

**Filtering Out the Bad: Healthcare Worker Compliance of Dialysis Practices in a Pediatric Setting**

by

**Dara Marie Czernikowski**

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This essay is submitted

by

**Dara Marie Czernikowski**

on

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and approved by

**Essay Advisor:** Jeremy Martinson, DPhil, Assistant Professor, Department of Infectious Diseases and Microbiology, School of Public Health, University of Pittsburgh

Essay Reader: Lindsay Montoya, MPH, CIC, Division of Infectious Diseases, Department of Pediatrics, School of Medicine, University of Pittsburgh

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## **Filtering Out the Bad: Measuring Healthcare Worker Compliance in a Pediatric Dialysis Setting**

Dara M Czernikowski, MPH

University of Pittsburgh, 2023

### **Abstract**

Central line associated bloodstream infections (CLABSIs) are one of the costliest healthcare associated infections to patient health and hospitals, incurring approximately \$48,000 in extra expenses per episode. Without proper maintenance of central line sites, pathogens like *Staphylococcus aureus* and *Enterococcus* genus organisms can colonize and develop infection in the body. CLABSIs occur in 70% of hemodialysis patients, made more susceptible to this infection from the direct bloodstream access provided by their central lines. The infection prevention team at UPMC Children's Hospital of Pittsburgh performed surveillance of current dialysis practices by staff over two months. Through this audit process, the objective was to review whether any areas in the dialysis procedure required improvement based on staff compliance. The team expected overall good compliance and aimed to provide feedback on improving compliance rates, if necessary, standardize methods across the UPMC system, and mitigate risks for CLABSI development in patients. Compliance of dialysis staff was measured using a CDC audit tool, developed through the CDC Dialysis Collaborative, which outlined necessary steps within five areas of dialysis: (1) connection, (2) disconnection, (3) medication preparation, (4) medication administration, and (5) hand hygiene opportunities.

Overall compliance reported for connection, disconnection, medication preparation, medication administration, and hand hygiene opportunities were 59%, 47%, 0%, 100%, and 94%, respectively. Once the overall compliance was broken down further, the team identified areas in

each category needing improvement. Steps such as “catheter hub scrub/dry time” were inconsistent, having a designated area of medication preparation, and aseptic technique were observed to have reduced compliance. To improve these areas, the team recommended several strategies including the standardization of catheter hub “scrub” and drying times, initiating sterility for the entire process, and establishing a designated medication preparation counter within the unit. This method of auditing and providing feedback can be replicated in other dialysis settings of healthcare facilities to maintain or improve compliance. This careful attention to proper maintenance may help reduce risks of developing healthcare associated infections, and in turn, reduce costs associated with extra hospitalizations and care from these infections.

## Table of Contents

<b>Preface.....</b>	<b>ix</b>
<b>1.0 Introduction.....</b>	<b>1</b>
<b>2.0 Materials &amp; Methods.....</b>	<b>6</b>
<b>3.0 Results .....</b>	<b>8</b>
<b>4.0 Discussion &amp; Recommendations.....</b>	<b>13</b>
<b>4.1 Standardization of Catheter Hub Scrub Process .....</b>	<b>15</b>
<b>4.2 Initiating Sterility for Entire Disconnection Process .....</b>	<b>15</b>
<b>4.3 Designated Medication Preparation Counter .....</b>	<b>16</b>
<b>4.4 Catheter Cap Attachment.....</b>	<b>17</b>
<b>5.0 Conclusion .....</b>	<b>18</b>
<b>Appendix A CDC Audit Tools .....</b>	<b>19</b>
<b>Appendix B CHP Hemodialysis Policies.....</b>	<b>21</b>
<b>Appendix B.1 CHP System Hemodialysis Initiation Policy.....</b>	<b>21</b>
<b>Appendix B.2 CHP System Hemodialysis Initiation Policy.....</b>	<b>24</b>
<b>Appendix C UPMC System Hemodialysis Competencies .....</b>	<b>28</b>
<b>Appendix C.1 UPMC System HD Connection Competencies .....</b>	<b>28</b>
<b>Appendix C.2 UPMC System HD Disconnection Competencies.....</b>	<b>30</b>
<b>Bibliography .....</b>	<b>32</b>

## List of Tables

<b>Table 1. CHP Dialysis Unit CLABSI Events per 100 Patient Months (2020-2022).....</b>	<b>5</b>
<b>Table 2. HD Connection Compliance Rates (based on 17 observations).....</b>	<b>8</b>
<b>Table 3. HD Disconnection Compliance Rates (based on 15 observations) .....</b>	<b>10</b>
<b>Table 4. HD Medication Preparation Compliance Rates (based on 12 observations).....</b>	<b>11</b>
<b>Table 5. HD Medication Administration Compliance Rates (based on 12 observations) ....</b>	<b>11</b>
<b>Table 6. Hand Hygiene Compliance Rates .....</b>	<b>12</b>
<b>Table 7. Overall HD Compliance Rate .....</b>	<b>12</b>
<b>Table 8. Successful Areas of HD Observation and Areas Needing Improvement .....</b>	<b>14</b>

## List of Figures

<b>Figure 1. HD Tunneled Catheter Anatomy Model [5].....</b>	<b>2</b>
<b>Figure 2. HD Process Flow Diagram [3] .....</b>	<b>2</b>
<b>Figure 3. CHP Outpatient Dialysis Unit Bedspace with Dialyzer .....</b>	<b>7</b>
<b>Figure 4. “ON” &amp; “OFF” HD kit packages.....</b>	<b>7</b>
<b>Appendix A Figure 1. CDC Audit Tool: Catheter Connection &amp; Disconnection [13] .....</b>	<b>19</b>
<b>Appendix A Figure 2. CDC Audit Tool HD Medication Preparation [14].....</b>	<b>19</b>
<b>Appendix A Figure 3. CDC Audit Tool HD Medication Administration [14] .....</b>	<b>20</b>
<b>Appendix A Figure 4. CDC Audit Tool HD Hand Hygiene Observations [15] .....</b>	<b>20</b>



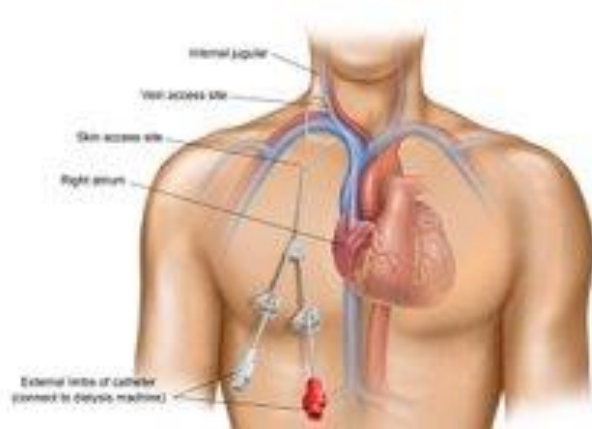
## **Preface**

The research conducted for this essay is my own original work in collaboration with Lindsay Montoya at the University of Pittsburgh Medical Center (UPMC) Children's Hospital of Pittsburgh (CHP). Without project guidance from Lindsay, cooperation from the CHP Outpatient Dialysis Unit staff, consultation with the hemodialysis working group through the corporate UPMC Infection Prevention system, and endless support from my advisor, Jeremy Martinson, family, and friends, this work would not be possible.

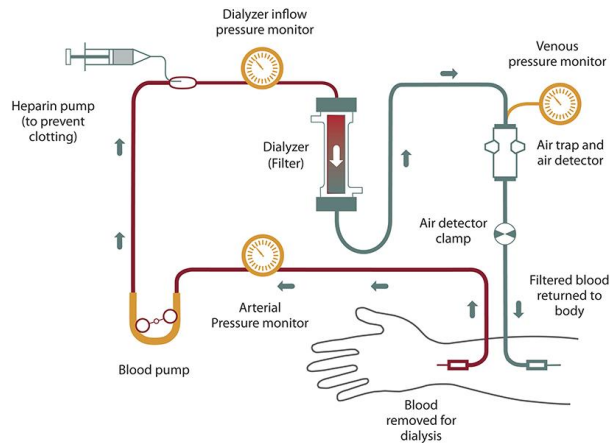
## 1.0 Introduction

Approximately 400,000 individuals are on hemodialysis (HD) in the United States, which equates to roughly 62 million dialysis procedures annually [1]. Of that dialysis population, approximately 10,000 are children [1]. HD is a process performed to filter salts, fluids and wastes from an affected person's blood when their kidneys are no longer functionable enough to do so on their own [2]. HD is also helpful for controlling a patient's blood pressure and maintaining appropriate mineral levels in the blood, such as potassium and sodium [3]. This process involves inserting a long-term double lumen tunneled catheter to the patient so a machine (dialyzer) may execute the necessary bloodstream filtration that their kidneys are unable perform (Figure 1). The dialyzer works by accessing the person's unfiltered blood through a "red" arterial line connected to their tunneled catheter, manually filtering out the excrement from the blood, and pushing filtered blood back into the person through a venous "blue" line connected to the second lumen of the tunneled catheter (Figure 2) [4]. Depending on the size of the patient and their tolerance to the filtration process and medication, a cycle of HD for children can take as little as two hours to as much as five hours on the dialyzer.

On some occasions, the patient may have more lumens on their catheter (e.g. trialysis catheter) or have an inserted arteriovenous (AV) fistula that connects a patient's artery to their vein as a source of reliable bloodstream access for HD. An AV fistula may even present less of a risk for developing a CLABSI due to it being fully internal to the patient's body, however this is an access method less frequently used in the pediatric population due to size limitations.



**Figure 1. HD Tunneled Catheter Anatomy Model [5]**



**Figure 2. HD Process Flow Diagram [3]**

Due to the frequent and direct access HD tunneled catheters allow to the bloodstream, HD patients are significantly more susceptible to developing central line associated bloodstream infections (CLABSIs) than a patient who does not require dialysis treatment [6]. These infections can be caused by any number of pathogens entering and contaminating a patient's central line, though gram positive organisms are identified as causing 40-80% of CLABSIs [7]. *Staphylococcus aureus* and *Enterococcus* genus organisms have specifically been identified as two of the most common bacterial causes for this class of infection [7]. These strains are also commonly

categorized as “commensal bacteria,” which means that these microbes can be found on the human skin’s surface as a protective means against more harmful microbes [8-10]. However, if commensal bacteria leave their site, they can cause infection and disease. Due to the high prevalence of *Staphylococcus aureus* and *Enterococcus* organisms on skin surfaces, that makes these strains more likely to contaminate central line sites and cause infection if proper site cleaning and maintenance does not occur.

Just as with any serious bacterial infection, this type of healthcare associated infection can have poor effects on a patient’s health and wellbeing. Consequences include delaying patient recovery time and inpatient stay by weeks, families incurring extra medical bill costs because of the extended stay and additional care required for clearing the infection, and risk of sepsis or death if the event is not treated soon enough [7]. While CLABSIs are not transmissible between patients like other types of healthcare associated infections, other parties can be affected by their incidence too. One example is the healthcare institution in which the infection occurs, incurring astronomical extra costs to treat the unexpected and unintended event. On average, healthcare institutions pay approximately \$48,000 in extra costs per CLABSI event that occurs in their facility [11]. Another example is the unit staff responsible for caring for the affected patient. These individuals, from nurses to physicians, are notified of these events to discuss with the involved parties of how the infection developed and promote education regarding how to prevent that specific hospital acquired infection from developing again. These sessions often look like monthly committee meetings between infection preventionists and unit staff but could become more frequent if there is a high incidence of infections coming from a specific unit. While these meetings are helpful education tools for staff and provide useful dialogue about best practice, a high frequency of these

committee sessions could take away from time spent providing necessary care directly to the patient.

To prevent CLABSIs from occurring in patients, guidelines have been developed for staff members to follow during the HD process which emphasize the importance of performing best practices on this population of patients. Despite the existence of these best practices in healthcare institutions, adherence to the recommended standard of care is not always appropriately met, leading to increased risk of central venous catheter contamination, and the subsequent development of CLABSIs or other healthcare associated infections. The University of Pittsburgh Medical Center (UPMC) Children's Hospital of Pittsburgh (CHP) Infection Prevention (IP) team performed an audit of HD processes performed by the CHP Outpatient Dialysis team. This unit has historically shown reasonable mitigation of CLABSI events, only reporting a rate of 2.86 CLABSIs per 100 patient months for 2020 with 0 CLABSIs reported since (Table 1). The two reported CLABSI events occurred in August and September 2020, caused by *Enterococcus faecalis* and *Candida parapsilosis* respectively. Despite the unit's seeming safe practices to yield such positive results, this review was initiated by a request from the UPMC corporate IP team, with the intention of helping to standardize the HD process across UPMC sites. The audit consisted of observing five areas of dialysis process performed by unit nurses: (1) connection, (2) disconnection (3) medication preparation, (4) medication administration and (5) hand hygiene. It was hypothesized that the CHP dialysis team would achieve an 80% compliance rate or better for each area of observation during the audit process.

**Table 1. CHP Dialysis Unit CLABSI Events per 100 Patient Months (2020-2022)**

	2020	2021	2022
Number of CLABSIs	2	0	0
HD Patient Census	827	864	663
<b>Rate</b>	<b>2.86</b>	<b>0</b>	<b>0</b>

## 2.0 Materials & Methods

For each area of dialysis, the IP team utilized an audit tool provided by the Center for Disease Control (CDC) as the guide for determining standard of practice. The team conducted between 12 to 17 observations per HD procedure area between May 2022 to June 2022. Using the CDC audit tool (Appendix A), the team gave a score of 1 if the step was completed successfully, and a score of 0 if the step was not completed at all or performed incorrectly. This scoring off the CDC guide was used to calculate compliance rates for each area of observation, and the team also consulted both the CHP specific HD policies (Appendix B) and the UPMC Systemwide HD policies (Appendix C) to determine whether other steps of the process not included in the tool were being performed appropriately. After comparing the CDC audit tool against the current UPMC HD policies, the tool was modified to account for the individual scrubbing and drying of two catheter lumens instead of one and is reflected in the compliance scoring results. Overall compliance for each area of HD was collected by scoring each observation cycle as 1 or compliant if every step was performed appropriately, or as 0 or non-compliant if any number of steps were missed or performed inappropriately during that cycle. These observation scores are then totaled and given a percentage score for overall compliance of each of the five areas of HD.

Each cycle of HD observed was performed using a Fresenius 2000 dialyzer (Figure 4). The materials made available for the dialysis unit staff to perform these areas are a connection or “ON” kit, a disconnection or “OFF” kit, personal protective equipment (PPE) including gowns, gloves, and eye protection, and various medications including, but not limited to, heparin and albumin. Inside each “ON” and “OFF” kit, the staff members were given a sterile tray, alcohol prep pads (2), sterile drapes (2) (one to lay on the patient’s chest, and another to establish the sterile working





### 3.0 Results

Table 2 describes the compliance rates for each step necessary in the connection or cannulation process of HD. Under observation, hand hygiene and appropriate personal protective equipment were donned by staff members 100% of the time. When preparing the catheter lumen for connection to dialyzer lines, each hub is instructed to be “scrubbed” individually for 30 seconds and allowed 15 seconds of time to dry to ensure the disinfectant is working to its full potential. During observations, each catheter hub was observed to be scrubbed for 30 seconds approximately 94% of the time, with missed adherence explained by individual attention not always being paid to each catheter hub and variable scrubbing techniques performed between staff members. When observing time to dry, the first catheter hub was allowed the full 15 seconds 100% of the time, whereas the second hub was only allowed the full time to dry approximately 82% of the time. Aseptic technique is expected to be maintained throughout the entire procedure, but upon observation, was only consistent 88% of the time due to the handling of dialyzer lines with sterile gloves or without the use of sterile 4x4 gauze pads as a barrier. When stepping away from the patient, gloves and other PPE items were doffed appropriately 100% of the time.

**Table 2. HD Connection Compliance Rates (based on 17 observations)**

Mask worn	New clean gloves worn	Catheter hub 1 scrubbed	Catheter hub 2 scrubbed	Hub 1 antiseptic allowed to dry	Hub 2 antiseptic allowed to dry	Catheter connected to blood lines aseptically	Gloves removed
100%	100%	94%	94%	100%	82%	88%	100%

Once the cycle of HD is completed for the patient, the disconnection or de-cannulation process was observed, with results from 15 audits described by Table 3. When approaching the patient for disconnection, appropriate personal protective equipment was donned by staff members 100% of the time. To prepare to de-access the dialyzer lines from the patient's catheter hubs, the red catheter hub is individually scrubbed with CHG for 30 seconds and allowed to dry for 15 seconds – this was observed successfully approximately 100% of the time. Before disconnection, appropriate technique and duration of catheter hub scrubbing was observed 100% of the time on the first hub and only 93% of the time on the second hub. When reporting on time allowed for the CHG disinfectant to dry after scrubbing, appropriate performance was only demonstrated 80% of observations on the first hub and 53% of observations on the second hub. Aseptic technique is expected to be maintained throughout the entire procedure, but upon observation, was only consistent 93% of the time due to the handling of dialyzer lines with sterile gloves or without the use of sterile 4x4 gauze pads as a barrier. Before de-accessing, the sterile field was maintained 93% of the time, with the primary faults occurring through management of the dialyzer lines or machine with sterile gloves before the access event was over. After disconnection, aseptic technique was demonstrated 100% of the time when attaching the new CHG impregnated ClearGuard hub caps. When stepping away from the patient, gloves and other PPE items were doffed appropriately 100% of the time.

**Table 3. HD Disconnection Compliance Rates (based on 15 observations)**

Mask worn	New clean gloves worn	Pre-Scrub Performed	Hub 1 antiseptic allowed to dry	Sterile gloves donned	Catheter removed from blood line aseptically	
100%	100%	100%	100%	100%	93%	
Catheter hub 1 scrubbed	Catheter hub 2 scrubbed	Hub 1 antiseptic allowed to dry	Hub 2 antiseptic allowed to dry	Hub 1 cap attached aseptically	Hub 2 cap attached aseptically	Gloves removed
100%	93%	80%	53%	100%	100%	100%

Between the performance of connection and disconnection of lines to and from the patient’s catheter, HD medications such as heparin and albumin are prepared for the patient to reduce blood clotting and promote increased fluid removal rates during the process [7, 12]. When this step was observed (Table 4), the medication preparation was never executed in a designated area (0% compliance). In the space that the medication preparation was performed, occasionally it was not wiped down prior to initiation, or was executed on a visibly dirty cart, which yielded a 92% compliance score. Medication vials were inspected 100% of the time. Hand hygiene was performed prior to beginning medication preparation 100% of the time. When initiating preparation, the septum of all medication vials were disinfected with alcohol wipes 100% of the time and always were entered with a new needle and syringe. Overall, the medication preparation was performed aseptically 100% of the time and finished with discarding any single dose vials 100% of the time. When administering the prepared medication to the patient (Table 5), all steps were performed appropriately 100% of the time: clean gloves and PPE donned, disinfecting the port with antiseptic, administering the medication aseptically, discarding the syringe at point of use, and doffing gloves with a final round of hand hygiene. The overall compliance score for HD medication preparation by staff members was 0%, and HD medication administration was 100%.

**Table 4. HD Medication Preparation Compliance Rates (based on 12 observations)**

<b>Med Prep done in designated area</b>	<b>Med prep area is clean</b>	<b>All vial(s) are inspected</b>	<b>Septum of all vials disinfected</b>	<b>All vials entered with new needle and new syringe</b>	<b>Med prep done aseptically</b>	<b>All single dose vial(s) discarded</b>
0%	92%	100%	100%	100%	100%	100%

**Table 5. HD Medication Administration Compliance Rates (based on 12 observations)**

<b>Clean gloves worn</b>	<b>Infection port disinfected with antiseptic</b>	<b>Med admin done aseptically</b>	<b>Syringe discarded at point of use</b>	<b>Gloves removed</b>
100%	100%	100%	100%	100%

Hand hygiene compliance scores are measured through a combination of observations from the previous four areas of HD, as well as observations of additional opportunities for hand hygiene (Table 6). These additional opportunities most frequently included, but were not limited to, entering the patient's space to silence alarms, take a set of vitals, or bring in supplies for the patient to make them comfortable. The most common situation observed that yielded incompliance during hand hygiene observations was not washing in before responding to a patient's alarm in the bedspace. Over 84 total observations, the hand hygiene compliance rate was 94%. According to organization level data, the average compliance rate for the UPMC system during the same May 2022 – June 2022 time frame was 79%, positioning the CHP dialysis unit at an exceptional level of compliance.

**Table 6. Hand Hygiene Compliance Rates**

<b>Observation Type</b>	<b>Observed opportunities</b>	<b>Compliance</b>
Dialysis Areas	70	98%
Additional Opportunities	14	71%
<b>Total</b>	<b>84</b>	<b>94%</b>

After examining each area of dialysis separately, the overall compliance score for dialysis performance in its entirety was calculated (Table 7). The overall compliance scores for connection, disconnection, medication preparation, medication administration and hand hygiene areas are 59%, 47%, 0%, 100% and 94% respectively. Overall average compliance was determined to be 77%, which was close to, but did not meet, the 80% compliance rate predicted in the original hypothesis.

**Table 7. Overall HD Compliance Rate**

<b>Connection</b>	<b>Disconnection</b>	<b>Medication Preparation</b>	<b>Medication Administration</b>	<b>Hand Hygiene</b>	<b>Overall HD Compliance</b>
59%	47%	0%	100%	94%	77%

## 4.0 Discussion & Recommendations

With these results, specific areas demonstrated exceptional skill and performance, whereas other areas indicated need for improvement. These areas are compared and summarized in Table 7 and were brought to the staff members of the dialysis team to discuss and raise awareness of non-compliant areas. Successful areas performed by the dialysis staff members included excellent hand hygiene and PPE compliance rates during all HD event areas, diligent pre-scrubbing and catheter hub drying compliance specifically during the disconnection step, and careful, proficient techniques observed in handling sterile materials. Areas needing improvement by the dialysis staff members included hand hygiene compliance during additional opportunity observations, inconsistent catheter hub scrubbing and drying times and techniques between staff members, premature unattachment of new catheter hub caps from their plastic packaging during the disconnection step, and breaking sterility during disconnection and connection areas by handling the dialyzer before the procedure steps are over. After a conversation with the dialysis outpatient unit team in August 2022, CLABSI rates within the unit have not increased as of January 2023.

A performance observation that also was identified as being a contamination risk during HD is the “one-gloved hand” technique utilized by staff members during the medication preparation step. This method is characterized by staff members handling the sterile syringe with a sterile gloved hand and holding the aseptic medication vial with a non-sterile gloved hand. The one-gloved technique was adopted by staff members as a reminder of maintaining sterility of the syringe when preparing it so it could be placed in the sterile field during the disconnection step. This variation of the medication preparation step is not included as a measurement point on the CDC Audit Tool nor the UPMC Systemwide Guidelines for HD, which is why it was not added

into the calculation of compliance. Despite the technique being performed well by staff, it presents unnecessary risk of accidental contamination to the preparation process. This practice was advised against in the improvement discussion with the dialysis outpatient unit team.

**Table 8. Successful Areas of HD Observation and Areas Needing Improvement**

Successful Areas	Areas Needing Improvement
Excellent hand hygiene and PPE compliance during connection, disconnection, medication preparation and administration steps	Poor hand hygiene compliance during additional opportunity observations (i.e. checking in with patient, responding to machine alarm, etc.)
Diligent pre-scrubbing and hub drying compliance during disconnection step	Inconsistent catheter hub scrub time across dialysis nursing team (15 vs. 30 seconds)
Careful and proficient techniques observed in handling sterile supplies within “ON” and “OFF” kits for HD	Premature unattachment of new CHG impregnated hub caps (ClearGuard) from plastic packaging during the disconnection step
Meticulous medication preparation and administration observed resulting in excellent compliance	Handling of lines and dialyzer after going sterile, but before connection is over, thus breaking sterility

Based on the observed team success and improvement areas, the UPMC HD policies, and the compliance rates associated with each area, a list of next steps and recommendations was cultivated to maintain excellent compliance and improve standard of practice in the dialysis setting.

#### **4.1 Standardization of Catheter Hub Scrub Process**

Team members are advised to adopt a standardized method for the techniques and times for catheter hub scrubbing and drying. The recommended times for scrubbing, per the UPMC system HD competencies, is 30 seconds per catheter hub, and the recommended drying time is 15 seconds per catheter hub. Occasionally, staff were observed scrubbing both catheter hubs together for 30 seconds, without paying individual attention to each hub. Per protocol, this is not best practice, as it is explicitly stated to scrub each hub separately with CHG to achieve maximum disinfection potential. Additionally, the drying time was often negligent for the second catheter hub because of the order in which the disinfecting process occurred. The first catheter hub would be scrubbed individually, allowed 15 seconds to dry while the second hub was being scrubbed, but the connection of dialyzer lines or new ClearGuard caps was often initiated immediately after, not permitting the second hub time to dry. This pattern of inappropriate disinfection could be broken by simply waiting an additional 15 seconds after scrubbing the second catheter hub before proceeding to the next relevant step. By consistently utilizing the same best practice approach across the team, the unit will likely increase compliance rates and reduce chances for contamination or infection even further.

#### **4.2 Initiating Sterility for Entire Disconnection Process**

It is advised that sterility be initiated and maintained through the disconnection of *both* catheter lines between the patient and dialyzer. According to UPMC HD disconnection competencies, sterility is initiated before de-accessing the first catheter line. It was often observed



that staff did not initiate their sterile field before disconnecting the “red” or input catheter line, which directly contradicts these systemwide competencies. Given the rest of the process was performed aseptically, this difference in practice was not reflected in the CDC audit tool used as the primary method of data collection for this evaluation. However, going forward, the CHP dialysis unit should adopt the standardized competency reflected by other UPMC sites. Not only does this practice increase standardization of practice across sites, therefore addressing variability in practice, but increased attention to maintaining sterility during this process could reduce risks of contamination or possible infection during disconnection.

#### **4.3 Designated Medication Preparation Counter**

A major criticism of the medication preparation process was the absence of a designated space for this area of HD. Observed medication preparation always took place on the patient’s bedside table or occasionally on a supply cart if the process needed to take place in an inpatient unit. Both methods were observed to be insufficiently clean, by either not wiping the patient bedside table before beginning the process, or by preparing the medications for the inpatients on a visibly dirty and crowded cart surface. Establishing a space (either countertop or cart) in the dialysis outpatient unit to prepare medication has the potential to eliminate contamination or infection risks previously associated with utilizing the one-gloved technique at the patient’s bedside and preparing medications on unclean surfaces. If establishing a separate counter is not feasible given the space that is available in the unit, the staff might consider using sterile 4x4 gauze included in the HD “OFF” kits to handle non-sterile materials, such as medication vials.

#### **4.4 Catheter Cap Attachment**

It was frequently observed that staff members unscrewed and dropped the new ClearGuard caps onto the sterile field at the beginning of the disconnection process. While performing this action does not negatively affect the efficacy of the CHG on the product, it does introduce the risk for accidental contamination by prematurely exposing the coated male-end of the ClearGuard caps. This step in the disconnection process was also so variable and unregulated due to the current lack of standardized use of ClearGuard caps across the UPMC system. Recommendation for future practice from CHP's IP team would be to attach the caps to the patient's catheter hubs immediately after disconnecting them from the female-end plastic holder.

## 5.0 Conclusion

Despite CHP's dialysis outpatient unit not meeting the hypothesized goal of compliance through this audit process, the program evaluation produced important data with future implications in research and clinical practice. Clinically, UPMC has taken a step further in standardizing HD practices performed by staff for all patients. Through this standardization, UPMC will be creating a process with less room for variability of technique, which is expected to increase compliance rates and reduce the risk of possible contamination and infection events. By reducing CLABSI events in UPMC facilities, this initiative would also be helping to reduce extra costs that are associated with managing healthcare associated infections in patients. Additionally, if this standardized process achieves a significant decrease in CLABSI rates in the future, UPMC's practice could set the standard for institutions state- or nation-wide. To develop this study further, research could expand upon the results from this study and determine whether performance of this review had any impact on CLABSI rate frequency for the unit. Additionally, this review can be expanded to touch on issues of health equity, ensuring the best standard of practice regarding central line care is being performed on all patients in the institution. From these recommendations, it is the intention that compliance rates will improve, potential risks associated with catheter line infections will be reduced, and CHP will achieve a more standardized HD process with the system.

## Appendix A CDC Audit Tools


**CDC Dialysis Collaborative** Facility Name: \_\_\_\_\_ Date: \_\_\_\_\_ Start time: \_\_\_\_\_ AM / PM  
 Day: M W F Tu Th Sa Shift: 1<sup>st</sup> 2<sup>nd</sup> 3<sup>rd</sup> 4<sup>th</sup> Observer: \_\_\_\_\_ Location within unit: \_\_\_\_\_

**Audit Tool: Catheter connection and disconnection observations**  
 (Use a "√" if action performed correctly, a "Φ" if not performed. If not observed, leave blank)


Procedure observed, C=connect, D=disconnect	Discipline	Mask worn properly (if required)	Hand hygiene performed	New clean gloves worn	Catheter removed from blood line aseptically (disconnection only)	Catheter hub scrubbed	Hub antiseptic allowed to dry	Catheter connected to blood lines aseptically (connection only)	New caps attached aseptically (after disconnecting)	Gloves removed	Hand hygiene performed

Discipline: P=physician, N=nurse, T=technician, S=student, O=other  
 Duration of observation period = \_\_\_\_\_ minutes      Number of procedures performed correctly = \_\_\_\_\_  
 Total number of procedures observed during audit = \_\_\_\_\_

**ADDITIONAL COMMENTS/OBSERVATIONS:**



National Center for Emerging and Zoonotic Infectious Diseases  
 Division of Healthcare Quality Promotion



**Appendix A Figure 1. CDC Audit Tool: Catheter Connection & Disconnection [13]**

Facility Name: \_\_\_\_\_ Observer: \_\_\_\_\_  
 Date(s): \_\_\_\_\_ Location of Medication Preparation: \_\_\_\_\_


**Audit Tool: Hemodialysis injectable medication preparation**  
 Observe a medication preparation session. (Use a "√" if action performed correctly, a "Φ" if not performed/performed incorrectly. If not observed, leave blank. All applicable actions within a row must have "√" for the procedure to be counted as successful.)

Day (i.e., M, Tu, W)	Shift (i.e., 1 - 4)	Discipline	Med prep done in designated area	Med prep area is clean *	All vial(s) are inspected **	Hand hygiene performed	Septum of all vial(s) disinfected	All vials entered with new needle and new syringe	Med prep done aseptically	All single dose vial(s) discarded	All multi dose vial(s) discarded or stored properly


Discipline: P=physician, N=nurse, T=technician, S=student, O=other  
 Number of sessions performed correctly = \_\_\_\_\_  
 Total number of sessions observed = \_\_\_\_\_

**ADDITIONAL COMMENTS/OBSERVATIONS:**

\*Preparation of injectable medications must be performed in a designated clean area that is free of obvious contamination sources (e.g., blood, body fluids, contaminated equipment, tap water).  
 \*\*Vial should be discarded if sterility is questionable, or expiration date or beyond-use date has been exceeded. If a multi-dose vial will not be immediately discarded after use, the vial should be labeled upon opening to indicate the beyond-use date.



National Center for Emerging and Zoonotic Infectious Diseases  
 Division of Healthcare Quality Promotion




**Appendix A Figure 2. CDC Audit Tool HD Medication Preparation [14]**



## Appendix B CHP Hemodialysis Policies

### Appendix B.1 CHP System Hemodialysis Initiation Policy

 <p><b>SCOPE:</b></p> <p><input checked="" type="checkbox"/> Children's Hospital of Pittsburgh ("CHP") Main  <input type="checkbox"/> Children's Hospital of Pittsburgh Satellites  <input type="checkbox"/> Children's Hospital of Pittsburgh Ambulatory Clinics  <input type="checkbox"/> Children's Hospital of Pittsburgh Ancillary Service  <input type="checkbox"/> CHP North Surgery Center  <input type="checkbox"/> CHP South Surgery Center  <input checked="" type="checkbox"/> CHP Outpatient Dialysis Unit</p>	<p><b>TITLE: Dialysis: Initiating Hemodialysis (HD) via Double Lumen HD Catheter or Two Single Lumen Catheters</b></p>		<p>POLICY #</p> <p style="text-align: center;"><b>D001</b></p>
	<p>ORIGINATION DATE:</p> <p style="text-align: center;"><b>02/2009</b></p>	<p>REVIEW/REVISION DATE: <b>03/10; 04/11 04/12; 06/13; 06/14; 01/15; 3/16; 2/17; 9/18, 8/19, 5/20; 3/21; 5/22</b></p>	<p>SECTION : <b>II Patient Care</b></p>
	<p style="text-align: center;"><input checked="" type="checkbox"/> <b>POLICY/PROCEDURE</b></p> <p style="text-align: center;"><input type="checkbox"/> <b>PLAN</b></p> <p style="text-align: center;"><input type="checkbox"/> <b>GUIDELINE</b></p>		<p><u><b>Approval Committee Review</b></u></p> <p><input type="checkbox"/> Medical Executive Committee  <input type="checkbox"/> Patient Care Leadership  <input type="checkbox"/> Practice Council  <input checked="" type="checkbox"/> Dialysis IDT Council</p>

**I. PURPOSE:**

To initiate hemodialysis through a double-lumen hemodialysis catheter or two single lumen catheters.

**II. WHO CAN PERFORM:**

The dialysis trained professional nurse.

**III. GENERAL GUIDELINES:**

1. The catheter may be either a temporary catheter placed in the femoral or jugular vein or a more permanent "tunneled dialysis catheter" (TDC).
2. Hemodialysis may also be done utilizing 2 single lumen catheters or 2 ports on an ECMO circuit.
3. The door to the patient's room must be closed or the curtain around the patient's bed must be drawn.
4. The dialysis nurse must wear Personal Protective Equipment (PPE) ie: gown, gloves and mask with face shield or goggles.
5. The patient should mask unless too young to understand or intubated.
6. Family members may stay in the room, but they must each wear a mask. The family member must also wear PPE if helping to hold the child.
7. Patients with a suspected or proven Chlorhexidine allergy may have their catheter scrubbed with 70% Isopropyl Alcohol (15 second scrub / 15 second dry).
8. Patients with a suspected or proven Chlorhexidine allergy may have their catheter capped with standard end caps that are provided in the off kit.

**IV. EQUIPMENT:**

1. Thermometer
2. Monitor
3. Scale
4. Dialysis “On Kit” which contains Sterile basin, sterile drape, 10ml syringes (2), Prefilled 10ml NSS syringes (2), sterile 4x4s and a Chlorhexidine applicator.
5. Clear Guards
6. Sterile gloves
7. Acute Hemodialysis flow sheet
8. Fresenius Hemodialysis machine with primed Artificial Dialyzer and Blood Lines as per physician order
9. PPE
10. Blue Clamps (4)
11. If heparin is ordered: Heparin, 10ml syringe, 3ml syringe, 2 needles, syringe pump tubing, alcohol swab, and 2 Heparin labels
12. If labs are being drawn: 10ml syringe, transfer device, and appropriate blood tubes

#### V. PROCEDURE:

1. Verify physician order.
2. Identify patient with two patient identifiers and explain procedure to patient and family.
3. Obtain patient weight and complete set of vital signs.
4. If heparin is ordered for the treatment, prepare as per policy D009.
5. Verify that the Fresenius hemodialysis machine is primed and set as per physician orders.
6. On the “Test & Options” screen, confirm that alarm and pressure tests have passed. Check that the Diasafe filter test was performed within the past 7 days. Ensure that the Venous Width is set at 160 mm Hg. Verify that Pediatric mode and High Flux options are correct. Confirm the correct dialyzer and bloodlines are on the machine. Open pump door to verify that the I.D. (Internal Diameter) number corresponds with bloodline size.(see policy D114, D115). Verify that the acidified concentrate solution (K+ and Ca+ Bath) is as ordered. Verify the sodium bicarbonate solution is not expired (expires 24 hours from the time it is opened).
7. Machine should display “Recirc Complete” which indicates that machine is ready for dialysis. “UF Removed” should read 100 ml.
8. Press “reset”. Display should read “Dialysis Paused”. On the “Home” screen, set the prescribed “Treatment Time”, “UF Goal” and “UF Time”. Set “Na Modeling” (if ordered), and “UF Profile” (at the dialysis nurse’s discretion). Verify the correct temperature is set. On the “Dialysate screen” verify the Na, K+, Ca+ and HCO<sub>3</sub>- settings are set as ordered. Complete Hemodialysis Machine Checklist.
9. Stop the blood pump. Clamp the arterial and venous lines and saline line. Secure patient lines to bed.
10. Perform hand hygiene.
11. Provide PPE for anyone staying in the room during this procedure, and mask patient as appropriate.
12. Pull curtains around patient’s bed/dialysis chair or close the door to patient’s room.
13. Perform hand hygiene. Don mask and PPE.
14. Prepare HD catheter by removing securing tape, label and gauze around catheter limbs.
15. Verify that clamps on both limbs of catheter are closed.
16. Remove gloves. Perform hand hygiene.
17. Open hemodialysis “ON” kit, sterile gloves and sterile field. Don sterile gloves. Arrange your tray by placing 1 sterile 4x4 in the tub. Activate the Chloraprep 10.5 mL applicator and drizzle the solution onto the 4x4x in the tub. “Dabbing” the sponge to the gauze to saturate the 4x4 is also acceptable.
18. Place sterile drape on patient, near catheter.
19. Using non-dominant hand and sterile 4x4 gauze, pick up patient’s dialysis catheter. With other hand, place sterile drape under catheter. Use separate sterile gauze in dominant hand to remove caps from both limbs.  
**Note: Limbs of catheter must have cap, syringe, or line in place at all times unless actively scrubbing the tips of the catheter limbs. A limb left clamped but open to air may become accidentally unclamped and puts the patient at risk for air embolism or blood loss.**
20. Using a CHG/Isopropyl (from chloraprep) saturated 4x4, scrub tips of catheter for at least 30 seconds and allowing to dry for 30 seconds

21. Holding catheter up with one hand, place sterile 4x4 under catheter and allow catheter to drop onto new 4x4 as the CHG/Isopropyl 4x4 is removed.
22. Using 4x4's to hold the catheter, attach an empty sterile 10 ml syringe to each limb of the catheter.
23. Note volume of the first limb which you will be accessing on the catheter (may access blue or red in either order).. (Volumes of catheter limbs are imprinted on each limb of hemodialysis catheter.) Using a sterile 4x4, release clamp and withdraw twice the volume of blood from the catheter limb. (If unable to aspirate blood and no kink is present, have patient cough and/or reposition patient and try again to aspirate blood from limb. If still unsuccessful, stop and notify MD.) Reclamp catheter.
24. Remove syringe. Cautiously discard withdrawn blood over dry 4x4 to check for the presence of clots.
25. If clots are seen, reattach empty syringe and repeat Steps 22 & 23 (except now withdraw just the volume of the limb) until no clots are seen. If blood work is ordered, attach a new sterile 10 ml syringe to limb, draw specimen at this time and reclamp limb (see policy D013).
26. Attach a saline filled 10ml syringe to the first limb. Unclamp limb using a sterile 4x4 and inject saline into the catheter. Reclamp limb. Leave syringe on limb.
27. Repeat Steps 22-25 with the second limb.
28. Pick up blood lines with a sterile 4x4. Using a second 4x4, remove arterial blood line from connector and attach to arterial limb of catheter. Remove venous blood line from connector and attach to venous limb of catheter.
29. Make sure connections are secure.
30. Unclamp blood lines and catheter limbs.
31. Initially, turn on the blood pump to half of the prescribed blood flow rate (BFR).
32. Confirm that "Treatment Time", "UF Time" and "UF Goal" are set correctly.
33. Select "Treatment Clock" in the center of the screen and "confirm" to start treatment. Display will read "Dialysis". "UF Removed" should reset to zero (0). Confirm that UF light is illuminated.
34. Give Heparin bolus if ordered.
35. Start Continuous Heparin infusion via syringe pump if ordered
36. Note and record arterial and venous pressures at ½ of the prescribed BFR then increase blood pump to the prescribed BFR

## **VI. DOCUMENTATION:**


On the Hemodialysis Flow Sheet (and in the electronic record as appropriate), document patient's vital signs and machine readings at start of treatment, then every 30 minutes or more frequently, with any changes.

### **REFERENCES:**

- Fresenius 2008K2 Hemodialysis System Operator's Manual
- Kallenbach, J. (2011). Review of Hemodialysis for Nurses and Dialysis Personnel. Elsevier Mosby, St. Louis, Missouri.
- Daugirdas, J., Blake, P., and Ing, T. (2007). Handbook of Dialysis. Lippincott Williams & Wilkins, Philadelphia



## Appendix B.2 CHP System Hemodialysis Initiation Policy

 <p><b>SCOPE:</b></p> <input checked="" type="checkbox"/> Children's Hospital of Pittsburgh ("CHP") Main <input type="checkbox"/> Children's Hospital of Pittsburgh Satellites <input type="checkbox"/> Children's Hospital of Pittsburgh Ambulatory Clinics <input type="checkbox"/> Children's Hospital of Pittsburgh Ancillary Service <input type="checkbox"/> CHP North Surgery Center <input type="checkbox"/> CHP South Surgery Center <input checked="" type="checkbox"/> CHP Outpatient Dialysis Unit	<b>TITLE: Dialysis: Terminating Hemodialysis with a Double Lumen Hemodialysis Catheter or Two Single Lumen Catheters</b>		<b>POLICY # D004</b>
	<b>ORIGINATION DATE:</b> <b>03/2009</b>	<b>REVIEW/REVISION DATE:</b> <b>04/10; 04/11; 04/12; 07/12; 06/13; 06/14; 04/15; 02/16; 2/17; 9/18; 03/19; 8/19; 5/20; 3/21; 5/22</b>	<b>SECTION:</b> <b>II Patient Care</b>
	<input checked="" type="checkbox"/> <b>POLICY/PROCEDURE</b> <input type="checkbox"/> <b>PLAN</b> <input type="checkbox"/> <b>GUIDELINE</b>		<u><b>Approval Committee Review</b></u> <input type="checkbox"/> Medical Executive Committee <input type="checkbox"/> Patient Care Leadership <input type="checkbox"/> Practice Council <input checked="" type="checkbox"/> Dialysis IDT Council

**I. PURPOSE:**

To safely end the hemodialysis treatment by returning the patient's blood and disconnecting the dialysis machine tubing from the patient's hemodialysis access. Note: When dialyzing a neonate, ( $\leq 6.6$  kg) the dialysis system may be primed with blood and post dialysis, the nephrologist may order that the blood not be returned.

**II. WHO CAN PERFORM:**

The dialysis trained professional nurse

**III. GENERAL GUIDELINES:**

1. The catheter may be either a temporary catheter usually placed in the femoral or jugular vein or a more permanent "tunneled dialysis catheter" (TDC).
2. The door to the patient's room must be closed or the curtain around the patient's bed must be drawn.
3. The dialysis nurse must wear Personal Protective Equipment (PPE) ie: gown, gloves and mask with face shield or goggles.
4. The patient should mask unless too young to understand or intubated.
5. Family members may stay in the room, but they must each wear a mask. The family member must also wear PPE if helping to hold the child.
6. Patients with a suspected or proven heparin allergy may have catheter locked with Alteplase (t-PA) or other medication. If using t-PA, see policy D012.
7. Patients with a suspected or proven Chlorhexidine allergy may have their catheter scrubbed with 70% Isopropyl Alcohol (15 second scrub/ 15 second dry)
8. Patients with a suspected or proven Chlorhexidine allergy may have their catheter capped with standard catheter end caps that are provided in the off kit (opposed to the Clear Guards).

**IV. EQUIPMENT:**

1. Thermometer
2. Monitor

3. Scale
4. Fresenius Hemodialysis machine
5. Hemodialysis "Off Kit" that contains sterile basin, sterile drape, 4x4s, 10ml prefilled NSS syringes (2), 3ml syringes (2), dead end caps (2), roll of tape
6. Clear Guards
7. Two sterile needles
8. Sterile Gloves
9. Medication label (Red for Heparin or Purple for t-PA)
10. Heparin 1:1000 units or prescribed medication to be instilled into catheter post HD. If using Alteplase, refer to Policy D012
11. PPE: gown, fluid shield mask and gloves for nurse (and family member who may be assisting with child during the disconnect procedure)
12. Mask for patient as appropriate
13. Hemodialysis flow sheet
14. If post labs ordered, 10 ml syringe, 21g needle, transfer device, and alcohol wipes
15. Chloraprep sponge
16. Sterile 4X4 gauze

#### V. PROCEDURE:

1. Identify patient using 2 patient identifiers. Explain procedure to patient and family.
2. Near the end of Hemodialysis, if using Alteplase, reconstitute vial(s) according to Policy D012.
3. Calculate the maximum amount of saline to be used to rinse back the patient's blood in the system:
  - i. **NOTE:** The total amount of saline used for rinseback should not exceed twice the volume of the system (dialyzer plus bloodlines); e.g. if the dialyzer holds 24 ml's and the bloodlines hold 48 ml's this is a total of 72 ml's, so the maximum amount of saline to be used to rinse back the patient's blood would be 144 ml [(24ml + 48ml) X 2 =144ml]
4. Pull curtain/close door.
5. Perform hand hygiene.
6. Provide PPE to family member who may be assisting with child.
7. Don mask and gown, perform hand hygiene and don non-sterile gloves.
8. Cleanse connection between arterial blood line and arterial limb of patient's catheter with chloraprep sponge and place sterile gauze under line connection.
9. Select the Treatment Clock in the center of the screen and press "confirm" to pause dialysis.
10. Press and hold "override" to open alarm limits
11. If post dialysis blood work is ordered, decrease blood pump speed to ¼ of treatment speed for 1 minute. Clean arterial sample port with alcohol wipe for 15 seconds. Use a 10 ml syringe and 21 gauge needle to draw blood specimen for ordered test(s). If post BUN is needed, refer to Policy D007.
12. Press the Start/Stop key to stop the pump.
13. Clamp arterial blood line, arterial limb of patient's catheter (venous limb if running reversed), and all clamps on saline line. Disconnect arterial bloodline from patient's catheter and attach pre-filled saline syringe to catheter limb. Connect the patient end of the arterial bloodline to the Y-site of the saline line. Unclamp arterial limb of patient's catheter, flush with saline and reclamp. Open the arterial bloodline clamp, the clamp on the saline line, and the clamp closest to saline bag. Leave the clamp at the bottom of the saline line Y-site closed. Restart blood pump at ¼ - ½ treatment speed and using saline, rinse back system
  - i. **NOTE:** When rinsing back small pediatric patients, a 60 ml syringe is used to accurately measure the amount of NSS given to rinse back the patient's blood. Attach a stopcock to the Y-site of the saline line. Attach the patient end of the bloodline to the end of the stopcock and the 60 ml syringe to the side port of the stopcock. \*Fill 60 ml syringe from saline bag, clamp saline line and turn stopcock off to saline line to rinse back patient using 60 ml syringe. Repeat from \* until all blood is returned.
14. Occasionally pinch bloodline below venous end of dialyzer to release blood cells from the sides of the blood tubing.
15. When rinseback is complete, stop pump. Close clamps on patient's venous catheter limb and venous bloodline.
16. Record data from the machine: Total UF and Liters Processed.

17. Open Hansen Hatch and place blue Hansen on machine. Close hatch to empty fluid from the dialyzer.
18. When dialyzer empty, open hatch and place red Hansen on machine. Close hatch.
19. Place caps on dialyzer and return to holder.
20. Remove red and blue connectors from acidified and bicarbonate jugs and replace on front of machine.
21. Press Acid Clean and confirm. Machine will do a brief rinse.
22. From here, proceed with mandatory vinegar rinse of Fresenius Hemodialysis machine (see policy D106).
23. Remove gloves. Perform hand hygiene. Don new non-sterile gloves.
24. Remove cap from Heparin vial.
25. Wipe each Heparin vial with an alcohol swab.
26. Open hemodialysis “OFF” kit. Prepare sterile needle. Open Clear Guards and drop onto the field.
27. Remove non-sterile gloves and perform hand hygiene.
28. Place sterile glove on dominant hand.
29. With ungloved hand attach sterile needle to 3 ml syringe. Remove cap from needle and place cap off sterile field.
30. With ungloved hand, pick up vial of Heparin. Still holding sterile syringe, withdraw volume of Heparin to equal the volume of the red catheter limb. **Note:** Catheter volumes vary. The fill volumes are printed on the catheter limbs.
31. Remove needle from syringe and place needle off sterile field.
32. Place syringe on sterile field. Repeat steps 29-31 with second needle and 3 ml syringe for the blue catheter limb and then place syringe on sterile field. Double-check heparin with a second RN.
33. Place sterile glove on non-dominant hand and prepare “OFF” Kit. Activate the Chloraprep 10.5 mL applicator and drizzle the solution onto a sterile 4x4. “Dabbing” the sponge to the gauze to saturate the 4x4 is also acceptable.
34. Place sterile drape on patient near catheter.
35. Using non-dominant hand and sterile 4x4 gauze, pick up patient’s dialysis catheter. With other hand, move sterile drape up and under catheter.
36. Verify that catheter limbs and venous bloodline are clamped (3 clamps).
37. Still holding the patient's catheter with non-dominant hand, use a sterile 4x4 to disconnect the bloodline from the venous limb of the catheter and the syringe from the arterial limb of the catheter. Drop the bloodlines off the sterile field.
  - i. **Note: Limbs of catheter must have cap, syringe, or line in place at all times unless actively scrubbing the tips of the catheter limbs. A limb left clamped but open to air may become accidentally unclamped and puts the patient at risk for air embolism or blood loss.**
38. Using a CHG/Isopropyl (From chloraprep) saturated 4x4, scrub tip(s) of the port(s) to be accessed for at least 30 seconds and allow to dry for at least 30 seconds.
39. Holding catheter up with one hand, place sterile 4x4 under catheter and allow catheter to drop onto new 4x4 as the CHG/Isopropyl 4x4 is removed.
40. Using 4x4’s to hold the catheter, attach a prefilled NSS 10 ml syringes to each of the limbs.
41. Unclamp first catheter limb and slowly flush with saline. Reclamp limb.
42. As you remove the 10ml syringe of saline, hold limb upright and ensure there’s saline to the end of the limb.
43. Attach 3 ml syringe filled with appropriate amount of Heparin to the first limb. If patient is able, have patient take a deep breath in and hold. While patient is holding his breath, quickly inject the Heparin and reclamp catheter using positive pressure technique. Note: If patient is unable to hold his breath, inject Heparin at end of expiration.
44. Remove syringe and apply Clear Guard catheter cap securely to end of limb.
45. Repeat Steps 40-43 with the second limb of catheter.
46. Apply tape around clamps and end caps.
47. Use preprinted red label for heparin documentation. Document on medication label the amount and strength of Heparin. Place label on catheter limbs.
48. If desired, wrap and secure 4x4 gauze around catheter limbs for patient comfort.
49. Document post dialysis assessment as per procedure.

## VI. DOCUMENTATION:

On the hemodialysis flow sheet (and in the electronic medical record as appropriate), document the patient's vital signs, a post dialysis note describing the overall treatment and access function throughout the treatment, the amount of fluid removed from the patient, any medications given, and the condition of the patient post dialysis.

The completed Hemodialysis Flow sheet will then be electronically scanned into the patient's electronic medical record.

## **VII. PATIENT TEACHING:**

Patient and family will be educated as appropriate in the sterility of the procedure to decrease apprehension. Signs and symptoms of infection will be discussed as well as instructions to call the dialysis nurses if signs of infection occur. They are also instructed not to get dressing wet (no showering).

## **REFERENCES:**

Fresenius 2008K Hemodialysis System Operator's Manual

Kallenbach, J. (2011). Review of Hemodialysis for Nurses and Dialysis Personnel. Elsevier Mosby, St. Louis, Missouri.

Daugirdas, J., Blake, P., and Ing, T. (2007). Handbook of Dialysis. Lippincott Williams & Wilkins, Philadelphia

## Appendix C UPMC System Hemodialysis Competencies

### Appendix C.1 UPMC System HD Connection Competencies

#### UPMC Pittsburgh Dialysis Services

##### Procedure/Competency

##### Accessing a Hemodialysis Catheter

**Purpose: Competency to validate skills for accessing a HD catheter**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Behavior/Skill	
<b>Supplies/Equipment:</b> <ul style="list-style-type: none"> <li>• Masks (2)</li> <li>• Goggles/face shield</li> <li>• Gown</li> <li>• Sterile gloves</li> <li>• Non-sterile gloves</li> </ul>	<ul style="list-style-type: none"> <li>• Hemodialysis "On" kit                             <ul style="list-style-type: none"> <li>○ 1 sterile drape</li> <li>○ 2 alcohol wipes</li> <li>○ Antimicrobial disinfectant</li> <li>○ Sterile 4 x 4 gauze pads</li> <li>○ 2 empty 10mL syringes</li> <li>○ 2 sterile pre-filled 10 mL NSS syringes</li> </ul> </li> </ul>
<p><b><u>Procedure: Accessing a Hemodialysis Catheter</u></b></p> <ol style="list-style-type: none"> <li>1. Gather equipment</li> <li>2. Verify physician order to initiate therapy.</li> <li>3. Perform hand hygiene and don appropriate personal protective barrier equipment. Hand hygiene must be performed between tasks and when gloves are changed. Close curtains around bed or close the door.</li> <li>4. Verify patient's identification.</li> <li>5. Explain procedure to patient. Mask the patient. The nurse/technician must don mask, goggles/face shield, and gown. Everyone in the room or area contained within the closed curtains must wear a mask during the procedure. Make sure the top of the mask is completely covering the patient's nose and the bottom of the mask extends to below patient's chin level.</li> <li>6. Remove tape/label from catheter. Ensure that the catheter limbs are clamped. Remove and discard gloves.</li> <li>7. Perform hand hygiene. Open "On" kit and don sterile gloves.</li> <li>8. Prepare supplies. Pour antimicrobial disinfectant over 4 x 4 gauze pads.</li> <li>9. Place sterile drape next to the patient's catheter and lift catheter using a sterile 4 x 4 gauze pad or swab. Do not touch the catheter directly. Always use 4 x 4 gauze pads to handle catheter with gloved hands. Remove and discard caps.</li> <li>10. Arrange sterile drape under the catheter and allow catheter, wrapped in a new sterile 4 x 4 gauze to rest on the drape. Strictly minimize the time catheter is uncapped. Never leave an uncapped catheter unattended.</li> <li>11. Use antimicrobial disinfectant soaked 4 x 4 gauze pads to scrub the exposed catheter hubs, including the threads and distal (4cm) limb of catheter for 30 seconds. Discard 4 x 4 gauze pads. Allow to air dry.</li> <li>12. Using a sterile 4 x 4 pad to hold catheter limb, attach a sterile 10 mL syringe to catheter hub. Release clamp, withdraw 4-5 mL of blood to remove the locking solution and assess catheter patency.</li> </ol>	

- If unable to aspirate blood and no kink is present, attach flush syringe to limb and attempt to irrigate. If resistance is felt, stop and notify nephrologist for further instructions.
  - If ordered, refer to Alteplase procedure
13. Re-clamp catheter limb.
  14. Repeat process with second catheter limb.
  15. While holding the catheter with a sterile 4 x 4 gauze pad, attach a NSS-filled syringe to each catheter hub.
  16. Unclamp the catheter limb and flush with 10 mL NSS.
  17. Re-clamp catheter.
  18. Using aseptic technique, remove the empty saline syringes, connect catheter limbs to appropriate end of blood lines if initiating HD.

**Met**  **Not Met / Comment** \_\_\_\_\_.

**Competency statements will be Met or Not Met. Met indicates that the staff member has been observed performing the competency. An action plan will be indicated for any Not Met competency. A Not Met competency will be described in the comment section.**

**Indicate action plan for Not Met competency:**

- Re-education provided by validator
- Referred to Education for re-education and re-evaluation
- Referred to Unit Director because of performance issue
- Other

**Validator:**

**Signature/Title\_ Date:** \_\_\_\_\_.

**References:**

1. National Kidney Foundation. KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for 2006 Updates
2. Hemodialysis Adequacy, Peritoneal Dialysis Adequacy and Vascular Access. National Kidney Foundation. KDOQI Clinical Practice Guidelines for Hemodialysis Adequacy, 2000.
3. CDC Dialysis Bloodstream Infection Prevention Collaborative Protocol, 2016.
4. Pryor, L. & Brouwer-Maier, D. (2017). Central Venous Catheter. In S.M. Bodin (Ed.), Contemporary nephrology nursing (3rd ed., pp. 349-362). Pitman, NJ: American Nephrology Nurses' Association.
5. National Kidney Foundation. KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for 2006 Updates
6. Hemodialysis Adequacy, Peritoneal Dialysis Adequacy and Vascular Access. National Kidney Foundation. KDOQI Clinical Practice Guidelines for Hemodialysis Adequacy, 2000.
7. CDC Dialysis Bloodstream Infection Prevention Collaborative Protocol, 2016.
8. Pryor, L. & Brouwer-Maier, D. (2017). Central Venous Catheter. In S.M. Bodin (Ed.), Contemporary nephrology nursing (3rd ed., pp. 349-362). Pitman, NJ: American Nephrology Nurses' Association.
9. Deaver, K. & Counts, C. (2015). Vascular Access for Hemodialysis: Central Venous Catheters. In C.S. Counts (Ed), Core Curriculum for Nephrology Nursing: Module 3. Treatment options for patients with chronic kidney failure. (6 th ed, pp. 206-215). Pitman, N.J: American Nephrology Nurses' Association.
10. Gomez, N. (2017). Nephrology nursing scope and standards of practice (8th ed.) Pitman, N.J: American Nephrology Nurses' Association.

## Appendix C.2 UPMC System HD Disconnection Competencies

### UPMC Pittsburgh Dialysis Services

#### Procedure/Competency

#### De-accessing a Hemodialysis Catheter

**Purpose: Competency to validate skills for de-accessing a HD catheter**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Behavior/Skill	
<p><b>Supplies/Equipment:</b></p> <ul style="list-style-type: none"> <li>• 2 masks</li> <li>• Goggles/face shield</li> <li>• Gown</li> <li>• Sterile gloves</li> <li>• Non-sterile gloves</li> <li>• Catheter locking solution</li> </ul>	<ul style="list-style-type: none"> <li>• Hemodialysis "Off" kit                             <ul style="list-style-type: none"> <li>○ 1 sterile drape</li> <li>○ 2 alcohol wipes</li> <li>○ Antimicrobial disinfectant</li> <li>○ Sterile 4 x 4 gauze pads</li> <li>○ 2 empty 3 mL syringes</li> <li>○ 2 needleless spike devices</li> <li>○ 2 sterile pre-filled 10 mL NSS syringes</li> <li>○ Catheter label/tape</li> </ul> </li> </ul>
<p><b><u>Procedure: De-accessing a Hemodialysis Catheter</u></b></p> <ol style="list-style-type: none"> <li>1. Gather equipment.</li> <li>2. Verify physician order.</li> <li>3. Perform hand hygiene and don appropriate personal protective barrier equipment. Hand hygiene must be performed between tasks and when gloves are changed. Close curtains around the bed or close door.</li> <li>4. Verify patient identification.</li> <li>5. Explain the procedure to patient.</li> <li>6. Mask the patient. The nurse/technician must don mask, goggles/face shield, and gown. Everyone in the room or area contained within the closed curtains must wear a mask during the procedure. Make sure the top of the mask is completely covering the patient's nose and the bottom of the mask extends to below patient's chin level.</li> <li>7. Return blood per unit policy. Ensure that catheter lumens and blood lines are clamped. Remove and discard gloves.</li> <li>8. Perform hand hygiene. Open "Off" kit and don sterile gloves</li> <li>9. Prepare supplies-draw locking solution into syringe using aseptic technique. Fill volumes are listed on the catheter or clamp.</li> <li>10. Place sterile drape next to patient's catheter and lift catheter using a sterile 4 x 4 gauze pad. Do not touch the catheter directly. Always use 4 x 4 gauze pads to handle catheter with gloved hands.</li> <li>11. Disconnect lines while holding catheter.</li> <li>12. Arrange sterile drape under catheter and allow catheter to rest on drape. Time that catheter is uncapped must be strictly minimized. Never leave an uncapped catheter unattended.</li> </ol>	

13. Use antimicrobial disinfectant soaked 4 x 4 gauze pads to scrub the exposed catheter hub, including the threads and distal (4 cm) lumen of catheter for 30 seconds. Discard 4 x 4 gauze pad. Allow to dry.
14. Attach a saline-filled syringe to each catheter lumen.
15. Unclamp the catheter lumen and flush with 10 mL NSS.
16. Re-clamp catheter.
17. Repeat process with the second lumen of catheter.
18. Remove the empty saline syringe and attach syringe with appropriate volume of locking solution.
19. Attach 3 mL syringe filled with prescribed locking solution to equal the volume of the catheter lumen being de-accessed. Fill volumes are located on each catheter lumen or clamp. Inject the prescribed locking solution quickly and re-clamp the catheter.
20. Repeat process with second lumen of catheter.
21. Remove syringe and apply dead end cap securely.
22. Repeat with second lumen.
23. Apply tape around clamps and end caps.
24. Apply catheter label if available and label lock solution with dose, concentration, volume, date, time, and initials of professional nurse or dialysis technician.
25. Remove personal protective equipment, discard used supplies in the appropriate receptacle, and perform hand hygiene.
26. Document per unit guidelines.

**Met**  **Not Met / Comment** \_\_\_\_\_.

**Competency statements will be Met or Not Met. Met indicates that the staff member has been observed performing the competency. An action plan will be indicated for any Not Met competency. A Not Met competency will be described in the comment section.**

**Indicate action plan for Not Met competency:**

- Re-education provided by validator
- Referred to Education for re-education and re-evaluation
- Referred to Unit Director because of performance issue
- Other

**Validator:**

**Signature/Title\_ Date:** \_\_\_\_\_.

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