial resistant organisms and overall infection rates in all healthcare settings.

Contact transmission or touch is the most common mode of pathogen transmission in health-care settings, including hemodialysis units. Contact transmission occurs when microorganisms from a patient are transferred to the hands or gloves of a health-care worker who fails to follow infection prevention practices, and then touches another patient. Hemodialysis patients are at increased risk of developing healthcare-associated infections due to the unique nature of the dialysis setting. Risk factors include regular invasive procedures, exposure to blood, close proximity to other patients,

frequent contact with staff, and periods of intense activity, during which one shift of patients must have their treatment terminated and the next shift have their treatment initiated.

Healthcare providers should practice hand hygiene at key points in time to disrupt the transmission of microorganisms to patients. The World Health Organization (WHO) has identified five essential moments when hand hygiene is required during health-care delivery,[1] including in the dialysis environment.[2] The "My Five Moments for Hand Hygiene" model requires an understanding of the key concepts of patient zone, health-care area, and critical sites or "geographical areas" (Appendix). Each of the five hand hygiene indications or "moments" is defined by the consecutive contacts with the surfaces contained in and between these "geographical" areas**.** Proper hand hygiene performance requires the distinction between the patient zone and health-care area to help prevent transmission of infectious agents. Point of care is an additional concept critical to the understanding of hand hygiene requirement.

Exercise #1: Use the required readings, references and helpful texts to complete Table 1.

Table 1. Key terms in hand hygiene.

Term	Definition
Patient Zone	
Health-care area	
Critical sites	
Point of care	

Standard Precautions and Personnel Protective Equipment

Standard Precautions are the minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any healthcare setting. These practices are designed to both protect healthcare personnel and prevent healthcare personnel from spreading infections among patients.

Standard Precautions include:

- Hand hygiene
- Use of personal protective equipment
- Safe injection practices
- Safe handling of potentially contaminated equipment or surfaces in the patient environment
- Respiratory hygiene/cough etiquette.

Personal protective equipment (PPE) refers to wearable equipment used to protect workers from serious injuries or illnesses while doing their jobs. Personal protective equipment acts as a barrier

between infectious materials and the skin, mouth, nose, or eyes (mucous membranes). Examples include gloves, gowns, face masks, goggles and face shields. The selection of PPE is based on the nature of the patient interaction and potential for exposure to blood, body fluids or infectious agents. For more details on standard and transmission-based precautions, and the use of PPE, please read the Wyoming Infection Prevention Orientation Manual (WY IPOM) Section #7, Standard and Transmission-based Precautions.
Infection prevention precautions for dialysis are more stringent than Standard Precautions due to the increased potential for contact with blood and bloodborne pathogens including HIV, hepatitis B virus (HBV), hepatitis C virus (HCV) and multi-drug resistant organisms (MDROs).

The risk of exposure is increased because accessing the bloodstream is required during the dialysis session, there is close proximity of patients, and staff has frequent contact with numerous patients and equipment. Exposure to blood and potentially contaminated items can be routinely expected during the process of hemodialysis. As a result, dialysis healthcare personnel must take more rigorous steps to protect their patients as well as themselves.

Examples of when hemodialysis staff should wear PPE include:

- Setting up the dialysis machine
- Initiation and termination of dialysis treatment,
- Manipulation of access needles or catheters,
- Administration of medications through the extracorporeal circuit or by subcutaneous injection,
- Touching the dialysis blood lines, dialyzer, or machine during or after a dialysis treatment,
- Handling blood lines, dialyzers, dialysate tubing and machines post dialysis treatment
- During the reprocessing of dialyzers
- When cleaning and disinfecting the dialysis machine and chair post dialysis treatment.

Protective clothing or gear must be changed if it becomes soiled with blood, body fluids (including dialysate), secretions, or excretions.

Glove use in the dialysis setting

Hand hygiene is required after every direct contact with a patient and between patient contacts, even if the contact is casual. However, gloves are not necessary for casual social contact with a patient, for example, staff members may touch the patient's shoulder, take his/her arm, or shake hands without wearing gloves. Dialysis staff should wear gloves while performing procedures which have the potential for exposure to blood, dialysate and other potentially infectious substances. Wear disposable gloves when caring for the patient or touching the patient's equipment at the dialysis station. Staff must remove gloves and perform hand hygiene between each patient and station. Gloves must be easily accessible at each dialysis station and work area.

Additional considerations for glove use in the dialysis setting include:

- Chair-side computer keyboards/screens are generally considered dirty as they can easily become contaminated because of their proximity to the patient station and therefore require the use of gloves.
- Hand hygiene is imperative after contact with the chair-side computer and before contact with the patient, regardless of whether contact with the computer occurred through gloved or ungloved hands.
- Gloves must be provided to patients and visitors if these individuals assist with procedures which risk exposure to blood or body fluids, such as when self-cannulating or holding access sites post treatment to achieve hemostasis.

Several examples of when gloves should be changed are available and include:

- When soiled (e.g., with blood, dialysate or other body fluids);
- When going from a "dirty" area or task to a "clean" area or task. The CDC defines a "dirty" area as an area where there are contaminated or "used" supplies; equipment, blood supplies or biohazard containers are stored or handled.
- A "clean" area is an area designated only for clean and unused equipment and supplies and medications;
- When moving from a contaminated body site to a clean body site of the same patient; and
- After touching one patient or their machine and before arriving to care for another patient or touch another patient's machine.

The intention is to ensure that clean gloves which have not previously touched potentially contaminated surfaces are in use whenever there is a risk for cross contamination to a patient or their blood stream.

Exercise #2: Review your dialysis unit hand hygiene/PPE policies and procedures. Use these documents to complete Table 2.

Table 2. Information regarding hand hygiene and PPE use in your specific facility.

Policy and Procedure Review	Comments
1. Review your dialysis unit's hand hygiene/PPE Policy • **Is there a written policy?** • **How often is it required to be revised or updated?**	
2. From the list below, select all of the elements that are included in your facility's hand hygiene and PPE policy. ☐ **Indications for hand hygiene** ☐ **Selection of hand hygiene agent** ☐ **Management of soap containers** ☐ **Management of alcohol-based hand–rub containers** ☐ **Use of hand lotion** ☐ **Use of alcohol-based hand-rubs** ☐ **Hand hygiene monitoring and compliance audits** ☐ **Use of artificial nails, jewelry, length of nails, and nail polish** ☐ **Indications for PPE use for staff** ☐ **Indications for PPE use for visitors**	

☐ **Hand hygiene/PPE monitoring and compliance audits**	
3. Review the hand hygiene/PPE <u>audit process</u>. • **Is there an existing infection prevention (hand hygiene and PPE) audit process?** • **How often are audits conducted and by whom?** • **Are audit results routinely shared with staff?** • **Are opportunities for improvement identified and followed-up on?** • **How are audit results reported and to whom?**	
4. Review your facility's hand hygiene/PPE <u>education process</u>. • **Does the dialysis unit have a mandatory infection control education program?** • **How often is education required?** • **Who is responsible for the training?** • **Does the education cover the following?** ☐ **Importance of hand hygiene in preventing HAI's?** ☐ **Indications for use of alcohol-rub vs. soap and water?** ☐ **Proper hand hygiene technique?** ☐ **Appropriate use of PPE?** ☐ **Discussion of possible barriers to hand hygiene/PPE and opportunities for improvement?** ☐ **Review of policy regarding artificial nails, nail polish, and jewelry?**	

5. List any teaching aids available in your dialysis unit	
6. Are posters available to promote hand hygiene? • **How long have they been in place?** • **Is there a process in place to change/update the posters?**	

Dialysis Staff and Visitor Protective Garments

Street clothes, scrub suits, or uniforms are all acceptable attire within the dialysis unit, except for times when the spurting or spattering of blood, body fluids, potentially-contaminated substances, or chemicals might occur. Physicians, advanced practice registered nurses, social workers, dieticians and other hospital staff must wear an impervious cover garment if they are providing service to any patient in the treatment area during this time. The garment may open to the back or front, but must be closed in front during use for patient care. The protective garment should fully cover the arms and torso from the neck area to the thigh/knee area. Similarly, visitors must be provided impervious cover garments if they are in the treatment area during initiation or termination of dialysis.

Exercise #3: Review the visitor policy in your dialysis unit and complete Table 3.

Table 3. Visitor management information for your facility.

Visitor Management	Comments
How are visitors alerted to the need for additional protective garment precautions?	
Who provides visitors with education on hand hygiene and PPE?	
Is there a process to review visitor's hand hygiene and PPE practices? **If so what is the process?**	

Prevention of Dialysis-Associated Bloodstream Infections (BSI)

As noted previously, infections are one of the leading causes of death among dialysis patients. The use of central venous catheters in both acute and chronic dialysis settings contributes to increased infection risks for this immunocompromised group of patients. The CDC estimates that about 37,000 BSIs occur among dialysis patients with central lines each year, costing approximately $23,000 per hospitalization. The CDC Dialysis BSI Prevention Collaborative has been in progress since 2009. The collaborative has been instrumental in developing evidence-based interventions that have been proven effective in reducing BSIs in the hemodialysis setting. To access additional information about the collaborative visit the website: www.cdc.gov/dialysis/collaborative/about/. The CDC has developed core interventions for dialysis BSI prevention that facilities are encouraged to follow. While many of the recommendations are similar to what you would do for the hospital or long term care settings, novice IPs may benefit from a review of the dialysis core interventions which can be found at the CDC website: www.cdc.gov/dialysis/prevention-tools/core-interventions.html .

Strategies for BSI Prevention in the dialysis population include:

- Reporting to the CDC's National Healthcare Safety Network (NHSN)
- Performing monthly hand hygiene observations
- Regular observation of vascular access care and catheter accessing
- Training staff on infection control topics, including access care and use of aseptic technique
- Providing standardized education to their patients on infection prevention strategies
- Working to identify and address barriers to permanent vascular access placement and catheter removal. The risk of vascular access infections is lowest for arteriovenous fistulas, followed by arteriovenous grafts, then central venous catheters.
- Use of chlorhexidine for catheter exit-site skin antisepsis during dressing changes
- Scrubbing catheter hubs with an appropriate antiseptic before accessing the lines for dialysis
- Applying an antibiotic ointment or povidone-iodine to catheter exit during dressing changes.

Exercise #4:

1. *View the provider training video: Preventing Bloodstream Infections in Outpatient hemodialysis patients: Best Practices for Dialysis Staff on the website: www.cdc.gov/dialysis/prevention-tools/training-video.html*
2. *Review the document by CDC titled "Approach to BSI Prevention in Dialysis Facilities." A copy of this document can be downloaded from the website: www.cdc.gov/dialysis/PDFs/Dialysis-Core-Interventions-5_10_13.pdf*
3. *Arrange to spend time at the dialysis unit to review infection control practices related to dialysis. Observe the following procedures:*
    - *Hand hygiene practices*
    - *Use of PPE*
    - *Cannulation procedures*
    - *CVC Care*
    - *Water System*
    - *Reuse (if applicable)*
    - *Environmental Hygiene Practices*
    - *Review QAPI program as it relates to infection control*
    - *Review for use of checklists*
    - *Review audits*
    - *Review documentation related to staff and patient education*

Multi-Drug Resistant Organisms (MDROs)

Dialysis patients are at higher risk for infections caused by MDROs. It should be noted that three of the eleven documented patients who have contracted vancomycin-resistant *Staphylococcus aureus* in the US were dialysis patients.[3] Recent studies suggest high rates of colonization with MDROs in hemodialysis patients. [3] MRSA carriage rates of over 5% have been documented in the dialysis population, which is higher than the general population. [3] Large gaps exist in understanding of the transmission of these organisms in the outpatient dialysis setting. Select infection prevention measures should be applied to patients with MDROs in any setting, including aggressive use of hand hygiene by providers after contact with patient or their environment. Following current dialysis infection prevention practices should be an effective means to limit transmission of MDROs between hemodialysis patients. Therefore, in dialysis facilities the use of contact precautions is generally *not* recommended by the CDC when patients are colonized with MDROs. Dialysis patients with the following conditions may need additional precautions: patients with draining infected wounds that cannot be adequately covered, and patients with uncontrolled diarrhea or fecal incontinence.

Exercise #5: Review the APIC Guide to the Elimination of Infections in Hemodialysis 2010 Recommendations available at the website: www.apic.org/Resource_/EliminationGuideForm/7966d850-0c5a-48ae-9090-a1da00bcf988/File/APIC-Hemodialysis.pdf

Hepatitis Prevention in the Dialysis Setting

Outbreaks of HBV or HCV may occur as a result of staff not following standard practice for infection prevention, and/or bloodbourne pathogen precautions. Generally, dialysis facilities may dialyze a small number of HBV positive patients in the chronic units. Because of its virulence, Hepatitis B surface antigen (HBsAg) positive patients are required by CMS Conditions of Coverage to be dialyzed in an isolation setting. For more details on this regulation, please visit the CMS website: www.esrdnet15.org/InterpGuides_10_3_08.pdf . This regulation does not apply to patients with HCV; however, hospital/facility policies or state regulations may be more stringent. For more information on Wyoming State Rules and Regulations, please read the WY IPOM Section #17, Rules and Regulations or visit the helpful websites listed at the end of this chapter. The risk factors for HBV or HCV infection in hemodialysis units include: the presence of HBsAg positive or HCV positive patients in the unit, the use of machines for multiple patients, not following appropriate isolation procedures, inconsistent HBV vaccination, and multiple entries into a single use medication vials. The CMS Conditions for Coverage (referenced earlier) contain recommendations for monitoring the Hepatitis B and C status of dialysis patients and staff members, as well as vaccination recommendations.

The following resources provide detailed information regarding the identification and safe care of the HBV positive patient receiving hemodialysis, the appropriate precautions which must be taken, and recommended policies and procedures. Recommendations for patients identified with HIV and HCV are included.

- Centers for Disease Control and Prevention. Recommendations for preventing transmission of infections among chronic hemodialysis patients *MMWR Morb. Mortal. Wkly Rep*. 50(RR-5), 1-43 (2001). www.cdc.gov/mmwr/preview/mmwrhtml/rr5005a1.htm
- APIC Guide to the Elimination of Infections in Hemodialysis 2010 Recommendations: www.apic.org/Resource_/EliminationGuideForm/7966d850-0c5a-48ae-9090-a1da00bcf988/File/APIC-Hemodialysis.pdf
- Guidelines for Vaccinating Kidney Dialysis Patients and Patients with Chronic Kidney Disease can be found at: www.cdc.gov/vaccines/pubs/downloads/dialysis-guide-2012.pdf

Environmental Hygiene for the Dialysis Unit

According to CMS regulation, facilities must follow the CDC recommendations for preventing transmission of infections among chronic hemodialysis patients. Because vascular accesses have high internal pressure, blood contamination of equipment and environmental surfaces in the dialysis unit is common. Much like the hospital environment, multiple studies have shown the presence of HBV and HCV on environmental surfaces in dialysis facilities. It is for these abovementioned reasons that it's incumbent upon facilities to use the recommended disinfectants and detergents to inactivate and remove potential pathogens from surfaces. With respect to environmental hygiene in dialysis facilities, there are five key concepts an IP should be familiar with. These include:

1. Ensuring that the facility is selecting the proper disinfectant(s) and determining the correct dilution(s) for routine use.
2. Reviewing with the clinic manager the procedure for disinfecting dialysis stations between patients.
3. Ensuring that dialysis staff have been properly trained on: dialysis station cleaning/disinfection, preparing the appropriate dilution of disinfectant(s), adherence to the manufacturer's recommended contact time between the surface and disinfectant, and the use of PPE
4. Reviewing with the clinic manager and staff, the cleaning and disinfection of shared devices e.g., BP cuffs, hemostats, clamps etc.
5. Ensuring that staff has access to proper supplies.

For a more detailed description of the these key concepts, please see the CDC's document for clinical managers "Environmental Surface Disinfection in Dialysis Facilities: Notes for Clinical Managers" available at: www.cdc.gov/dialysis/PDFs/collaborative/Env_notes_Feb13.pdf
This document also contains information regarding the use of appropriate disinfectants in the dialysis setting. Additional resources are found in the required reading section of this chapter.

Exercise #6:

1. *Arrange a visit to the dialysis unit to review policies and procedures with regard to the topic areas above. Observe environmental hygiene practices.*
2. *Meet with the dialysis clinic manager and review policies and procedures for the proper decontamination of medical equipment, and list of products used in the unit/facility. Then work together to complete Table 4. Identify the correct action(s) to take for the various scenarios listed.*

Table 4. Contamination scenarios, and the proper decontamination procedure and products in your facility.

Scenario	Proper decontamination procedure/product to use
Blood spill on floor	

Scenario	Proper decontamination procedure/product to use
Blood on dialysis machine	
Staff needle stick from HBV+ patient	
Routine use of shared BP cuff	
Dried blood on dialysis chair	
Removal of dialyzer from machine and placement in common area	
Bathroom contaminated with stool	
Outbreak of *Clostridium difficile* infection among patients at facility.	
Routine use of shared thermometer	

Injection Safety

Safe injection practices are not optional. As part of Standard Precautions safe injection practices are a set of measures to perform injections in an optimally safe manner for patients and healthcare providers. Injection safety includes practices intended to prevent transmission of infectious diseases between one patient and another, or between a patient and healthcare provider, and also to prevent harms such as needle stick injuries. As defined by the World Health Organization, a safe injection does not harm the recipient, does not expose the provider to any avoidable risks and does not result in waste that is dangerous for the community. Unsafe injection practices put patients and healthcare providers at risk of infectious and non-infectious adverse events.

Examples of unsafe injection practices include:

- Syringe reuse between patients during medication administration;
- Contamination of medication vials or IV bags;
- Failure to follow basic injection safety practices when preparing and administering parenteral medications to multiple patients.
- "pre-spiking" IV bags at the beginning of the shift or day.

Injection Safety in the Dialysis Unit

Dialysis patients receive injected medications with every dialysis treatment. Consider that many patients receive erythropoietin, heparin, vitamin D analogue and normal saline flush at every visit. In order to minimize the risk for pathogen transmission from contaminated medications, the CDC recommends that:

- Medications for individual patients from multi-dose vials are prepared in a separate medication room or in another area that is separate from patient treatment areas.
- Medication carts should not be used to deliver medications to multiple patients,
- Supplies such as vials, alcohol swabs and syringes should not be stored in the pockets of healthcare provider's clothing.
- Single-use vials are entered only once; and discarded after use.
- Multi-dose vials are not brought into patient treatment areas and are entered with a new sterile needle and syringe for each injection given.

General Principles and use of Aseptic Technique

The following general principles are recommended in all patient care settings, including hemodialysis, in order to reduce the risk of infection transmission between patients and between employees and patients.

Aseptic technique is the handling, preparation, and storage of medications and all supplies used for injections and infusions in a manner that prevents microbial contamination. The main components of aseptic technique include:

- Perform hand hygiene prior to accessing supplies, handling vials and IV solutions, and preparing or administering medications.
- IV medications should be prepared in a clean area away from the patient treatment area to avoid contamination.
- Discard all opened vials, IV solutions, and prepared or opened syringes that were used in an emergency

Additional item specific recommendations for aseptic technique are listed in Table 5.

Table 5. Injection items and the recommendations for aseptic technique specific to each item.

Supply and/or Item	Recommendations for Aseptic Technique

Syringes	• Never use medication in a syringe for more than one patient even if the needle is changed between patients**. Changing the needle but not the syringe is unacceptable.** • Utilize sharps safety devices whenever possible. • Dispose of used needles at the point of use in an approved, puncture resistant sharps container.
IV Solutions	• Never use IV solution containers (e.g., bags or bottles) for the purpose of IV flush solutions for more than one patient. • Never use infusion supplies such as needles, syringes, flush solutions, administration sets, or IV fluids on more than one patient. • Disinfect IV ports prior to accessing using friction and 70% alcohol. Allow to dry prior to accessing
Vials	• Use single-use or single-dose vials whenever possible. • Always use a sterile syringe and needle/cannula when entering a vial. • Never enter a vial with a syringe or needle/cannula that has been used on a patient. • Cleanse the access diaphragm of vials using friction and 70% alcohol. Allow to dry before inserting a device into the vial. • Discard single-dose vials after use. Never reuse for another patient. • Use multi-dose medication vials for a single patient whenever possible. • Never pool or combine leftover contents of vials for later use. • Never leave a needle or cannula inserted into a medication vial rubber stopper because it leaves the vial vulnerable to contamination. • Date vial to reflect date opened and date of expiration • Examine the vial for any particulate matter, discoloration, or turbidity. If present, do not use and discard immediately.

Healthcare personnel awareness and compliance with safe injection practices is of utmost importance. The following recommendations help ensure that all healthcare personnel understand and adhere to safe injection practices:

- Assign responsibility for ongoing oversight for infection prevention issues.
- Have a mechanism in place to ensure expired medications are not available for use.
- Review medication administration and infection prevention policies annually.
- Provide mandatory injection and infection prevention training for all applicable staff at least annually.
- Conduct quality assurance assessments and routine audits of injection and infection control practices.
- Review audit results with staff to identify opportunities for improvement.

Exercise #7:

1. *Audit injection practices in the dialysis unit.*
2. *Review the current policies and procedures related to injection safety.*
3. *Review the staff injection safety education program.*
4. *Review medication storage area and check medications for expiration dates.*

Water Treatment in Dialysis

Water is an essential component of every dialysis treatment. Water is also one of the greatest hazards to dialysis patients if not monitored properly. The average dialysis patient is exposed to 350 to 500 liters of water in one week as compared to 14 liters per week for the average healthy person. Since dialysis patients are exposed to vast quantities of water, a well-functioning water treatment system is crucial in the care and safety of dialysis patients.

Hemodialysis patients are at increased risk to contaminants in the water used to prepare concentrate and dialysate for several reasons. First, as previously noted, compared to healthy individuals, hemodialysis patients are exposed to extremely large volumes of water. Hemodialysis patients may be exposed to 350 to 500 L of water per week, depending upon their treatment time and dialysate flow rate. Second, dialysis patients have inadequate barriers to such toxins. Healthy individuals are protected from water contaminants crossing into blood by stomach acid and the intestinal barrier. For the hemodialysis patient, the barrier between blood and water is the thin semipermeable membrane of the dialyzer, through which the transfer of contaminants is limited only by the size. Third and finally, dialysis patients cannot easily eliminate contaminants. Healthy individuals can excrete contaminants via their kidneys. The compromised kidneys of the hemodialysis patient are unable to excrete any contaminants taken up from the dialysate.

Exercise #8: Use the Dialysis Water Training Class power point slides by J. Curtis, available at www.fmqai.com/library/attachment-library/7WaterSystems.pdf to *complete Table 6.*

Table 6. Key terms in the treatment and quality of water used for dialysis.

Term	Definition
Permeate	
Concentrate	
Filtration	
Ion Exchange	
Deionization	
Chloramines	
Hardness	

Conductivity	
Resitivity	
Dialysate	
Semipermeable Membrane	
Microorganism	
Colony Forming Unit (CFU)	
Biofilm	
Endotoxin	
Limulus Amebocyte Lysate	
Endotoxin Units (EU)	
Pyrogenic Reaction	
Hemolysis	

Water Supply or Source Water

The supply of water in most dialysis facilities comes from two sources: ground water and surface water. Table 7 provides a comparison of the different water sources for water used in dialysis.

Table 7. Comparison of water sources for water used in dialysis facilities.

Ground Water	Surface Water
• Comes from wells and springs • Higher in iron, calcium, and magnesium. • Lower in microorganisms e.g., bacteria, viruses, and endotoxins.	• Comes from lakes, ponds, rivers, and reservoirs. • Often higher in pesticides, industrial waste, sewage, and microorganisms.

Components of a Water Treatment System

Municipal water systems treat ground and surface water to meet the Environmental Protection Agency National Drinking Standards and to make drinking water safe for public use and consumption. In order to do this water authorities may routinely add chemicals such as fluoride, aluminum, chlorine, and chloramines. Chloramine is often used to kill bacteria, fluoride to prevent tooth decay, and aluminum to remove solid particles from the water. This makes municipal water unsafe for use in hemodialysis, because these chemicals have been known to accumulate in dialysis patients leading to significant morbidity and mortality. Therefore, all dialysis facilities require a properly designed and maintained water treatment system to ensure the safety of their patients.

A water treatment system consists of a series of components placed according to their function in the process of purifying water for dialysis. Water treatment components are discussed in terms of upstream and downstream. Upstream components are placed before downstream components. The water treatment system begins upstream where feed water (from outside the dialysis center) enters and moves downstream through the water system components resulting in product water (purified water). Water continuously moves through the water treatment system to prevent stagnant areas and bacterial growth. Most dialysis centers have a return loop that continuously carries water back through the system.

The treatment of water for use in dialysis consists of four main stages (listed below). Each stage includes a set of components (Tables 8, 9, 10 and 11). Most dialysis centers will have some or all of these components depending on the amount and type of contaminants found in their local water supply. The stages of water treatment include:

1. Feed water (components shown in Table 8)
2. Pretreatment (components shown in Table 9)
3. Purification (components shown in Table 10)
4. Distribution (components shown in Table 11)

Table 8. Components of **feed water** used in dialysis facilities.

Component	Definition
Backflow Preventer	Prevents water from the dialysis center's water treatment system from flowing back into the feed water. Keeps any contaminants removed by the water treatment system from getting into the feed water.
Temperature Blending Valve	Mixes hot and cold water to a standard 77 degrees F. This temperature prevents harm to the patients and to the water system.

Booster Pump	The water treatment system requires constant pressure. If there is a decrease in the flow or pressure from the incoming water the booster pump will increase both.

Table 9. Components of **the pretreatment** of feed water used in dialysis facilities.

Component	Definition
Multi-media Filters	Removes incoming particles, solutes, and other substances. Consists of layers of different size rocks that allow water to pass through but traps and strains out particles above a certain size.
Water Softener	Softens "hard" water by removing calcium and magnesium ions, which are traded for sodium ions to form sodium chloride. The result is "soft" water.
Carbon Tanks	Two carbon tanks are in sequence, one tank feeding the other. Granular activated charcoal is used to remove chlorine, chloramines, and organics from the water.

Table 10. Components of **the purification stage** of water treatment in dialysis facilities.

Component	Definition
Reverse Osmosis	Uses a pump to force feed water at high pressure against a semipermeable membrane, allowing water to pass through while blocking the passage of salts and other contaminants. The salts and contaminants are then sent to the drain and the purified water is used for dialysis.
Component	**Definition**
Deionization	Exchange process that removes cat ions and anions, replacing them with hydrogen and hydroxide ions that combine to form pure water. Available as portable exchange tanks for use in acute settings or can be added to the RO system for additional water treatment.
Ultra-filters	Cartridge that houses a semipermeable membrane filter. The membrane removes submicron solutes as well as bacteria and endotoxins.

Table 11. Components of the **water distribution system** in dialysis facilities.

Component	Definition
Indirect Feed System	Uses a storage tank to hold product water and send it to the product water loop for use.
Direct Feed System	Delivers product water directly from the RO system to the product water loop for distribution

Water Contaminants

The purpose of treating municipal water (whether it's from a ground or surface water source) is to remove contaminants. There are four main categories of contaminants found in municipal water as described in Table 12. Of specific mention are select inorganic water contaminants (listed in Table 13)

that are particularly toxic to dialysis patients as these chemicals can cross over into blood and result in major adverse consequences.

Table 12. Categories of contaminants found in water and a definition and example of each.

Category	Definition/Example
Particulates	Tiny pieces of solid matter/rust, dirt, dust
Inorganics	Substances of mineral origin/aluminum, calcium, magnesium, nitrates, etc.
Organics	Substances of biologic origin/crude oil, coal, pesticides, tannins
Microbiological	Microscopic organisms/virus, bacteria, fungi

Table 13. Specific inorganic water contaminants that are toxic to dialysis patients.

Contaminant	Source	Adverse Event(s)
Aluminum	Municipal water	Encephalopathy, bone disease, anemia
Chloramines	Municipal water	Hemolysis
Fluoride	Municipal water	Nausea, abdominal pain, pruritus, arrhythmia
Nitrates	Source water	Anemia
Endotoxin	Dialysis unit	Pyrogenic reactions, chronic inflammation
Copper	Dialysis unit	Hemolysis, nausea, vomiting
Lead	Dialysis unit	Abdominal pain, arthralgia, muscle weakness
Zinc	Dialysis unit	Hemolysis, nausea, vomiting
Calcium, Magnesium	Source water Municipal water	Nausea, vomiting

Water Quality in Dialysis

Water and equipment used for dialysis must meet quality standards and requirements (respectively) as set forth by the Association for the Advancement of Medical Instrumentation (AAMI).[4-9] The fluid quality requirements for dialysis apply to the purified water as it enters the equipment used to prepare dialysate or concentrates from powder, and apply to the water treatment system as a whole; not to each of the devices that make up the system.

Bacteriologic and endotoxin assays are performed to validate the adequacy of the dialysis equipment disinfection process and frequency with which it's performed. Determining water quality through bacteriologic tests is not performed to determine when disinfection is needed. The frequency of testing water for bacteria counts and endotoxin concentration should be the following in all dialysis units/facilities:

- Minimum once a month for established systems
- After a suspected pyrogenic reaction
- After modification to the water treatment system

- At least weekly for new systems until a pattern is established that allows reduction in frequency.

Because bacterial proliferation can be rapid and 48 hours can elapse between sampling water and receiving test results, action levels for microbial counts and endotoxin concentrations are regulated by the Centers for Medicare and Medicaid. "Action level" indicates that once bacterial and/or endotoxin contaminants are measured in the purified (a.k.a. product) water, corrective measures shall promptly be taken to reduce the levels of bacteria/endotoxin. Table 14 provides a breakdown of microbiological action and maximum allowable levels depending on the fluid tested. If the dialysis facility's monthly testing results are below the action levels and disinfection frequency is monthly, this suggests that the process and frequency of disinfection is effective. If monthly testing results are above acceptable levels for bacteria/endotoxin, this suggests that either the disinfection process or frequency is not sufficient to control bacterial growth. An adjustment to the frequency or process of disinfection is indicated in order to keep bacteria/endotoxin below action levels.

Corrective measures must be performed promptly when results exceed the action level or the maximum allowable level. Regulations require that cultures be performed weekly for at least a month until a stable trend has been reestablished demonstrating control of the bacteria/endotoxin levels which does not exceed the maximum allowable.

Dialysis may continue when bacteria/endotoxin is found to be at the action level, but retesting and/or disinfection of the system should be performed promptly. The term "promptly" has been defined by the CMS regulation as within 48 hours of receiving the report of testing results. For bacteria/endotoxin levels exceeding the maximum allowable levels, the medical director must determine the course of action. The medical director must assess the impact to the patient and determine which option would result in a more detrimental outcome for the patient: not receiving the treatment or using a dialysate which contains greater than the allowable CFU and EU limits.

Table 14. Microbiological (bacterial and endotoxin) action levels for water used in dialysis based on the fluid tested. Abbreviations include: colony forming units (CFU), endotoxin units (EU), and milliliters (ml).

Fluid	Bacteria (CFU/ml)	Endotoxin (EU/ml)
Water used for dialysate, reprocessing of dialyzers, germicide production	Max: 200 CFU/ml Action Level: 50 CFU/ml	Max: 2 EU/ml Action Level: 1 EU/ml
Dialysate	Max: 200 CFU/ml Action Level: 50 CFU/ml	Max: 2 EU/ml Action Level: 1 EU/ml

Staff Training and Education in Water Treatment

The human factor is the most critical component in any water treatment system. Deficient practices in water treatment are serious and can pose a viable risk to patient health and safety. The dialysis staff members who operate the water treatment system must be understand the importance of their work and how their performance and adherence to policies and procedures can affect patient health and safety.

All staff who perform monitoring and testing of the water treatment system must complete a training program approved by the medical director and governing body. Dialysis staff members are required to

monitor the water treatment system daily to ensure the system is functioning properly and that the quality of the product water is maintained.

Daily dialysis staff responsibilities with respect to water treatment include:

- Staff must fully complete all water logs (i.e., documentation of water temperature, pH, conductivity, water hardness, chloramine/chloramine results). These logs must meet the same stringent standards of patient care documentation.
- Water is monitored continuously via conductivity and resistivity meters with alarms that must be audible in the treatment area.
- Test for chlorine and chloramines before each patient shift or at a minimum of every 4 hours
- Record any out of range results and take proper action

The dialysis clinic manager should perform the following audits, observation and reporting:

- Perform routine practice audits – observe staff performing water tests
- Review of all water policies at least annually
- Conduct mandatory water training at least annually-usually performed by dialysis educator or biomedical staff
- The operation of the water system and monitoring results are routinely reported to the medical director, infection prevention committee and reviewed in Quality Assurance & Performance Improvement (QAPI) meetings

Exercise #9:

1. *Visit the hemodialysis unit to understand the processes and procedures required for facilities to comply with the current CMS Conditions for Coverage of ESRD facilities (review required reading for this section listed on page 4)*
2. *Review the standards for water treatment in the dialysis unit.*
3. *Tour the dialysis facility, including the water treatment area to view the setup of the water system.*
4. *Check daily water logs to ensure that required testing is performed on time and that logs*

Documentation and Reporting

Quality Incentive Program (QIP) for ESRD Facilities

The ESRD Quality Incentive Program developed by the CMS provides the renal community with the opportunity to enhance the overall quality of care that patients with ESRD receive. The QIP is the first Medicare program that links provider or facility payments to performance, based on outcomes assessed through specific quality measures. The ESRD QIP is mandated by the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA) section 153 (c). MIPPA provides a mechanism for establishing standards of care and authorizes payment reductions of up to 2% for facilities failing to meet or exceed the minimum Total Performance Score articulated by CMS for each evaluation year. Facilities receiving Medicare reimbursement for dialysis services that meet eligibility requirements automatically qualify to be a part of the program. CMS QIP requires dialysis facilities to report dialysis event information to the CDC electronic reporting system, the NHSN. The QIP measures that are required to be reported via NHSN vary each year. For the current year of 2014, the QIP measure that is related to infections in dialysis patients is the number of hemodialysis outpatients with positive blood cultures per 100 hemodialysis patient-months. For the most current information about the requirements of the QIP program please visit the CMS website: www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/ESRDQIP/index.html.

The current four CMS NHSN monthly reporting requirements for dialysis facilities are listed below. It is important to note that these requirements apply to all dialysis facilities with chronic provider numbers, even those which may be hospital-based.

1. Outpatient Dialysis Center Practices Survey- completed upon enrollment and annually thereafter
2. Monthly Reporting Plan-indicates the NHSN surveillance the facility will do each month
3. Summary Data (Denominators for Outpatient Dialysis) Form-completed once monthly, summarizes the types of vascular accesses in use by each patient on the first 2 working days of the month
4. Dialysis Event Form- completed when a dialysis event occurs

Other dialysis related events that can be entered and monitored in NHSN include:

- IV antimicrobial starts
- Positive blood cultures
- Pus, redness, or increased swelling at the vascular access site combination of above
- Any patient who receives hemodialysis treatment at the facility is monitored for dialysis events
- Includes transient patients who had a dialysis event while being treated at the facility

The CDC provides a host of resources related to NHSN, such as enrollment steps, surveillance protocols, templates, and checklists. The general NHSN website is www.cdc.gov/nhsn. The dialysis event protocol can be downloaded from the CDC's website: www.cdc.gov/nhsn/PDFs/pscManual/8pscDialysisEventcurrent.pdf.

State Regulations

For information regarding what is required for documentation and reporting at the state level, please review the following resources:

- To obtain End Stage Renal Dialysis Center-Wyoming Licensure Information visit the Wyoming Department of Health, Healthcare Licensing and Survey ESRD website: health.wyo.gov/ohls/Wyoming_ESRD.html
- To obtain a copy of the Wyoming specific ESRD Rules and Regulations for licensure (chapter 18) visit the website and download the following document: soswy.state.wy.us/Rules/RULES/2943.pdf
- The Wyoming construction rules and regulations for healthcare facilities included in chapter 3 also apply to dialysis facilities located in Wyoming. For details download the following document: soswy.state.wy.us/Rules/RULES/6920.pdf

Resources

Helpful/Related Readings

- The Survey and Certification Program for ESRD Facilities - Centers for Medicare & Medicaid Services. Available at: www.cms.gov/Medicare/Provider-Enrollment-and-Certification/GuidanceforLawsAndRegulations/Dialysis.html
- National Kidney Foundation Kidney Disease Outcomes Quality Initiative. Clinical practice guidelines for vascular access, 2000. *American Journal of Kidney Disease*, 2001: volume 37 supplement S137-S181. Available at: http://www.ajkd.org/article/S0272-6386(01)70007-8/fulltext
- Centers for Medicare & Medicaid Services: Part 494 Conditions for Coverage for End-Stage Renal Disease Facilities, Interpretive Guidance. Applicable Vtags: 110-148, 175-278, 625-640. Available at: www.esrdnet15.org/InterpGuides_10_3_08.pdf

- Checklist: Dialysis Station Routine Disinfection. Centers for Disease Control and Prevention. Available at: cdc.gov/dialysis/PDFs/collaborative/Env_checklist-508.pdf
- Injection Safety-"One Needle, One Syringe, and Only One Time" Healthcare Provider Toolkit. Centers for Disease Control and Prevention. Available at: www.oneandonlycampaign.org/content/healthcare-provider-toolkit
- Dialysis Water Training Class power point slides by J. Curtis. Available at www.fmqai.com/library/attachment-library/7WaterSystems.pdf
- Chartier, K. Hand Hygiene: The Simplest Solution. *Renal Business Today*. 2011. Available at: networkofnewengland.org/wp-content/uploads/2013/02/Hand_Hygiene1.pdf
- Centers for Disease Control and Prevention Healthcare Infection Control Practices Advisory Committee (HICPAC), *Guidelines for Environmental Infection Control in Health-Care Facilities*. Available at: www.cdc.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf
- Mayhall, C.G. ed. Hospital Epidemiology and Infection Control (4th Edition). Philadelphia, PA: Lippincott Williams & Wilkins, a Wolters Kluwer business; 2011.
    - Chapter 63, Control of Infections Associated with Hemodialysis, by PR Patel, ND Thompson, and MJ Arduino
    - Chapter 64, Infections Associated with Peritoneal Dialysis, by JJ Szela and JD band

Helpful Contacts (in WY or US)

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Related Websites/Organizations

- Centers for Disease Control and Prevention: www.cdc.gov
- Wyoming Department of Health, Infectious Disease Epidemiology Unit, Healthcare-Associated Infection Prevention: www.health.wyo.gov/phsd/epiid/HAIgeneral.html
- Intermountain ESRD Network #15: www.esrdnet15.org
- Mountain-Pacific Quality Health – Wyoming: www.mpqhf.com/wyoming/index.php
- Arizona ADVICE Collaborative: azdhs.gov/phs/oids/hai/advisory-committee/end-stage-renal-disease.htm
- National Kidney Foundation KDOQI Guidelines: www.kidney.org/professionals/KDOQI/guideline_upHD_PD_VA/index.htm
- The CDC Dialysis BSI Prevention Collaborative: www.cdc.gov/dialysis/collaborative/about/
- The CDC Core Interventions for Dialysis BSI Prevention: www.cdc.gov/dialysis/prevention-tools/core-interventions.html
- The Association for the Advancement of Medical Instrumentation (AAMI): www.aami.org/

My Facility/City/County Contacts in this Area

Title	Name	Phone	Email
Dialysis Unit Administrator			

Comments:			
Medical Director Dialysis			
Comments:			
ESRD Surveyor, WY Department of Health	Tony Madden	307-777-7123	Anthony.madden@wyo.gov
Comments:			
Infectious Disease Physician			
Comments:			
County Public Health Contact			
Comments:			
Hospital or Associated Laboratory			
Comments:			

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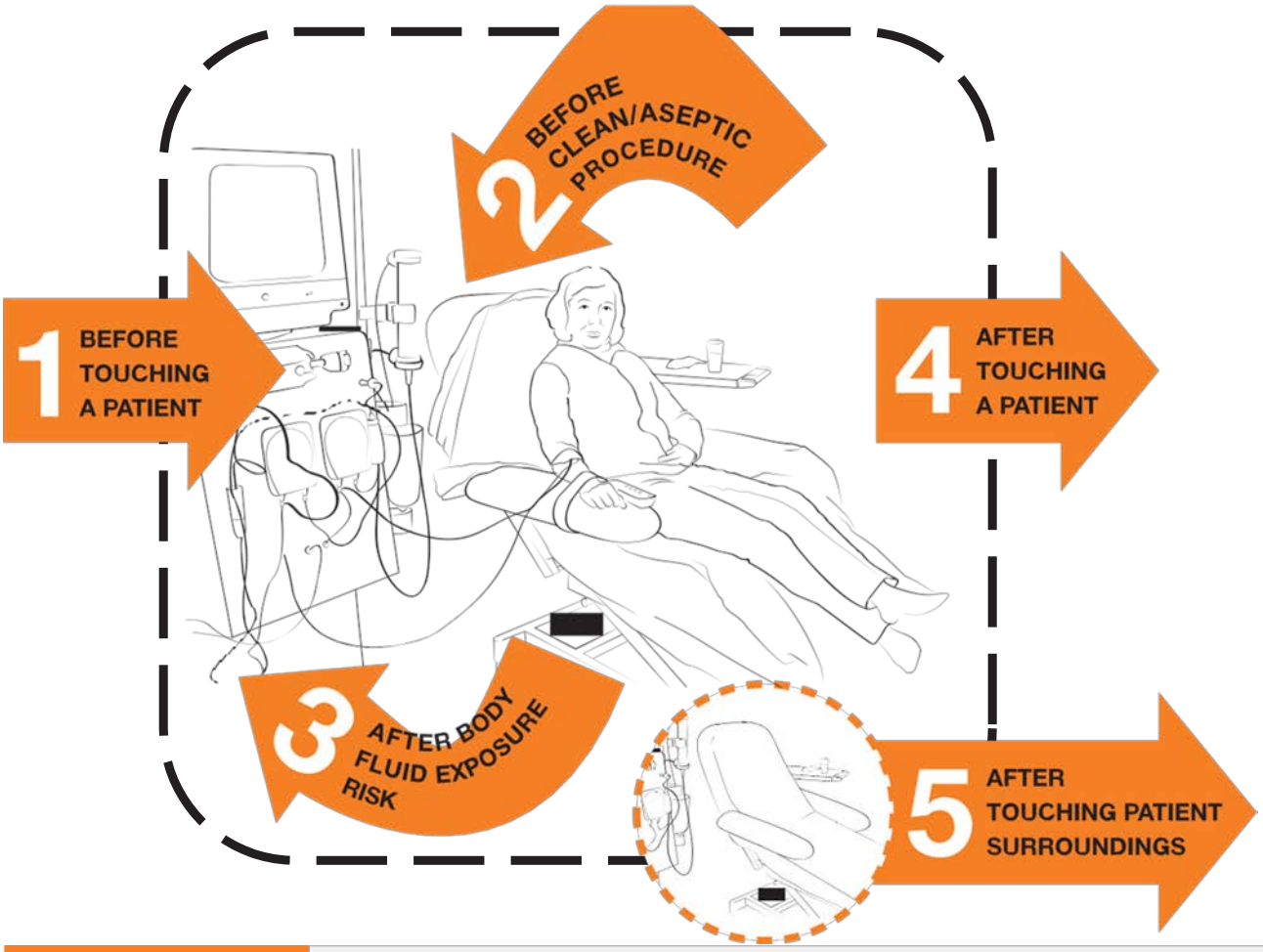
7. Association for the Advancement of Medical Instrumentation (AAMI). 2009. ANSI/AAMI/ISO Water for hemodialysis and related therapies. Published by AAMI, Arlington, VA.
8. Association for the Advancement of Medical Instrumentation (AAMI). 2009. ANSI/AAMI/ISO Water treatment equipment for hemodialysis and related therapies. Published by AAMI, Arlington, VA.
9. Association for the Advancement of Medical Instrumentation (AAMI). 2009. ANSI/AAMI/ISO Ultrapure dialysate for hemodialysis and related therapies. Published by AAMI, Arlington, VA.

Appendix: *World Health Organization "My Five Moments for Hand Hygiene: Hemodialysis"*

World Health Organization . (2012). 5. *Hand hygiene in Outpatient and Home-based Care and Long-term Care Facilities*. Geneva: World Health Organization. Retrieved from apps.who.int/iris/bitstream/10665/78060/1/9789241503372_eng.pdf?ua=1



1	BEFORE TOUCHING A PATIENT	WHEN?	Clean your hands before touching a patient.
		WHY?	To protect the patient against harmful germs carried on your hands.
2	BEFORE CLEAN/ ASEPTIC PROCEDURE	WHEN?	Clean your hands immediately before performing a clean/aseptic procedure.
		WHY?	To protect the patient against harmful germs, including the patient's own, from entering his/her body.
3	AFTER BODY FLUID EXPOSURE RISK	WHEN?	Clean your hands immediately after a procedure involving exposure risk to body fluids (and after glove removal).
		WHY?	To protect yourself and the environment from harmful patient germs.
4	AFTER TOUCHING A PATIENT	WHEN?	Clean your hands after touching the patient at the end of the encounter or when the encounter is interrupted.
		WHY?	To protect yourself and the environment from harmful patient germs.
5	AFTER TOUCHING PATIENT SURROUNDINGS	WHEN?	Clean your hands after touching any object or furniture in the patient surroundings when a specific *zone* is temporarily and exclusively dedicated to a patient - even if the patient has not been touched.
		WHY?	To protect yourself and the environment from harmful patient germs.

WIPAG welcomes your comments and feedback on these sections.
For comments or inquiries, please contact:

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