UNIVERSITY OF WISCONSIN - LA CROSSE

Graduate Studies

ASSESSING GAPS IN DIALYSIS STATION DISINFECTION PRACTICES AT A
LOCAL OUTPATIENT DIALYSIS FACILITY

A Graduate Project Submitted in Partial Fulfillment of the Requirements for the Degree
of Master in Public Health in Community Health Education

Leah Bomesberger

College of Science and Health
Health Education and Health Promotion

May, 2019
ASSESSING GAPS IN DIALYSIS STATION DISINFECTION PRACTICES AT A LOCAL OUTPATIENT DIALYSIS FACILITY

By Leah Bomesberger

We recommend acceptance of this graduate project in partial fulfillment of the candidate's requirements for the degree of Master of Public Health in Community Health Education.

The candidate has completed the oral defense of the graduate project.

Dr. Gary Gilmore, MPH, Ph.D., MCHES
Faculty Advisor

Bridget Pfaff, MS, Administrative Director
Infection Control Advisor

Graduate project accepted

Meredith Thomsen, Ph.D.
Director of Graduate Studies

Date

April 23, 2019

4/24/19

5-3-2019
ABSTRACT

Bomesberger, L.S. Assessing gaps in dialysis station disinfection practices at a local outpatient dialysis facility. MPH in Community Health Education, May 2019, 168pp. (G. D., Gilmore)

Infection is the second leading cause of hospitalization and death in the dialysis patient population. Hemodialysis requires direct access to the patient’s blood; therefore, the area that the patient inhabits during treatment has the potential to be contaminated. Nursing staff are required to disinfect the patient station between each patient who utilizes the dialysis machine. The purpose of this project was to better understand the multi-layered approach at reducing patient infections at an outpatient dialysis facility with station disinfection. A needs and capacity assessment was performed to determine future protocols and sustainable educational objectives regarding station disinfection. Infection control environmental surveillance methods were used to objectively determine the cleanliness level of the surfaces in the dialysis station. In-depth interviews with infection control leadership, dialysis staff members, and patients were completed to gather themes and gaps in station disinfection processes. Results from both objective surveillance and interviews demonstrate that providing hands-on educational skills to staff, especially when unique cleaning situations arise, are needed. Providing strong rationale and definition of tasks that are required of staff, and patients, are recommended. Infection control within the dialysis patient population is an emerging priority that demands the interest of multiple stake-holders, specifically in station disinfection.
ACKNOWLEDGMENTS

I want to thank the staff and patients at the Renal Department at Gundersen Health, and the individuals in the Infection Control Department. Without their honesty and willingness to work with me, this project would not have been possible. To Bridget Pfaff, thank you for being a cheerleader, supporter, friend and a mentor to me throughout this project. Thank you, Dr. Gary Gilmore, for challenging me, guiding me along the graduate path, and believing in me.

One cannot simply complete graduate school without a tribe of individuals who help them along the way. My tribe has been my family and friends, my cohort, peers and co-workers. To Sonny, thank you for supporting me, even when things got a little rough these past two years. Thank you, Alexandra Larsen and Janessa VandenBerge, for being my friends, sisters, foundation, and continual support throughout each and every stage.
# TABLE OF CONTENTS

| LIST OF TABLES | .................................................... | ix |
| LIST OF FIGURES | .................................................... | x |
| LIST OF APPENDICES | .................................................... | xi |

## SECTION I: INTRODUCTION

- Background .......................................................... 1
- Significance of the Problem ...................................... 3
- Rationale for Project ............................................... 6
- Review of Related Literature ...................................... 7
  - Affected Population ............................................ 7
  - Scope of the Issue: Infection Rates in the Dialysis Setting .. 9
  - Cost .............................................................. 13
  - History of Hepatitis B and C Outbreaks ......................... 14
  - Interventions Related to Infection Control in the Dialysis Setting ........................................ 16
  - Dialysis Station Disinfection: Current Recommendations .... 19
  - Human Factors Engineering .................................... 24
- Summary .............................................................. 28
- Definition of Terms ................................................. 29

## SECTION II: METHODS

- Introduction .......................................................... 33
- Timeline of Procedures .............................................. 35
- Objective Data Sampling: Background of ATP Bioluminescence and Chemiluminescence Markers ......................... 38
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most Common Infection Control Deficiency Citations Reported During</td>
<td></td>
</tr>
<tr>
<td>Medicare Surveys at GHS</td>
<td></td>
</tr>
<tr>
<td>ATP Testing Results from Onalaska Dialysis Station</td>
<td>56</td>
</tr>
<tr>
<td>Frequency of Themes Occurring in Staff Interviews</td>
<td>64</td>
</tr>
<tr>
<td>Themes Identified in Key Informant Leadership Interviews</td>
<td>74</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SEIPS Model of Work System and Patient Safety</td>
<td>27</td>
</tr>
<tr>
<td>3. Gantt Chart: Timeline of Needs and Capacity Assessment Project Process</td>
<td>38</td>
</tr>
<tr>
<td>4. Vacated Dialysis Station With Sites Marked Where ATP Testing Was Conducted</td>
<td>42</td>
</tr>
<tr>
<td>5. SEIPS Model, Adapted for Dialysis Station Disinfection Assessment</td>
<td>54</td>
</tr>
<tr>
<td>6. Low Light Photos of Common Objects Brought into Patient Zone, After Luminol Application</td>
<td>58</td>
</tr>
<tr>
<td>7. Blood Pressure Cuff: Blood Stains Illuminated After Luminol Application</td>
<td>58</td>
</tr>
<tr>
<td>8. Onalaska Chair, After Luminol Application</td>
<td>59</td>
</tr>
<tr>
<td>9. La Crosse Center Dialysis Chair: Blood Stains Illuminated After Luminol Application</td>
<td>59</td>
</tr>
<tr>
<td>10. Upper Portion of Dialysis Machines, After Luminol Application</td>
<td>60</td>
</tr>
<tr>
<td>11. Close-up of Upper Portion of Dialysis Machines, After Luminol Application</td>
<td>60</td>
</tr>
<tr>
<td>12. Base of Dialysis Machine, After Luminol Application</td>
<td>61</td>
</tr>
<tr>
<td>14. Ports Where Large Blood Spills or Sprays Can Occur</td>
<td>67</td>
</tr>
</tbody>
</table>
# LIST OF APPENDICES

<table>
<thead>
<tr>
<th>APPENDIX</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. GHS Commitment Letter to CDC’s <em>Coalition</em></td>
<td>104</td>
</tr>
<tr>
<td>B. GHS Dialysis Station Disinfection Checklist</td>
<td>106</td>
</tr>
<tr>
<td>C. CDC Dialysis Station Disinfection Checklist</td>
<td>108</td>
</tr>
<tr>
<td>D. AHRQ Dialysis Station Disinfection Checklist</td>
<td>111</td>
</tr>
<tr>
<td>E. IRB approval from the University of Wisconsin-La Crosse</td>
<td>113</td>
</tr>
<tr>
<td>F. IRB approval from Gundersen Health System</td>
<td>115</td>
</tr>
<tr>
<td>G. Questions and Consent Form for Leadership Interviews</td>
<td>117</td>
</tr>
<tr>
<td>H. Questions and Consent Form for Patient Interviews</td>
<td>121</td>
</tr>
<tr>
<td>I. Questions and Consent Form for Staff Interviews</td>
<td>125</td>
</tr>
<tr>
<td>J. Complete Data Tables of Thematic Coding</td>
<td>129</td>
</tr>
<tr>
<td>K. Abstract Submission for National Renal Administrators Association Annual Conference, 2019</td>
<td>132</td>
</tr>
<tr>
<td>L. Presentation for APIC Badger, Regional Meeting</td>
<td>134</td>
</tr>
<tr>
<td>M. Executive Summary</td>
<td>147</td>
</tr>
</tbody>
</table>
SECTION I

INTRODUCTION

Background

Gundersen Health System (GHS) of La Crosse, Wisconsin has expanded from a small local clinic run by Dr. Adolf Gundersen 125 years ago to a complex and thriving health system serving over 19 counties in a tri-state region (GHS, 2018a). Renal dialysis clinics are included in the diverse healthcare related services GHS provides. Currently, GHS has seven dialysis centers located in and serving seven different regions of Western Wisconsin (GHS, 2018b). According to Bridget Pfaff, Administrative Director of Infection Control and Renal Dialysis at GHS, dialysis centers employ between three and 30 employees and provide dialysis care for six to 24 individuals at a time, depending on the location (B. Pfaff, personal communication, April 4, 2018).

Hemodialysis is a complex, time-consuming process which provides life-saving and life-sustaining treatment for 87.7% of the estimated 30 million patients who suffer from chronic kidney disease in the United States (United States Renal Data System, 2017). The complexity and invasiveness of hemodialysis contributes to a myriad of safety and infection issues for the patient, which will be discussed in further detail in the review of literature. At the national level, the Centers for Disease Control and Prevention (CDC) launched an initiative in 2016, the Making Dialysis Safer for Patients Coalition (henceforth referred to as the Coalition), to bring attention to the unique infection-related
issues facing dialysis patients, and to improve safety and health outcomes for the individuals requiring hemodialysis care (CDC, 2018c).

In addition to promoting core interventions and recommendations for outpatient dialysis centers, and in order to improve health practices and outcomes, the main goals of the Coalition are to facilitate and implement the core interventions recommended by the CDC, provide education to staff and patients about the core interventions, and share experiences and findings from work done at local sites with other coalition partners.

The GHS renal dialysis group understands the importance of developing a culture of safety for their staff and patients and has committed to becoming an active partner with the Coalition as of April 2018 (Appendix A). With GHS’s commitment as a partner in the coalition, the group members have agreed to work to reduce the incidence of bloodstream infections among their patient population by continuing to track vascular access infections, providing education and training to staff and patients regarding CDC’s core recommendations, and continuing to ensure ongoing competency in reducing central line infections.

During the process of GHS dialysis group becoming a partner in the Coalition, one of the seven dialysis centers received an official Medicare program survey the summer of 2018. The Medicare health insurance program provides funding for individuals who require dialysis treatment, regardless of age. Any dialysis centers that receive Medicare insurance federal funds are required to complete an initial certification program and periodic surveys to ensure dialysis facilities meet specific safety and quality standards (Centers for Medicare and Medicaid Services, 2017). During a survey, a surveyor inspects the facility; assess processes; and audits protocols, procedures, and
practices to ensure the center is following applicable laws and regulations set forth by the federal government. Should the surveyor find a discrepancy in practice while observing staff members during the audit, the facility is cited for the specific deficiency, which is recorded in an official report. The facility has a set period of time to create a plan to correct the specific deficiency and implement changes surrounding the protocol (B. Pfaff, personal communication, August 2, 2018). For example, a commonly reported citation is improper hand hygiene and gloving prior to entering a patient care area. The facility would acknowledge this deficiency and implement an action plan by

- defining and educating staff members regarding what constitutes a patient care area in the dialysis setting,
- reinforcing hand hygiene and gloving practice education to all staff members, and
- performing monthly audits on hand hygiene and gloving processes to ensure the protocol continues to be followed.

**Significance of the Problem**

Since 2013, the seven GHS dialysis clinics have undergone a total of 12 Medicare surveys. In July of 2018, the principal investigator joined the GHS Infection Control Department (ICD), as well as the Renal Dialysis Department. As noted, the administrative director for the ICD is also the director of the Renal Dialysis Department, which includes seven different outpatient dialysis facilities within GHS. The close relationship between the ICD and Dialysis Department provides opportunities to fulfill preceptorship requirements as a graduate candidate for the Master of Public Health program through the University of Wisconsin-La Crosse. As part of the experience, the GHS dialysis Medicare surveys were thoroughly reviewed by the principal investigator to
determine common trends or themes in deficiencies related to infection control and prevention. Administrative director Ms. Pfaff understands the importance of infection prevention in the dialysis setting, as well as the implications of finding trends occurring in infection-related citations in the Medicare surveys, and has initiated work on this assessment through the graduate preceptorship.

The Medicare survey reports analyzed for GHS dialysis centers varied in depth and specificity. Of the 12 Medicare surveys, the top three citations were related to infection control practices. These include hand hygiene and gloving; disinfecting surfaces and equipment; and disinfecting, disposing, or dedicating specific equipment utilized in the patient care area. Hand hygiene and gloving practices, along with disinfecting surfaces and equipment, were cited in ten, or 83.3% of the Medicare surveys.

Table 1. Most Common Infection Control Deficiency Citations Reported During Medicare Surveys at GHS

<table>
<thead>
<tr>
<th>V Tag* Deficiency Citation</th>
<th>Occurrences</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>V113 IC-Wear Gloves/Hand Hygiene</td>
<td>10</td>
<td>83.3</td>
</tr>
<tr>
<td>V122 IC-Disinfect Surfaces Equipment/Written Protocol</td>
<td>10</td>
<td>83.3</td>
</tr>
<tr>
<td>V116 IC-IF To Station = Dispose/Dedicate or Disinfect</td>
<td>5</td>
<td>41.7</td>
</tr>
<tr>
<td>V115 IC-Shields/Masks-No Staff Eat/Drink</td>
<td>3</td>
<td>25.0</td>
</tr>
<tr>
<td>V117 IC-Clean/Dirty; Med Prep Area; No Common Carts</td>
<td>2</td>
<td>16.7</td>
</tr>
<tr>
<td>V147 IC-Staff Education-Catheters/Catheter Care</td>
<td>4</td>
<td>33.3</td>
</tr>
<tr>
<td>V132 IC-Training and Education</td>
<td>3</td>
<td>25.0</td>
</tr>
</tbody>
</table>

Such citations for GHS surveys are not unique. Carole Wittenberg, Quality Specialist for the Renal Dialysis Departments at GHS, compiles and reports all data for the GHS centers to the National Healthcare Safety Network (NHSN), as well as multiple other safety and quality reporting organizations. According to Medicare data compiled for the region, hand hygiene and gloving, along with disinfecting surfaces and equipment, are the top two citations in all dialysis facilities of the Midwest region (C. Wittenberg, personal communication, July 26, 2018). Similarly, according to Kristen Ward, Quality Improvement Systems Specialist for the Midwest Kidney Network, the top citations related to infection control in Region V (to include Maryland, Virginia, West Virginia and Washington, D.C.) are also hand hygiene and gloving and disinfection of surfaces (K. Ward, personal communication, October 1, 2018). Understanding that these infection control problems exist beyond the GHS demonstrates the scope and importance of this problem.

GHS continues to renew education and efforts toward hand hygiene practices system wide. This includes collaborating with all groups of employees including physicians, bedside staff, environmental services, and patients and family (B. Pfaff, personal communication, September. 2018). According to the 2009 publication of the World Health Organization’s Guidelines on Hand Hygiene in Health Care, while there have been centuries of studies and efforts directed at hand hygiene, lack of proper hand hygiene practice continues to contribute to the majority of healthcare acquired infections. Considering the amount of work that has been done, and that will continue to be done in ICDs regarding hand hygiene practices, the focus of this project instead will examine the overall environment of the hemodialysis patient. Delimiting work related to the station
disinfection process will help provide the focus that this topic deserves, as specified by
the administrative director, Ms. Pfaff, and the results from those data obtained from
Medicare surveys, both locally and nationally.

**Rationale for Project**

As Medicare continues to be a main source of funding for dialysis care
reimbursement, and as long as hemodialysis patients require complex care in facilities
that have potential to spread infection through their environment, it is imperative that
leaders in infection control examine the factors that are contributing to infection rates in
this sensitive population. Utilizing data from Medicare surveys and researching (e.g., the
principal investigator auditing and observing staff) to understand the physical
environment in which dialysis staff and patients are a part may help provide insight into
infection control and patient safety. A unique crossroads of the GHS Dialysis Department
collaborating with the CDC’s *Coalition*, the opportunity to review and improve practices
based on themes emerging from Medicare survey reports, and the addition of a student
principal investigator through the graduate preceptorship Master of Public Health
program has allowed this project to emerge. At present, an important opportunity to
perform a thorough needs and capacity assessment regarding potential gaps in the
knowledge and practice of dialysis station disinfection exists.

As Gilmore (2012) states in the first chapter of *Needs and Capacity Assessment
Strategies for Health Education and Health Promotion*:

Needs and capacity assessments do not take place in isolation, nor are they
confined solely to a phase in program-planning endeavors. They occur because, as
health professionals, we are attempting to better understand the impactors on the
health and well-being of individuals and population groups so that the appropriate
health-enhancing next steps can take place. In this way, informed decisions can be
made. (p. 2)

It is the goal of this project to better understand the multi-layered approach at
reducing infections in the dialysis population at GHS, specifically in the realm of dialysis
station disinfection, and to include the diverse views and perspectives of the individuals
who care for the patients on a daily basis. An additional goal is to determine the best
course of action for future development of protocols, procedures, and sustainable
educational objectives. Ultimately, the goal is to reduce transmission of potential
infections; improve patient safety; and continue to encourage a culture in which staff,
leadership, and patients can thrive.

Review of Literature

Affected Population

In 2017, the United States Renal Data System (USRDS) completed their annual
report, compiling data regarding the details of kidney disease in America. Per this report,
an estimated 30 million adults, or one in seven people, suffer from chronic kidney disease
(CKD), placing the prevalence of kidney disease at 14%. Kidney disease remains number
nine of the ten leading causes of death in the United States (CDC, 2017c). The years of
life lost and the financial burden that kidney diseases place on individuals and the
healthcare system is overwhelming. Friedman and Friedman (2006) report that over 25%
of Medicare budget is utilized in the CKD and end stage renal disease (ESRD) patient
population, and the USRDS (2017) calculate the cost of Medicare spending of dialysis
patients to be 34 billion dollars as of 2015. Addressing kidney disease and the
complications that arise from the process should be a main concern for the American public. Accordingly, a *Healthy People 2020* (2018) goal is to reduce the incidence, complications, and economic burden of chronic kidney disease; a goal that deserves timely intervention.

Patients with CKD require frequent dialysis treatments in order to filter their blood and remove waste products, a process that a healthy kidney would normally perform for an individual. Hemodialysis requires a patient to have vascular access, which moves blood from the patient’s body to the hemodialysis machine for filtration (CDC, 2017d). This vascular access line is life-saving for these patients. Yet, this life-saving vascular access has the potential to provide a highway for infectious organisms to invade the body and cause harm.

According to the USRDS (2017), infection is the second leading cause of hospitalization and death in dialysis patients, after cardiovascular disease. Individuals who require dialysis for their kidney disease often require dialysis for years if they are not eligible for kidney transplants, or while they are waiting for a transplant. Patients are typically dialyzed three times a week for three to four hours at a time. Based on the principal investigator’s calculations, if an individual receives dialysis for four years, they will physically be sitting in a dialysis unit environment having their vascular site accessed 624 times, meaning that infectious pathogens have at least 624 opportunities to enter a patient’s bloodstream.

The GHS nephrology group provides dialysis for about 255 patients among the seven dialysis centers (B. Pfaff, personal communication, October 11, 2018). Each patient travels to a Gundersen dialysis facility to receive their care, sits in a chair, and
utilizes a machine that has been occupied by countless others before them. Staff members consist of nurses, dialysis technicians, social workers, dieticians, and physicians. Each of these disciplines physically touches or enters the space occupied by the patient undergoing dialysis.

In a typical day at a GHS dialysis unit, there are two groups of patients who undergo dialysis in two different shifts. Between each shift, the nurses and technicians must disinfect the patient’s chair, external surfaces of the dialysis machine, trash can, and call light or remote. The entire disinfection process must be completed in a short period of time, as the next shift of patients are typically waiting to be put on the machine for their treatment. Even as patients wait in the waiting room, opportunities for infection to spread via surface areas potentially exist. Prior to starting their treatment, Dialysis patients must be weighed and have their temperature taken with shared equipment.

Hemodialysis requires direct access to the patient’s blood; therefore, the area that the patient inhabits during treatment has the potential to be grossly or microscopically contaminated with blood and infectious organisms (Muche & Baid-Agrawal, 2018; Rao et al., 2013). Due to the fact that so many individuals require access to this vital space, and that these individuals are at great risk of developing infections, the disinfection of the external dialysis environment becomes extremely important.

Scope of the Issue: Infection Rates in the Dialysis Setting

As mentioned previously, infection is the second leading cause of hospitalization and death in dialysis patients (USRDS, 2017). According to the CDC’s Morbidity and Mortality Weekly Report (2011), an estimated 37,000 infections occurred in outpatient hemodialysis centers in 2008, with one in every four patients dying from complications
of infection. Dialysis patients are 100 times more likely to develop a *Methicillin-resistant Staphylococcus aureus* (MRSA) infection than the general population (CDC, 2011). This clearly demonstrates the need for improved infection control in outpatient dialysis patients. While there are many potential infectious sources that a dialysis patient may be exposed to, ranging from their home and personal environment to clinics, one of the greatest sources of infection is related to their dialysis treatment center environment.

Infection rates of vascular access sites in hemodialysis patients are tracked by the CDC’s National Health Surveillance Network (NHSN) (2015b), a data gathering system for hospitals and healthcare centers to help track healthcare-associated infections (HAIs), or nosocomial infections, in real time. Data provided by these institutions allow local organizations to track their infection rates and compare their numbers to national averages. Additionally, these data provide organizations a standard by which they can measure their progress and standing in comparison with other centers and national rates. Institutions report their infection rate data quarterly. NHSN data are accessible to both patients and governmental agencies like Medicare to foster conversation and safety initiatives regarding infection rates related to the hospital setting. According to the CDC’s website on NHSN (2015a):

NHSN data are analyzed by CDC and others to direct actions for healthcare-associated infection (HAI) prevention. Local, state, and national HAI trends are used to identify emerging problems and areas of concern that need intervention, and to measure progress in HAI reduction against national, state, and local prevention goals. (para. 6)
Reporting infection rates, while time-consuming and detail oriented, provides a lens through which facilities can compare their overall numbers and assess areas in which they can improve. GHS dialysis centers report all infection rates to NHSN per protocol. Following are the results from these analyses.

The Onalaska dialysis center is the largest outpatient dialysis center of the seven in Western Wisconsin, with 27 available dialysis chairs, or stations, in which patients are served. Based on 2017 data, the Onalaska center is open Monday through Saturday, 5:00 a.m. to 4:00 p.m., has about 36-40 renal dialysis staff, and averages 1,398 dialyzing sessions per month (B. Pfaff, personal communication, June 20, 2018). In the first quarter of 2016, the Onalaska outpatient renal center had a total of seven vascular access site infections, including fistula, grafts, other access sites (e.g., catheter access sites), tunneled central line, and non-tunneled central lines (i.e., different types of central lines with exit sites either tunneled under, or on the surface, of the skin). The vascular access infection rate per 100 patient months for the first quarter was 1.94, in comparison with the NHSN vascular access infection rate of 1.21 per 100 patient months. Infection rates are reported out in patient months as the denominator. This measurement summarizes the incidence of infection events during the period of time (months) that the patient is at risk for infection (Alexander, Lopes, Ricchetti-Masterson, & Yeatts, 1998). In the second quarter of 2016, the rate was lower at 0.28, compared to the NHSN’s reported average of 1.21 per 100 patient months. The rate fluctuated dramatically in the third quarter for the Onalaska dialysis center, with a report of 10 total vascular access infections, or 2.87 per 100 patient months, compared to the NHSN average of 1.21 per 100 patient months. According to Quality Specialist Carole Wittenberg, who compiles data and reports for
GHS to NHSN, reporting infection rates is a complex process; sometimes minor details in a patient’s course of treatment can count as an infection, which may cause fluctuations in final reports for the dialysis center (C. Wittenberg, personal communication, September 13, 2018).

Infection rates decreased in 2017 to an average of 2.25 total vascular access infection events per quarter. The vascular access infection rate per 100 patient months ranged from 0.29-1.18, compared to the NHSN average of 0.6-1.21. Overall, infection rates decreased at the nationally reported level, as well as locally at the GHS Onalaska care clinic in 2017. For the first quarter of 2018, Gundersen Onalaska reported a total of four infections, or 1.29 vascular access infections per 100 patient months as compared to NHSN reported 1.06.

When examining bloodstream infections that occurred related to vascular access devices in 2016, GHS Onalaska center reported an average of 0.14 bloodstream infections per 100 patient months, while the national average was reported at 0.42 bloodstream infections per 100 patient months. In 2017, the national average was maintained at 0.42, while GHS Onalaska dialysis center reported a mean average of 0.59 bloodstream infection per 100 patient months.

Comprehending the burden of infection on a personal and financial level for patients underscores the significance of continuing to decrease infection rates. Additional details of cost burden will be further addressed below. Modern understanding of epidemiology and infectious diseases allows healthcare personnel to take necessary precautions in reducing the harm incurred on dialysis patients. Therefore, it should not be
unattainable to strive for little to no vascular access infections per quarter by outpatient dialysis centers.

Cost

Hospitalization and treatment for infections from vascular access devices are costly. When a patient develops an infection from a healthcare facility where they are receiving care, organizations track this information as a HAI. HAIs are infections that occur from a healthcare related setting, when the patient is being treated for something other than the infection (CDC, 2018d). There are many different types of HAIs, and the CDC tracks them through the NHSN surveillance network. For purposes of this project, the cost related to central line associated bloodstream infections (CLABSI) from acute care facilities were examined in order to provide insight into what the overall cost may be for a dialysis patient. The most recent report available, published in 2009 by the CDC, estimates that the average attributable per patient cost of a CLABSI ranges between $7,288-$29,156. This estimate was based on 2007’s consumer price index (Scott, 2009).

What cannot be quantified in dollars is the emotional and physical toll that an infection places on an individual. Length of hospitalizations for a patient could vary depending on the severity of the infection and the medical history of the individual. However, as infection is the second cause of death in dialysis patients, the potential impact becomes exponentially greater for this population. In a systematic review completed by Currie and colleagues (2018), major themes that emerged from patients’ experiences from HAIs were a continuum of physical and emotional symptoms or responses that continued well after the infection was over. In addition, the meta-analysis found that patients expressed frustration with healthcare workers and the inconsistencies
of infection prevention measures, and the fear of developing another infection or being socially stigmatized by infection. Therefore, continued efforts like the CDC’s *Coalition* are important to continue to work on decreasing the incidence of infections in dialysis patients—for both cost and the emotional and physical burden to patients.

**History of Hepatitis B and C Outbreaks**

At baseline, dialysis patients have a weakened immune system from the overall physiology related to CKD, and are at increased risk for infections like hepatitis B virus (HBV) and hepatitis C virus (HCV) from the required dialysis treatment process (CDC, 2001; Fissell et al., 2004). Fissell and colleagues (2004) calculated the mean prevalence of HCV to be about 13.5% in hemodialysis patients (in rates studied across seven countries) compared to under 2.0% prevalence rate for HCV in the Americas for the general population (Heymann, 2015). The CDC tracks outbreaks of HBV and HCV in non-hospital settings like dialysis units in order to determine if trends are occurring (CDC, 2018a). There were a total of 21 confirmed outbreaks of HCV in hemodialysis settings out of a total of 38 reported HCV outbreaks in non-hospital settings between 2008 and 2017 (CDC, 2018b).

A systemic review was conducted by Fabrizi and Messa (2015) to determine potential risk factors or practices that could be identified in the spread of HCV outbreaks in dialysis facilities between the years of 1992 and 2015, and was reviewed in order to understand station disinfection changes throughout the years. The findings of this review revealed no single cause. While inconsistencies or breaches in environmental cleaning of the physical dialysis station were noted, the exact mechanism that contributed to the transmission of Hepatitis C was unknown.
Additional reviews and analysis have taken place over the past two decades to determine a specific cause in the spread of HBV and HCV in the dialysis setting (CDC 2018b; Fissell et al., 2004; Muche & Baid-Agrawal, 2018; Rao et al., 2013; Thompson, Perz, Moorman & Holmberg, 2009). However, a specific mode of transmission was again unable to be identified. The reviewers’ final determination was that lapses in infection control measures at different stages in the delivery of care of hemodialysis patients had occurred at some point. Suspected lapses in infection control measures that were thought to have contributed to the spread of HBV and HCV included:

- Improper cleaning of environmental surfaces in between patients.
- Improper medication preparation in contaminated settings.
- Lapses in hand-hygiene opportunities.
- Insufficient staffing.

Medicare has utilized these findings related to the spread of hepatitis B and C, and developed the infection control guidelines and specific citations for facilities in order to decrease the risk of spreading potential diseases like HBV and HCV in dialysis facilities. Specifically cited in the Centers for Medicare and Medicaid ESRD Surveyor Training Interpretive Guide (2008) are the recommendations put forth by the CDC (2001) in *Recommendations for Preventing Transmission of Infections among Chronic Hemodialysis Patients*. By understanding the hemodialysis patients’ increased risk of developing HBV or HCV due to the overall disease process, treatment process, and infection control practices of facilities, one can appreciate the time and effort that should be committed to improving infection control and environmental surveillance in outpatient dialysis facilities.
Interventions Related to Infection Control in the Dialysis Setting

Interventions for decreasing infections in healthcare facilities require a multi-layered approach. In the inpatient hospital setting, the Agency for Healthcare Research and Quality (AHRQ, 2012) focused on reducing hospital-acquired infections, specifically CLABSI. According to the organization website, AHRQ was originally developed in 1989 and is an organization within the U.S. Department of Health and Human Services system. The mission of the agency is to “…produce evidence to make healthcare safer, higher quality, more accessible, equitable, and affordable, and to work within the U.S. Department of Health and Human Services and with other partners to make sure that the evidence is understood and used” (AHRQ, 2017). AHRQ provides funding opportunities, as well as resources and detailed framework for hospitals to follow, in order to create a culture of change in addressing nosocomial infections.

Like many other health service specialties, dialysis healthcare is complex, with multiple disciplines consulting on the care of a patient within the system. This complexity can lead to patient safety issues and requires diligent attention to ensure a culture that embraces evidence-based practices, clear communication among all disciplines, and teamwork to ensure positive health outcomes for individuals. In reducing healthcare-associated infections (HAI), AHRQ’s initial efforts focused on improving bloodstream infection rates and ventilator-associated pneumonia in intensive care units (ICU) in 2003. The pilot project in the first ICU where AHRQ implemented the evidence-based protocols to prevent bloodstream infections was successful and reduced their CLABSI rates by 66% in an 18-month period (AHRQ, 2012).
Additionally, inpatient ICUs have significantly decreased their central line infection rates by implementing the CDC recommended evidence-based practices, or “bundles” of interventions. In 2011, the CDC reported a national 58% decrease in central line infections by 2001 in ICUs. Due to the sheer number of patients living with CKD who have vulnerable vascular access sites that provide ready infectious opportunity, outpatient dialysis centers need to intervene in a similar manner as inpatient hospital units do in order to decrease the morbidity and mortality associated with infection. The CDC has recommended that these evidence-based interventions cross over to the outpatient dialysis centers in an attempt to decrease infection rates (CDC, 2018c).

In response to these unique needs for outpatient dialysis infection rate surveillance and improvements, the CDC developed the Making Dialysis Safer for Patients Coalition in 2009. A collaborative panel was assembled and developed the core recommendations based on previous evidence-based research to help guide the Coalition. Specific tools and materials were created specifically for the outpatient dialysis population to utilize, and communication was ensured among the founding participating centers in the United States to help disseminate information and share success strategies (Lindberg et al., 2013; Patel et al., 2013).

Patel and colleagues (2013) documented the findings from the initial collaboration effort that utilized the core recommendations. Results from the 17 outpatient dialysis centers obtained after the Coalition began in January of 2010 demonstrated a 54% decrease in access-related bloodstream infections (p < 0.001) and a 32% decrease in bloodstream infections (p = 0.01). Prior to the Coalition interventions, the dialysis facilities’ “…pooled mean BSI and access-related BSI rates were 1.09 and 0.73 events
per 100 patient-months, respectively” (p. 324). After the core recommendations, the dialysis facilities’ pooled mean rates dropped to 0.89 BSIs and 0.42 access-related BSIs events per patient-months. Outcomes in a similar study that implemented the CDC core interventions from the Coalition reported eight catheter-exit site infections per 100 patient months prior to implementation, and only three catheter-exit site infections per 100 patient months after collaboration (Lincoln, 2011).

Flexibility exists within the Coalition, as member facilities are able to problem-solve potential barriers by collaborating with one another and share results or ideas that have been successful for their center. Additionally, dialysis centers can implement recommendations from the Coalition, as needed. While not mandated, the recommendations are evidence-based and readily available to be utilized in participating dialysis facilities. For example, Lindberg and colleagues (2013) recommend positive deviance as a unique intervention to overcome the barrier of culture change within their facility, along with the CDC Coalition collaboration efforts to reduce their bloodstream infections. As described above, healthcare processes are complex and require multiple partners to provide care to patients. Changing practices to improve safety among multiple disciplines takes concerted effort from multiple levels. Lindberg and colleagues (2013) describe positive deviance as “…a social and behavioral change process developed to address such issues [decreasing bloodstream infections]. The process rests on the premise that in organizations there are individuals and groups whose different (deviant) practices produce better (positive) results than colleagues who have access to the same resources” (pp. 513-514). Adherence rates to their process measures, which included CDC’s Coalition recommendation of proper technique in accessing and de-accessing vascular
access devices increased from 93% to 99% (p < 0.001) after initiating positive deviance theory.

While limitations certainly exist within all of the studies presented, all three of the dialysis centers that agreed to do preliminary research with the Coalition recorded decreased bloodstream infection rates after initiating CDC’s Coalition core interventions. As mentioned, as of April 2018, GHS has become an active partner within the Coalition. The resources and interventions provided by the Coalition offer a valuable platform for outpatient dialysis centers to creatively collaborate, share experiences, receive updates from the CDC, hold each other accountable, and monitor infection rates.

**Dialysis Station Disinfection: Current Recommendations**

One of the core interventions proposed by both the CDC and AHRQ is the process of cleaning and disinfecting the dialysis station (AHRQ, 2015; CDC, 2017a). Each entity provides a basic checklist of the station disinfection process that facilities can utilize for their protocols. Additionally, the Centers for Medicare and Medicaid Services ESRD Core Survey Version 1.6 provides a dialysis station disinfection checklist that GHS uses directly with their current protocol (Appendix B, C, D). However, there are observed discrepancies in the steps between the checklists. The AHRQ process states that the outside of the hemodialysis machine can be wiped and disinfected prior to the patient leaving the hemodialysis station. This would occur when the patient has been unhooked from the dialysis machine and is receiving final processes in their care: achieving hemostasis of their vascular access device, getting a final assessment from the nurse, and their last vital signs to determine if they are safe to leave the dialysis chair. Dialysis patients often have complex medical histories which can contribute to the intricate
processes of caring for them. Common comorbidities of dialysis patients include hypertension, diabetes, and nutrition abnormalities (Prichard, 2000). Studies have shown comorbidities, along with aging of patients, may translate into movement and mobility issues or cognitive disorders for individuals (Braun Curtin, Bultman, Thomas-Hawkins, Walters, & Schatell, 2002; Kurella, Mapes, Port, & Chertow, 2006). Therefore, many patients require extra assistance in getting on and off the dialysis machine, as well as physically to and from the dialysis station.

Per the CDC Dialysis Station Routine Disinfection Checklist, however, the patient must be completely out of the chair and vacate the dialysis station before the dialysis machine may be disinfected. Additionally, AHRQ disinfection checklists state that all surfaces be disinfected, including “counters around the station” and the CDC checklist states that “all surfaces” be wiped down. Examples of the surfaces are given; however, the list and detail are not fully exhaustive of items that may be present in the patient area, nor does either list clearly define the patient area. For example, per GHS policy regarding dialysis station disinfection, the trash can is removed and both the inside as well as the outside of the waste basket are to be disinfected between each dialysis patient session, as the waste basket is present in the patient area during their dialysis session. This practice is not substantiated in any of the discussed checklists. However, GHS included the practice in the standard operating procedure and defined the waste basket as part of the patient area that could potentially be contaminated.

During the most recent Medicare survey at GHS, the facility was cited for not wiping down the back side of the dialysis machine during the disinfection process. The AHRQ, CDC, and GHS policies do not specify to wipe the back side of the machine
down. Therefore, questions arose from this citation, specifically whether the back side of the dialysis machine should be disinfected after each treatment. Stemming from this question and event, the principal investigator began examining the literature and resources to determine the process and rationale for each step in the station disinfection procedure. As 83% of the CMS surveys produced citations for deficiency in station disinfection, it is unclear what specific staff variations are occurring, and whether additional details should be included in the station disinfection process which staff are currently missing. In July of 2018, Ms. Pfaff reached out to the National Renal Administrators Association, a large network of dialysis administrators, to see whether other dialysis centers have policies or information regarding disinfection of the back side of the dialysis machine after each patient. Responses consistently indicated this was not the case. Each facility reported a slightly different policy of disinfecting the back side of the machine, as well as the walls or counters behind the patient chair. Some reported that their policy was to clean them at the end of the day, once a week, and sometimes only monthly (B. Pfaff, personal communication, July 20, 2018).

In reviewing other related literature outside of the CDC and AHRQ on environmental cleaning of the dialysis station, very little detailed information was found to exist. Infection control professionals often refer to the guidance put forth by the Association for Professionals in Infection Control and Epidemiology (APIC) when deliberating potentially infectious issues. In 2010, APIC released an updated Guide to the Elimination of Infections in Hemodialysis. In the 78-page document, one page is dedicated to describing the disinfection of environmental surroundings. The document provides tips on cleaning the environment, such as not wadding a cloth when wiping
surfaces, and ensuring that all soap dispensers are restocked at the end of the day. The document also notes that many frequently touched areas not necessarily in the patient zone should still be disinfected between dialysis sessions. No mention of cleaning the back side of the dialysis station is reported; according to the report, cleaning walls or other high dusting areas should occur “on a routine basis” (p. 21), though the term ‘routine’ is not defined.

The Midwest Kidney Network (n.d.) website for providers provides basic resources regarding infection prevention, focusing on educating staff and patients about proper hand hygiene. Videos are available to highlight the importance of hand hygiene, and links to AHRQ and the CDC’s core recommendations via Making Dialysis Safer for Patients are provided. However, additional resources regarding environmental surveillance and disinfection are not present.

Further, when searching “dialysis station cleaning” or “environmental cleaning, dialysis, infection control” in a research database for additional articles or studies, few results were found. The majority of research articles related to infection control in dialysis focus on vascular access or peritoneal dialysis issues, water quality, hepatitis outbreaks, and internal machine disinfection processes (Lee & Park, 2012; Yadav, England, Vanderkolk, & Pui-Ying, 2017). While each of these topics are important and must be considered when looking at the overall infection control picture, the lack of literature that exists specifically for external dialysis station disinfection continues to demonstrate the deficiency of information available to dialysis professionals. Additionally, dialysis station disinfection is unique compared to other environmental surface cleaning, as nurses and dialysis technicians are responsible for the cleaning
process, rather than a dedicated group of environmental services or housekeeping individuals (J. Lisowski, personal communication, September 20, 2018). Adding to the complexity of the disinfection process, groups of patients must rotate through the same dialysis station, which presents a timing issue for staff members as they complete all necessary tasks in a few short minutes.

Environmental cleaning guidelines for healthcare settings from the CDC (2017b) were referenced as a supplement for specifics in the dialysis setting. While recommendations regarding dialysis water quality and dialysate are present in the document, no specific instructions were found regarding the patients’ dialysis station. The majority of recommendations in cleaning and disinfecting strategies for environmental surface in patient-care areas specify using Environmental Protection Agency (EPA)-registered disinfectants and using them per the manufacturer’s directions. Additional recommendations include the following:

• E.I.E.3. “Clean and disinfect high-touch surfaces (e.g., doorknobs, bed rails, light switches, and surfaces in and around toilets in patients’ rooms) on a more frequent schedule than minimal touch housekeeping surfaces.”

• E.I.E.4. “Clean walls, blinds, and window curtains in patient-care areas when they are visibly dusty or soiled.”

The CDC has an Infection Control Assessment Tool for Hemodialysis Facilities (CDC, 2016) referenced by the Midwest Kidney Network which aligns with Medicare survey guidelines. This serves as an additional resource to understand where gaps in infection control may exist in certain facilities. The checklist can be used to determine whether specific protocols and procedures are in place, including audits and guidelines related
specifically to environmental cleaning practices. This document, while thorough and informative, did not provide any additional insight, as GHS already meets all practices outlined in the assessment.

**Human Factors Engineering**

From reaching and bending to scrubbing and wiping, disinfecting the dialysis station requires physical effort. Staff must protect themselves from blood and cleaning chemicals, perform frequent and precise hand hygiene and gloving methods, and adequately scrub all of the equipment utilized by the patient. In addition, the entire process must be done in a short amount of time, as the next patient is waiting to be put on dialysis, and other patients may be needing assistance, medications, or assessments during their session. These processes all occur concurrently. According to Yanke, Carayon, and Safdar (2014):

> As healthcare systems evolve and adopt new models of care…this complexity and ambiguity will become even more pervasive. Other contributing factors include an environment of increasingly limited work hours, increasing patient care handoffs, and a greater presence of multidisciplinary teams. This confluence of complexity, ambiguity, and a continuous evolution of healthcare delivery underscores the need for a structured systems-based approach that can serve as a framework for implementation of infection prevention practices. (p.1177)

From an administrative perspective, the logistics of employing special environmental services staff for intermittent station disinfection would not be feasible. Employing individuals to clean dialysis stations between shifts would require the staff members to be present but sit idle while the patients are on dialysis for three to four hours
at a time (B. Pfaff, personal communication, October 2, 2018). Therefore, continuing to utilize dialysis technicians and nursing staff for station disinfection processes is needed at this time. Examining the larger picture, and understanding how this entire process occurs, is important in determining what variations or inconsistencies exist in the station disinfection process. By observing the physical environment in which staff members operate and interviewing staff members to gain their perspective on the disinfection process, the principal investigator could better understand what human factors were occurring.

By utilizing human factors engineering theory in assessing station disinfection procedures, a systematic approach assesses from multiple angles. According to the International Ergonomics Association website (n.d.), human factors engineering is defined as “…the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance” (para. 1). Utilizing human factors engineering theory divides the process into physical, cognitive, and organizational domains. Through an assessment of the needs of staff members regarding their disinfection process in terms of these domains, a greater insight into the possible gaps of the process could potentially emerge.

Gurses, Rosen, and Pronovost (2018) utilized human factors engineering in determining which parts of the infection prevention processes in donning and doffing personal protective equipment during an Ebola outbreak were confusing or not being followed. Obtaining insight on the logistics from multiple disciplines allowed an increased understanding of the complexity surrounding the process and created more
meaningful education and guidelines for practitioners. This ultimately led to improved
guidelines and clear educational training while keeping both staff and patients safe.

Other ideas utilizing human factors engineering in order to improve patient room
cleaning suggested by Rock et al. (2016) include examining the tasks that each individual
is required to perform. Upon understanding their responsibilities, such as workload or
patient care expectations and time requirements, solutions surrounding those specific
concerns can be identified. In addition, repetitive tasks or ambiguity surrounding their
responsibilities may be identified. The ability to identify each of these potential problems
utilizing the theory and guidance of human factors engineering may improve the
understanding of staff needs surrounding station disinfection processes.

The Systems Engineering Initiative for Patient Safety (SEIPS) model provides an
organized framework of the human factors engineering theory (Carayon & Wood, 2010).
Carayon and colleagues (2006) explain that the SEIPS model evaluates the work system
as a whole, investigating five components (technology and tools, tasks, environment,
organization and person) which contribute to the overall care process leading to the
subsequent outcomes for the patient (Figure 1). Additionally, this model may be useful
in assessing the needs of staff in dialysis station cleaning, as it identifies not only the
knowledge and skills of the staff member, but each step within the system as a whole. As
Carayon and colleagues (2006) state:

The SEIPS model is useful for understanding that, although the skills and
knowledge of an individual healthcare provider are important, it is not sufficient
by itself to ensure high quality care and patient safety. The entire work system
needs to be well designed for optimal performance. (p. 54)
Studies utilizing the SEIPS model in inpatient healthcare settings were better able to assess barriers as well as opportunities in the delivery of care. For example, Caya and colleagues (2015) examined the five components of the working system in the SEIPS model to evaluate a hospital-wide daily bathing intervention. They observed the environment in which nursing personnel worked, observed and surveyed the staff, and evaluated equipment available for the process. Through the use of SEIPS and the systematic approach, the researchers identified time as the main barrier for daily bathing of the patient.

Funded by AHRQ, a collaborative effort among multiple outpatient surgery centers utilized the SEIPS model to address systems and improve patient safety (Carayon, Schoofs Hundt, Alvarado, Springman, Borgsdorf, & Jenkins, 2005). Evaluation of the physical environment, tools and technologies available to staff, and numerous work
systems related to the outpatient surgical experience allowed researchers to identify communication and team interactions within the process which required improvement. Additionally, organizational recommendations regarding the layout or structure of the physical environment were assessed and identified to improve patient safety in the surgical setting.

**Summary**

Dialysis treatment is a complex, life-saving process for 30 million Americans. Complications due to infections are costly for this population, not only for health outcomes but financially and emotionally, as well. Fortunately, many infections related to vascular access devices in dialysis can be prevented by following core recommendations provided by the CDC and AHRQ. Additionally, requirements by Medicare in infection control measures are surveyed in order to address outbreaks of infectious diseases like HBV and HCV in dialysis centers. In response to high infection rates in outpatient dialysis centers, the CDC created the *Coalition*, an initiative that is aimed at making dialysis safer for patients with collaborative efforts across the nation.

GHS dialysis centers, and other outpatient dialysis centers nationally, are frequently cited in improper dialysis station disinfection processes, one of the measures surveyed by Medicare. Questions from the renal dialysis leadership team surrounding the disinfection process arose from the most recent Medicare survey. When inconsistencies and vague descriptions regarding station disinfection processes were discovered through discussion and a review of the literature, a quality improvement project was initiated to assess and identify the potential gaps in protocol and practices at GHS. Drawing on human factors engineering theory, specifically the SEIPS model, to better understand the
tasks related to station disinfection may provide insight into contributing gaps in station disinfection processes.

Infection control and prevention is a vital aspect in the dialysis setting. With the complexity of providers, patients, and other individuals involved, infection prevention is a multi-faceted process, and must be approached from different vantage points. Performing a thorough assessment of the station disinfection protocol allows insight into the gaps in practice and potential needs existing around the process. These insights can lead to recommendations for GHS in updating protocols, providing specific resources for staff members, and/or potentially developing educational tools to ensure sustainability in the future.

**Definition of Terms**

**Access-Related Bloodstream Infection (ARBSI):** “Positive blood culture with the suspected source reported as the vascular access or uncertain” (CDC, 2018a, p. 4).

**Adenosine Triphosphate (ATP):** The molecule that provides energy to cells in living organisms. ATP is present in all living cells (including viruses and bacteria).

**Audit:** A methodical examination and review.

**Bioburden:** The number of bacteria living on a surface that has not been disinfected.

**Bloodstream Infection:** Infection that has spread to the bloodstream. “Any positive blood culture event” (CDC, 2018a, p. 4).

**Bluestar Forensic/Luminol:** Name brand latent bloodstain reagent products. These chemicals are designed to bind to hemoglobin and reveal blood that has been dried or washed.
**Chemiluminescence:** The emission of light by an atom or molecule that is in an excited state (in chemical reactions).

**Dialysis/Hemodialysis:** “A treatment to filter wastes and water from your blood, as your kidneys did when they were healthy. Hemodialysis helps control blood pressure and balance important minerals, such as potassium, sodium, and calcium, in your blood” (NIDDK, 2018a, para. 1).

**Disinfection:** The use of chemicals or commercial products to clean contaminated surfaces in healthcare settings (CDC, 2008).

**Environmental Surveillance:** Monitoring, analyzing, and controlling the surrounding physical environment. Includes monitoring bioburden on surfaces and analyzing cleaning methods of surfaces.

**Hand Hygiene:** “Performing handwashing, antiseptic handwash, alcohol-based hand rub, or surgical hand hygiene/antisepsis” (CDC, 2002, p. 3).

**Hawthorne Effect:** “Phenomenon in which participants change their behavior simply because they are in a study and have the attention of researchers” (Adams & Lawrence, 2015, p. 589).

**Healthcare-Associated Infection (HAI):** An infection that occurs in healthcare facilities when the patient is being treated for something else (CDC, 2018d).

**Hepatitis B Virus (HCV):** A virus disease that affects the liver. Clinical signs and symptoms include nausea, vomiting, abdominal discomfort, and jaundice. The average incubation period for the illness is 60-90 days and is transmitted via percutaneous and mucosal exposure of infected body fluids (Heymann, 2015).
**Hepatitis C Virus (HCV):** A virus disease that affects the liver. Clinical signs and symptoms include nausea, vomiting, abdominal discomfort, and sometimes jaundice. The average incubation period is six to nine weeks, but can be up six months. Hepatitis C is transmitted via percutaneous and mucosal exposure of infected body fluids (Heymann, 2015).

**Intensive Care Unit (ICU):** Highest level of medical care in the hospital for individuals who are acutely ill.

**Kidneys:** “Two bean-shaped organs, each about the size of a fist, located just below your rib cage, one on each side of your spine. Your kidneys filter blood to remove waste products and extra fluids, which become urine. The urine flows from your kidneys to your bladder through tubes called ureters” (NIDDK, 2018b, para. 1).

**Nephritis:** General term for inflammation of the kidney.

**Nephrology:** The branch of medicine that deals with kidneys and kidney-related diseases.

**Nephrosis:** Another term for nephrotic syndrome.

**Nephrotic Syndrome:** “A kidney disorder that causes your body to excrete too much protein in your urine. Nephrotic syndrome is usually caused by damage to the clusters of small blood vessels in your kidneys that filter waste and excess water from your blood” (Mayo Clinic, 2018, para. 1).

**Nosocomial Infection:** Another term for healthcare-associated infection.

**Outbreak:** “Refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in [a more limited geographic] area” (CDC, 2012, para. 3).
Renal: Another term that refers to kidneys.

Vascular access: “A term used to describe the place on your body where blood flows from and returns to your body during hemodialysis. A vascular access point may be an arteriovenous fistula, an arteriovenous graft, or a catheter” (NIDDK, 2018a, para. 15).

**Definitions Related to Vascular Access Types**

**Fistula:** “A surgically created direct connection between an artery and a vein to provide a permanent vascular access for hemodialysis” (CDC, 2018a, p. 4).

**Graft:** “A surgically created connection between an artery and a vein using implanted material (typically synthetic tubing) to provide a permanent vascular access for hemodialysis” (CDC, 2018a, p. 4).

**Nontunneled central line:** “A central venous catheter that is fixed in place at the point of insertion and travels directly from the skin entry site to a vein and terminates close to the heart or one of the great vessels, typically intended for short term use (e.g., triple lumen catheters)” (CDC, 2018a, p. 4).

**Other Vascular Access Device:** “Includes catheter-graft hybrid vascular access devices, ports, and any other vascular access devices that do not meet the above definitions” (CDC, 2018a, p. 4).

**Tunneled Central Line:** “A central venous catheter that travels a distance under the skin from the point of insertion before entering a vein and terminates at or close to the heart or one of the great vessels” (CDC, 2018a, p. 4).
Section II

METHODS

Introduction

Throughout this graduate preceptorship experience, discussions with leadership in both the Infection Control Department (ICD) and the dialysis units were conducted to determine the best methods for understanding the potential needs that may exist in dialysis station cleaning and the capacities or resources available within Gundersen Health System (GHS) to create and sustain education or changes to the disinfection process. In order to gain further insight into potential problems and solutions surrounding dialysis station cleaning, the principal investigator drew on learning experiences of infection control and environmental cleaning surveillance methods and a needs and capacity assessment. In McCawley’s *Methods for Conducting an Education Needs Assessment* (2009), he states:

> A needs assessment is a systematic approach to studying the state of knowledge, ability, interest, or attitude of a defined audience or group involving a particular subject…A needs assessment also provides a method to learn what has already been done and what gaps in learning remain. (p. 3)

In conducting a capacity assessment, the principal investigator’s purpose was to identify key groups throughout the entire process of providing care to a dialysis patient and review resources available to support any potential education or protocol changes.
that may be needed to properly disinfect the dialysis station. In order to conduct the needs and capacity assessment, three key groups of individuals were recognized as important throughout the work process of station disinfection: members of the renal dialysis leadership team, staff members performing direct patient care, and patients receiving dialysis.

Through in-person interviews, these groups layered the understanding and perspectives of dialysis station cleaning and infection control from multiple vantage points throughout the work process of the System Engineering Initiative for Patient Safety (SEIPS) model. The leadership team members provided an observational and organizational perspective of the process, as well as information on the capacity to which GHS may be able to invest in certain resources for future educational or protocol changes. Dialysis staff members provided the perspective from individuals actually performing the disinfection processes. The SEIPS model was utilized as a guide to ask staff members questions about their experiences, needs, and opinions.

Finally, gathering the perspective through the patients’ experiences was completed. By interviewing patients, the investigator was able to better understand how the disinfection process and infection control practices could affect the patients’ experience and health outcomes. Additionally, the patient experience allowed a complete assessment of the needs throughout the entire patient care process and identified where potential gaps in education may be occurring at different levels. To determine the specific needs and capacity delegated to the station disinfection process, a systematic approach utilizing the SEIPS model and interviews with key roles throughout the outpatient dialysis center at GHS was employed to obtain vital qualitative data.
Prior to performing interviews with leadership, patient representatives, and staff members, institutional review board approval was obtained from both the University of Wisconsin-La Crosse and Gundersen Health System (Appendices E, F). The following sections provide the timeline of assessment procedures, the purpose, rationale, and step-by-step procedures performed in completing the needs and capacity assessment of dialysis station disinfection at GHS.

**Timeline of Procedures**

A systematic approach to the assessment was undertaken (Figure 2). Careful review of the literature was completed prior to the assessment to provide adequate background and context surrounding the station disinfection process. The principal investigator reviewed protocols and procedures and past Medicare audits at GHS to determine if any major gaps or questions surrounding infection control related to station cleaning were immediately identified. The next step was to draw on the secondary data from the adenosine triphosphate (ATP) and chemiluminescent marker testing completed by the principal investigator during the graduate preceptorship. This allowed the investigator to establish an objective baseline of surface cleanliness levels based on current methods utilized by the ICD and to determine if there were specific problem areas in the dialysis station that could be identified.

Next, three groups of individuals were identified within the patient care process (including patients themselves) who could be interviewed to help provide insight and perspective on dialysis station disinfection. Each group was carefully considered and chosen to represent the viewpoints involved in the overall work process of the SEIPS model (Figure 1). This included the renal dialysis leadership team to represent the
organizational perspective, the dialysis staff members to provide their opinion related to the environment and work processes contributing to patient care, and finally, the patients’ perspectives. The patient perspective is the culmination of how the environment and work process accomplishes the goal of providing patient care and quality outcomes within the SEIPS model. Allowing the patients to provide their experiences and opinions ensured that the investigator accurately captured the needs of the intended population with the performed assessment.

Next, questions were formulated for the interviews with the renal dialysis leadership group, the patient representatives, and the staff members. No existing questions, surveys, or interviews were found through the review of literature to draw from. Therefore, using the SEIPS model as a guide and drawing on assumptions from the principal investigator, questions were formulated specifically for this project (Appendix G).

Figure 2. Methodology of Needs and Capacity Assessment Process.
It is important to note that assumptions may be negatively viewed by researchers in the academic realm. However, according to Gilmore (2012), assumptions may be appropriate as initial starting points in better understanding the circumstances of the issue at hand by the practitioner and the target audience, as they can be “…intuitive in nature, influenced by the previous experiences, opinions, feelings, and ideas of each individual. Practitioners develop assumptions based on ongoing interaction with community members and other professionals…” (p.13). With the healthcare-related background, experience, and involvement of the principal investigator, assumptions acted as a starting point for the process. The completion of the assessment could then verify the accuracy of the assumptions and provide more insight or detail to the process.

Required Institutional Review Boards (IRB) approval from the University of Wisconsin-La Crosse and GHS was obtained in November of 2018. In-person interviews with members of the renal dialysis leadership team, patient representatives, and staff members were conducted between November and December 2018 (Figure 3). All interviews were conducted in person with the principal investigator, and verification of respondents’ answers was obtained at the time of the interview to ensure the researcher’s perception of their responses was accurate. In order to verify the answers of each respondent, the investigator paraphrased responses after each question to determine at the time of the interview if the response was accurately communicated.

Trends and themes were identified from the interviews and consolidated in order to identify specific insights into future recommendations for dialysis station disinfection practices. Descriptive data analysis (e.g., counts and percentages) was performed to describe the aggregated project results. The full assessment and future recommendations
were written into a final report and submitted to the renal dialysis leadership team. The following describes the purpose, rationale, and specific procedures taken for each step in the assessment process.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ATP Testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forensic Luminol testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literature Review/Method development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRB Submission &amp; Approval Process</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dialysis Leadership Interviews</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Interviews</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff Interviews</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyze Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report Development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissemination of report</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral defense of project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Gantt Chart: Timeline of Needs and Capacity Assessment Project Process.

**Objective Data Sampling: Background of ATP Bioluminescence and Chemiluminescent Markers**

Currently, the department utilizes adenosine triphosphate (ATP) bioluminescence meters and chemiluminescence markers in objectively determining the level of cleanliness of healthcare-related environmental surfaces (L. Grupa, personal communication, September 18, 2018). These processes are also recommended by the CDC in evaluating environmental surface cleaning (CDC, 2010; Carling, Parry, & Von Beheren, 2008). ATP testing is a rapid procedure which detects microscopic residue of living organisms on surfaces that appear otherwise visibly clean. ATP is present in all cells and will be present on surfaces when they have been contaminated and not properly
cleaned (CDC, 2010; Whiteley, Glasbey, & Fahey, 2016). Baseline objective data were obtained using ATP bioluminescence meter sampling and chemiluminescence markers. ATP testing has limitations; for example, it cannot detect specific types of organisms and variability exists within the method that the sample is collected. Nonetheless, it has become an evaluation tool for use in environments where surface cleaning is crucial, like the food and healthcare industries (CDC, 2010; Omidbakhsh, Ahmadpour, & Kenny, 2014; Whiteley, Glasbey, & Fahey, 2016).

These processes have the potential to be used as an evaluation tool to determine whether quality disinfection practices are sustained at the present time and in the future. For example, if high levels of ATP are present on frequently touched areas of the dialysis machine, this may indicate that reinforcement of station cleaning practices needs to be undergone with staff. In addition, ATP testing can help provide objective, non-judgmental data and feedback to staff. This method has been utilized in the ICD at GHS when working with the environmental services staff. Per discussion with an Infection Control Prevention Specialist, feedback from environmental services staff when using data obtained from the ATP bioluminescence meter was a positive, non-punitive way to observe cleaning behavior, and provide objective real-time information for improvement in disinfection skills (L. Grupa, personal communication, September 24, 2018).

While ATP bioluminescence testing can provide information on the presence of organisms detected on a surface, chemiluminescent markers, such as Bluestar Forensic or Luminol brands, can detect minute amounts of dried or washed away blood that may be invisible but still present on surfaces. When chemiluminescent markers bind to hemoglobin, the result is a glowing blue light, indicating the presence of blood
Bergervoet and colleagues utilized forensic Luminol to detect invisible traces of blood on hemodialysis machines in a 2008 study as a way to introduce this method and monitor disinfection of surfaces. Forensic Luminol testing has been utilized in the GHS ICD for assessing blood on common items such as glucometers, as well as to provide a visual for teaching staff about infection control (M. Michel, personal communication, October 2, 2018).

**Purpose and rationale.** The purpose of utilizing ATP bioluminescence and chemiluminescent markers was to gather a baseline, objective understanding of the cleanliness of various surfaces in the dialysis patient station. In addition, testing was completed to identify potential areas or surfaces that could be problematic (e.g., a high bioburden, high risk of transmitting infection), which may not have otherwise been recognized by staff in the cleaning process. These environmental surveillance methods are currently recommended by the CDC and used by the ICD at GHS to periodically assess the cleaning interventions in the inpatient hospital setting. Even if certain areas tested prove to be clean, the information can be transferred back to staff members as a way to transparently and objectively demonstrate that they are thoroughly cleaning the station. Additionally, surveillance methods may prove to be helpful in providing education and periodic cleaning surveillance of surface areas in the future for outpatient dialysis settings.

**Procedures.** Eighteen ATP tests were completed on the dialysis machine and on areas that were perceived to be high touch or potential high contaminant areas (e.g., Hansen fittings, area where medication is administered in tubing during dialysis session, alarm silence button, arm rest on chair, call light). The number of samples taken was
based on suggestions by an Infection Control Specialist, as well as cost constraints (L. Grupa, personal communication, September 25, 2018).

The following steps were performed, based on IC departmental procedures, to assess the cleanliness of the surfaces before and after station disinfection on a vacated dialysis station.

1. Six 2x5cm surface areas were each swabbed three times. An experienced dialysis staff member suggested the following surfaces be tested based on their knowledge and expertise of the dialysis process and where specific areas may be highly contaminated during the patients’ session. The surfaces included (Figure 4):

   - The silence alarm button on the dialysis machine
   - The on/off button on the dialysis machine
   - The blood pump area where direct access to blood is obtained
     (Medication is administered to the patient during dialysis near this surface.)
   - Tray table attached to the patient chair
   - Arm rest of patient chair
   - Call light patient utilized to call staff during dialysis session

2. The dialysis station surfaces were swabbed with the IC department’s 3M CleanTrace ATP bioluminescence meter after the patient left the station and before the disinfection process took place. The first swab was completed and recorded. A second swab was done in the same area to verify or confirm approximate ATP readings on each surface.
3. The dialysis station was then disinfected by the principal investigator according to policy, utilizing the GHS provided cleaning products and protocol methods (Appendix B). An observing dialysis staff member was present to verify that the investigator cleaned the station based on protocol standards.

4. After appropriate drying time for the disinfectant was observed (60 seconds, per manufacturer’s recommendation), a final swab was completed on each surface area to determine the surface cleanliness level.

Readings and notes were recorded in a table, and descriptive analysis was performed to describe counts on each surface area. Results regarding the cleanliness levels of the surfaces tested will be discussed in detail later in this report.

![Figure 4. Vacated Dialysis Station With Sites Marked Where ATP Testing Was Conducted.](image)

Bluestar Forensic chemiluminescence (also referred to as Luminol, another brand name) was used to identify areas of the dialysis machine and patient station that had microscopic blood or high-risk areas that may be missed in the daily disinfection process. Various dialysis machines, patient chairs, thermometers, and objects that frequently enter
the patient area were sprayed with Luminol and photographed by the Medical Media Department at GHS. In a darkened room, the chemiluminescence was mixed per manufacturer’s recommendations and sprayed on surfaces that had been disinfected by staff members per GHS protocol on the previous day. Dialysis staff members were not aware that the principal investigator would be performing the chemiluminescence testing; and therefore, they did not do any additional station disinfection cleaning beyond the prescribed duties they would usually complete on a regular shift.

Due to the short period of time in which the chemical reaction occurs, long-exposure, low light photography was taken to capture the reaction, and the photograph was utilized to demonstrate the results. Data recorded from these processes were reported out in a table and photographs, and descriptive analysis was utilized to describe what was observed on the various surfaces of the dialysis station. Additional results from these procedures will be discussed in detail in the results section.

**Qualitative Data: Interviews with Leadership, Patients, and Staff**

As stated previously, in order to achieve rich qualitative data, a multi-disciplinary perspective is important. Insight from the following individuals within the GHS dialysis team layered the understanding of infection control surrounding the dialysis station, and the importance at each level:

- renal dialysis leadership members
- dialysis patient representatives
- dialysis staff members

The ultimate purpose of this quality improvement project was to determine what gaps existed in the infection control methods of dialysis station disinfection coupled with
recommendations for improvement. In order to provide safe delivery of quality healthcare to dialysis patients, assessing each perspective within the patient care process was essential—from administrative support and staff members performing the procedures to the patients, who are affected by the infection control measures. In order to form conclusions and develop recommendations, the following framework was observed, and steps taken, in order to verify, organize, and identify the trends and themes from the qualitative research.

During the interviews, responses were paraphrased and repeated back to the individual. Clarification or confirmation of their response was completed to ensure that their comments were accurately recorded. Additionally, this gave the respondent the chance to reinforce, emphasize, or expand on their answers. The principal investigator stayed at the dialysis facility where all interviews were completed in order to be available for follow-up. This was done to ensure that staff members and patients had the chance to communicate additional thoughts or comments after the interview. Immediately after interviews took place, the principal investigator reviewed the notes. This was done to clean up grammatical errors, complete thoughts or sentences, and ensure that all notes were complete and clear for later review.

Analysis of qualitative data obtained from the interviews were approached by open coding with a single coder review. Due to the gap in literature regarding dialysis station disinfection processes, utilizing open coding allowed the exploration of new themes to emerge that may have otherwise been missed. After all interviews were complete, the principal investigator read each interview twice. During the review, coding of themes began to take place. The coding of themes came from the text itself—a priori
approach-or the principal investigator’s prior theoretical understanding of the problem. It is important to recognize at this point the difference between the a priori approach and reflexivity, that is, personal biases that may have occurred during the data collection process. Due to the nature of qualitative data collection in the form of personal, one-on-one interviews, the principal investigator recognizes that personal biases may have been exhibited or occurred during the interview (e.g., time, task constraints as a nurse). By reflecting and recognizing that bias may have occurred within the conversations and interviews, the investigator will attempt to address them throughout the analysis process.

Based on Ryan and Bernard’s *Techniques to Identify Themes* (2003), three techniques were utilized in the coding process:

- Repetition (placing priority on themes based on codes that appear more frequently than others),
- similarities and differences (discovered by comparing and contrasting themes that begin to emerge), and
- cutting and sorting techniques.

Repetitions look for ideas and topics that emerge over and over again. Similarities and differences examine comparisons of ideas and have the investigator examine the differences in the expression of themes. The cutting and sorting method involved identifying texts, quotes, and ideas and combining the themes into related categories. All interview transcriptions were printed, answers were physically cut out or color coded and placed together in piles that were related. This physical process allowed the investigator to determine additional subthemes that could occur. “By sorting expressions into piles at
different levels of abstraction, investigators can identify themes, subthemes, and meta-themes” (Ryan & Bernard, 2003, p. 103).

Once the coding of the main trends and themes were identified, they were placed within the SEIPS model to help organize, categorize, and conceptualize the ideas in developing conclusions. Initially, prioritization was assigned to the predominant themes by looking at frequency. The more frequent the themes, the higher the priority was placed on the emerging theme. High priority was placed on themes that occurred five or more times. Moderate priority was placed on themes that occurred three to four times, and low priority to themes that repeated two times. Preliminary themes that emerged from the conversations were shared with key individuals, such as the administrative director of renal dialysis and infection control and nurse leaders of renal dialysis. This procedure allowed these experienced individuals to help interpret the ideas forming and determine priority on the themes based on their background and relationships to the process. Additionally, this allowed the investigator to be open to the connection of themes to other ideas or priorities not previously recognized from the coding method.

Finally, two reviewers, administrative director Bridget Pfaff and chair of the project, Dr. Gary Gilmore, were consulted with the final categories of themes. This final, two-reviewer process allowed discussion, exploration, and feedback of the categories to be finalized based on data collected. The final sounding board process ensured that the principal investigator was reflective and open to additional subthemes that may have been missed in the coding process. It also allowed the investigator to continue to be reflective of any biases that may have occurred during the coding process.
Leadership Interviews

Purpose and Rationale

The purpose of performing key informant interviews with the renal dialysis leadership team at GHS was to gather qualitative data representing a broad, observational perspective or understanding of the station disinfection process. The renal dialysis leadership team at GHS represents diverse, in-depth experience to assist in understanding infection control methods, gaps in practice, and educational development of staff members. Their knowledge of quality improvement initiatives, development of protocols and procedures, and expertise in preparing for Medicare surveys helped the principal investigator fully assess the process and capacity within GHS. Additionally, the unique perspective from the administrative director, who also works as the director for infection control, provided insight into methods, education, and a culture of safety regarding infection control in the dialysis setting.

Procedures. In-person key informant interviews were conducted with the following individuals:

- Administrative Director of Infection Control and Renal Dialysis: Bridget Pfaff
- Quality Specialist: Carole Wittenberg
- Nurse Educator: Jennifer Tucker
- Expert Nurse Leader: Jennifer Lisowski
- Nurse Manager: Jessica Adams

Interviews were scheduled to take place at times convenient for each individual. After obtaining informed consent, interview questions were asked. Detailed notes were
taken during the interviews by the principal investigator. A full list of interview questions is available in Appendix G. In order to verify responses, themes, trends, and ideas emerging from the conversation were paraphrased and repeated back by the investigator after each question was answered by the individual. The verbal paraphrasing of responses ensured that each individual response reflected what the individual intended to convey and allowed them the chance to confirm or clarify the conversation. Once accuracy of response was ensured, the next question was asked.

The process was repeated until all questions were completed. At the end of the interview, the respondent was asked if they had any additional comments or thoughts they would like to add, to give them the opportunity to include any pertinent opinions they deemed important to include that may have been missed in the questions asked. All notes were compiled after completion of the interviews to identify the major trends and themes. Descriptive data analyses (e.g., frequency, percentages) were used to aggregate the data and report results in the final report.

**Patient Perspective**

**Purpose and Rationale**

To continue to layer the perspective and experience of all individuals involved in the project, three volunteer patient interviews were performed. The purpose of the patient interview was to elicit insight from the individuals who carry the greatest risk related to the disinfection process. This perspective represents the final outcomes portion of the SEIPS model, as the patient viewpoint can help identify the perceived quality of care and overall safety in the station disinfection process (Figure 1). Through discussions with the core team of the *Coalition* at the CDC, the patient-centered perspective was reported as
an important aspect in the creation and purpose of the *Making Dialysis Safer for Patients* project. The CDC team members discussed how patient perspectives regarding infection control practices, including dialysis station cleaning, can be utilized to help engage and educate patients and staff members in the future (P. Patel, & L. Mocia, personal communication, September 7, 2018; See et al., 2014). Three patients were chosen by the dialysis leadership team to be interviewed by the investigator in order to identify trends and themes that were occurring from the patient perspective. More than one patient interview allowed the principal investigator to determine whether specific priorities or concerns emerged from multiple patient interviews. Dialysis patients are often seen three times a week for several years in the same dialysis facility. Therefore, staff often develop a relationship with patients. Dialysis staff members typically know more about a patient’s personal life, learning style, health needs, and even personal interests, than most other clinician-patient relationships. The dialysis leadership team utilized their personal knowledge of each patient, along with the following criteria, to approach specific individuals regarding their participation in the project:

- 18 years of age or older
- Able to communicate in English
- Cognitively independent and able to make own medical decisions (e.g., no history of dementia or Alzheimer’s, does not have a power of attorney activated for medical decision making)
- Variety of ages groups, or generations
- Different stages in dialysis treatment: New patients just starting dialysis, as well as patients who have been treated for several years
- Willingness to be engaged in voicing their perspective with the principal investigator

**Procedures.** Three volunteer patient representatives were identified and contacted by the renal dialysis leadership team at the Onalaska dialysis center. The leadership team acted as gatekeepers, and approached patients they knew may be interested and willing to complete an in-person interview with the principal investigator. A systematic procedure of introducing the project and the details of the interview process were performed by the dialysis leadership member to ensure that each patient had consistent and detailed information regarding the project. After disclosure of the details of the interview process, and notification that the interview was voluntary and was in no way related to their receipt of care, the interview time was coordinated by a renal dialysis leadership team member once the patient agreed to be involved in the project. Please see Appendix H to see the patient interview procedure and informed consent. Having the dialysis leadership member contact the patient and organize the interview time ensured patient confidentiality. The investigator did not need to access any medical charts or personal contact information in order to complete the patient interviews.

During the scheduled interview, the patient was again introduced to the purpose of the project. Any questions regarding the process were answered and informed consent was obtained prior to the interview taking place. Detailed notes were taken during the interview by the principal investigator, and verification by paraphrasing themes and ideas of their responses after each question ensured accuracy of the recorded comments. The process was repeated until all questions were completed. At the end of the interview, the patient was asked if they had any additional thoughts or comments to add in order to give
them the opportunity to include any opinion they deemed important to include beyond the interview questions.

Patient interview notes were de-identified (no names or personal identifying information were recorded) and compiled by the investigator. Trends, themes, and ideas emerging from the conversations were identified from the investigator’s notes. Descriptive data analysis (e.g., frequency, percentages) was completed to aggregate the data and report results in the final report.

Staff Interviews

Purpose and Rationale

Finally, one-on-one, in-person interviews with dialysis staff members completing the disinfection tasks were completed. Prior to commencing this project, the investigator was aware of the possibility that the Hawthorne effect may influence staff responses. The Hawthorne effect refers to how participants change their behavior or responses due to the fact that they are being observed by a researcher (Adams & Lawrence, 2015). The staff was already aware that a graduate investigator was working with the ICD in the dialysis units. The process of being watched and interviewed by the researcher may have altered the actions or responses by staff members. This effect is acknowledged as a limitation. Further, the dialysis units had already adopted several infection-control related recommendations since the results of the Medicare survey had been released, and collaborative efforts with the CDC’s Coalition began.

The purpose of conducting staff interviews was to assess the disinfection process as perceived by those performing the duties and to understand their work system, environment, practices, and educational needs in greater detail (with guidance from the
SEIPS model). Utilizing the systematic approach of the SEIPS model allowed the principal investigator to identify trends and themes in the moment of the interview. It is important to note that staff members are audited yearly to ensure that they have the knowledge and skills of the procedures to disinfect the dialysis station. These audits are used to help staff members refine and reinforce their practice, as well as provide documentation for Medicare showing that staff are proficient in these tasks. As part of the preceptorship experience, the investigator performed the audits for the dialysis units. By interviewing staff members during their audit check-off, the principal investigator was able to qualitatively gain candid insight into the knowledge, understanding, practice, and overall needs of the staff members performing this vital task, and further, to understand the educational needs or support staff may require in order to complete their tasks. These data helped develop the understanding of the gaps in practice and knowledge, as well as provided an assessment of the need for development of future staff education.

**Procedures.** Permission to perform interviews with staff members during the audit process was obtained verbally from the administrative director and renal dialysis leadership team prior to beginning. Each staff member was asked if they were willing to be interviewed by the principal investigator as they completed their station disinfection competency audit. If the staff member agreed, the purpose of the project was described in detail (Appendix I). Any questions or concerns were addressed, and informed consent was obtained prior to the interview.

The interviews were conducted at the end of the day, as the final dialysis patient shift was completed, in order to provide adequate time for the staff member to candidly answer the principal investigator’s questions, without interfering with patient care or
other duties. If a staff member did not want to be interviewed, and did not sign an informed consent, the required competency audit took place without any interview questions for the project being asked. Themes, trends, and ideas emerging from each conversation were paraphrased by the investigator to verify that the staff members’ responses reflected what they intended to convey. Once the accuracy of response was ensured, the next question was asked. The process was repeated until all questions were completed. At the end of the interview, the respondent was asked to add any additional comments or thoughts in order to give them the opportunity to include any pertinent opinions they deemed important to include.

All notes were de-identified and compiled after completion of the staff surveys to identify the major or saturating trends and themes that are identified during the interviews. Descriptive data analyses (e.g., frequency, percentages) were used to aggregate the data and report results in the final report.

**Summary**

Approaching the assessment of station disinfection through a systematic process and utilizing the SEIPS model of human factors engineering allowed potential gaps in knowledge, tools, and resources to be identified. Additionally, by interviewing three groups of individuals within the work system process, a better understanding emerged of where the specific needs exist regarding infection control within the dialysis station. Notes from all interviews were carefully reviewed by the principal investigator during the in-person interview process in order to clarify and validate responses from each individual.
Descriptive statistics were utilized to analyze qualitative data and to describe trends and themes occurring from each group interviewed. By recontextualizing the SEIPS model, questions correlating to the different categories of the model were grouped together to identify specific areas of priority (Figure 5). This allowed respondents’ answers to be categorized into specific areas of the work system relating to the disinfection process.

Additionally, near the completion of each interview, the principal investigator asked each person if they had any additional comments, or wished to emphasize any particular response. This process allowed the respondent to place priority on specific tasks or perspectives. These emphasis statements helped the principal investigator interpret overall prioritization, or greatest needs, of the disinfection process within the work system process. Collectively, responses from the broad perspectives of the key informants, patient, and staff members will influence future recommendations in dialysis station disinfection protocol recommendations. Additionally, the sustainability of re-educating staff regarding infection control processes is an important factor to consider.

Figure 5. SEIPS Model, Adapted for Dialysis Station Disinfection Assessment.
Section III

RESULTS

Adenosine Triphosphate Testing

The instrument utilized for adenosine triphosphate (ATP) testing states that a relative light unit (RLU), a unit of measurement for ATP, reading of 250 or below is considered background noise, or insignificant. Readings above 250 RLUs suggest an unclean, or potentially contaminated, surface. Each surface of the vacated dialysis station was swabbed three times (Figure 4). The first swab test gave an initial reading. The second swabbing was performed over the same surface. The entire station was disinfected, per protocol, by the principal investigator, and allowed to dry. Finally, the third and final swabbing of the surface area was completed.

Prior to cleaning the dialysis machine surfaces (i.e., on/off button, silence alarm button and blood pump area), the highest reading of all three testing points recorded was 157 RLUs. After cleaning, the surface level RLUs decreased to 15-38 (Table 2). The readings demonstrate that the dialysis machine is clean and that staff practices of performing hand hygiene and gloving, prior to touching the machine while the patient is receiving dialysis, is most likely occurring. Additionally, even though the RLUs were insignificantly low, the overall decrease in RLUs after disinfecting the surface per protocol provides an illustration of the thoroughness of the disinfection process. This
concept may be useful for dialysis centers when teaching about the importance of disinfection.

Table 2. ATP Testing Results from Onalaska Dialysis Station

<table>
<thead>
<tr>
<th>Surface</th>
<th>Reading 1 (RLU)</th>
<th>Reading 2 (RLU)</th>
<th>Reading 3 (RLU) (after disinfection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Silence Alarms</td>
<td>70</td>
<td>157</td>
<td>38</td>
</tr>
<tr>
<td>*On/Off Button</td>
<td>91</td>
<td>50</td>
<td>19</td>
</tr>
<tr>
<td>*Blood Pump</td>
<td>106</td>
<td>74</td>
<td>15</td>
</tr>
<tr>
<td>**Tray Table</td>
<td>241</td>
<td>372</td>
<td>875</td>
</tr>
<tr>
<td>**Chair Arm Rest</td>
<td>8560</td>
<td>7219</td>
<td>1585</td>
</tr>
<tr>
<td>**Call Light</td>
<td>764</td>
<td>571</td>
<td>217</td>
</tr>
</tbody>
</table>

*Dialysis Machine **Patient Area

The surrounding patient area of the dialysis station proved to be more problematic, the chair arm rest most so. The station utilized for this testing had gross blood contamination on the arm rest, which can be common due to bleeding issues with arm fistulas after treatment. The ATP test swab was taken just outside the visible blood spot on the arm rest. Despite the fact that no actual blood was swabbed, the test showed a result of 8,560 RLUs. Second swabbing of the same area resulted in 7,219 RLUs.

Protocol was followed in disinfecting the chair. First, the grossly contaminated bloody area was wiped down with an Oxivir wipe. Next, the area was wiped again with the Oxivir wipe, with a wet contact time of one minute, and allowed to fully dry, per manufacturer directions and department policy. Even after following protocol, the final ATP swab demonstrated a total of 1,585 RLUs. This result was problematic, as it demonstrates that while the overall contamination decreased, it wasn’t enough to meet the standard of at least 250 or fewer RLUs.

Pre-cleaning ATP readings of the call light were greater than 500 RLUs but decreased to 217 after cleaning. The tray table, where supplies are kept for accessing and
bandaging patient fistulas and catheters, had actually increased from 241 to 372 RLUs on second swabbing to 875 RLUs after cleaning. These results were rather confounding, as the result continued to increase after each swab. When swabbing the silence alarm on the dialysis machine, the result increased on the second swab as well. Further discussion on what these results may demonstrate, and the potential limitations of ATP testing, will be discussed in further detail below.

**Forensic Luminol**

Forensic Luminol was tested on multiple dialysis machines, objects, and surrounding patient areas in the Onalaska and La Crosse dialysis clinics. Low light photographs were taken by partners of the Medical Media Department at Gundersen Health System (GHS) to capture the reaction. Forensic Luminol products must be used within three hours once mixed. Therefore, Jennifer Lisowski, expert nurse leader, asked the investigator to spray additional items that were frequently brought into the patient zone to determine if other objects were inadvertently contaminated during a patient dialysis session. Some of these items included the thermometer, pens from the nurse station, and a staff member’s protective face shield for blood splatters (Figure 6). Surprisingly, none of the objects appeared to glow. The only object to have a clear reaction was a reusable blood pressure cuff at the La Crosse clinic (Figure 7). In the Onalaska outpatient dialysis setting, patients have their own cuffs which are not cleaned or re-used for the next patient.
Additionally, the patient television and the chair were sprayed. The televisions appeared completely clean. The chairs varied. At the Onalaska dialysis center, the chairs, including the side tables, had no tell-tale blue glow and appeared quite clean (Figure 8). Chairs and dialysis machines were also tested at the La Crosse GHS dialysis center, and appeared quite different (Figure 9). The inside arm of one chair was notably glowing blue compared to the other parts of the chair. Dialysis staff leadership and staff members
reported that the inside arm and arm rest areas of the chair are often where patients will bleed the most or have large blood spills occur during their session.

Figure 8. Onalaska Chair, After Luminol Application.

Figure 9. La Crosse Center Dialysis Chair: Blood Stains Illuminated After Luminol Application.

High touch areas of the dialysis machine were clean and free of microscopic blood. Areas with small cracks, divots, and rough surfaces that were small and not frequently touched or cleaned were glowing (Figures 10 & 11). However, while the highly touched surfaces appeared clean, the base of most of the machines appeared blue
and glowing. One can easily identify the drips or spills of blood that are not cleaned well on the bottom of the machine based on these images (Figure 12).

Figure 10. Upper Portion of Dialysis Machines, After Luminol Application.

Figure 11. Close-up of Upper Portion of Dialysis Machines, After Luminol Application.
The back sides of machines were also tested to determine how much invisible blood may be present. The back side of the dialysis machine contains lines and cords, has numerous crevices, and is only wiped down weekly. When this surface was tested for invisible blood, the surface that reacted with the Luminol was the metallic component of the blood pressure cord (Figure 13). This, however, may be a false positive and will be discussed in further detail as a limitation.
Interviews

Twenty staff interviews, five key informant leadership interviews, and three patient interviews took place for the qualitative portion of this project. Copies of the raw data (detailed notes of all interviews) were given to Bridget Pfaff and Dr. Gary Gilmore for review once the principal investigator had coded for common themes.

Staff Interviews

A total of 20 staff interviews took place (N = 20) at the Onalaska outpatient dialysis center. Staff members approached by the principal investigator were willing to participate and agreed to be audited and observed while the interview was occurring. Based on frequency and open coding techniques, as described in the previous section, the following themes emerged. Throughout the coding process, the principal investigator made judgment calls on how to code specific responses into themes. Interpreting language proved challenging at times. However, based on the notes taken and the interaction at the time of the in-person interviews, the investigator needed to determine
how to proceed with these statements. For example, some staff needed more prompting to elaborate on specific thoughts. The investigator would ask an additional question or ask the staff member to explain a time that they had a particularly unique or difficult experience with disinfection in order to help illicit responses and encourage the staff member to speak more on the subject. While some conversations did not state the exact language of the theme, the staff eluding to certain situations or experiences were interpreted by the investigator and placed into appropriate thematic categories during coding with review.

After the interviews were coded, themes were tallied to indicate how many staff members mentioned each particular one. Additionally, staff members who mentioned a particular theme two or more times in an interview were tallied. Frequencies and percentages were calculated to determine what themes carried the most weight or to determine how priority was placed on the themes (Table 3). Due to the limited sample size, the principal investigator felt that percentages would clearly convey the results and allow individuals to quickly visualize the priority of themes.
Table 3. Frequency of Themes Occurring in Staff Interviews

<table>
<thead>
<tr>
<th>Theme Identified</th>
<th>Interviews Mentioning Theme = 1</th>
<th>Interviews Mentioning Theme $\geq$ 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate Tools</td>
<td>85 (17)</td>
<td>-</td>
</tr>
<tr>
<td>Educational Needs – Hands On</td>
<td>70 (14)</td>
<td>-</td>
</tr>
<tr>
<td>Educational Needs – Other</td>
<td>50 (10)</td>
<td>15 (3)</td>
</tr>
<tr>
<td><strong>Mistakes or Repetition</strong></td>
<td>15 (3)</td>
<td>10 (2)</td>
</tr>
<tr>
<td>Visual or Video Refresher</td>
<td>15 (3)</td>
<td>5 (1)</td>
</tr>
<tr>
<td>Time</td>
<td>25 (5)</td>
<td>45 (9)</td>
</tr>
<tr>
<td>Blood Spills or Sprays</td>
<td>25 (5)</td>
<td>35 (7)</td>
</tr>
<tr>
<td>Nooks &amp; Crannies</td>
<td>35 (7)</td>
<td>20 (4)</td>
</tr>
<tr>
<td>Defining the Patient Zone</td>
<td>20 (4)</td>
<td>25 (5)</td>
</tr>
<tr>
<td>Layout of the Unit</td>
<td>45 (9)</td>
<td>-</td>
</tr>
<tr>
<td>Chair Arm Rest</td>
<td>20 (4)</td>
<td>10 (2)</td>
</tr>
<tr>
<td>Communication of Responsibilities</td>
<td>10 (2)</td>
<td>20 (4)</td>
</tr>
<tr>
<td>Back Side of Dialysis Machine</td>
<td>15 (3)</td>
<td>5 (1)</td>
</tr>
<tr>
<td>Defining the Why</td>
<td>20 (4)</td>
<td>-</td>
</tr>
<tr>
<td>Checking the Box</td>
<td>10 (2)</td>
<td>5 (1)</td>
</tr>
</tbody>
</table>

*N = 20

**Mistakes or Repetition:** Staff learning from a blood spill incident or other mistake, or doing the disinfection task repeatedly.

**Time.** Time constraints and feelings of being rushed surrounding the disinfection process, particularly at patient turnover time, was commented on in 70% ($n = 14$) of the staff interviews. Of the 14 staff that spoke about time as an issue, nine staff members mentioned this theme two or more times throughout the interview. This theme became emphasized when blood spills or excessive bleeding occurred, or when a patient developed low blood pressure that required interventions. Both leadership and staff commented on this issue, making this theme evident across disciplines. Six staff members remarked that they clean the best they can with the time and resources they have.
However, they acknowledged that they are not as thorough or detailed as they needed to be when these situations arise.

**Educational needs.** Of the staff interviewed, 70% (n = 14) said a hands-on approach is the best way to teach station disinfection. This educational theme was evident in the dialysis leadership interviews as well, and will be further explored below. Twenty-five percent (n = 5) of staff remarked that repetition and learning tips and tricks from their own, or others’, mistakes followed hands-on methods for education needs. One staff member gave the example of how they forgot to clamp the blood line prior to administering a medication. The result was a significant blood spray due to the increased pressure in the pump. This staff member noted that they only had to make that mistake once, and clean the resulting blood spill from the area, in order to never forget to clamp the blood pump again prior to administering medication.

During the start of the interviews, prior to questions and note-taking, staff members often remarked on how disinfecting the station had become a muscle memory, one that they rarely stopped and truly thought about, until they were observed and interviewed by the primary investigator. The muscle memory helped them repeat the tedious task while performing a variety of other responsibilities. Experienced staff members described a seamless flow that they developed over time, balancing their disinfection processes with other critical thinking practices they performed at the same time. When auditing or feedback was discussed as part of the education and re-enforcement process, two staff members commented that they appreciated a timely, in-the-moment critique of what they were doing right or wrong. Other educational needs
that were discussed with the principal investigator included 20% \((n = 4)\) of staff wanting a visual or a video refresher on the disinfection protocol.

**Blood spills and sprays.** Eighty-five percent of staff \((n = 17)\) felt confident that they have all the tools they need to adequately clean the dialysis station. However, a subtheme began to emerge throughout the interviews. Sixty percent \((n = 12)\) of staff discussed the difficult and unique situation of having to clean and disinfect large blood spills. Staff remarked that they did not always have adequate tools, supplies, and time to clean and disinfect the dialysis machine and station when gross contamination occurred. For example, one staff member pointed out that the disinfecting Oxivir wipes provided are inadequate at soaking up blood. Of the 12 staff that commented on blood spills, 35% \((n = 7)\) mentioned the same theme two or more times.

**Nooks and crannies.** Small crevices were a common theme of frustration for the staff members. Of the staff interviewed, 55% \((n = 11)\) remarked that they were difficult to clean thoroughly, and 20% \((n = 4)\) mentioned this theme two or more times throughout their interview. Staff identified that these areas were likely the most contaminated. The port near these knobs are where medications are administered and blood sampling occurs during the dialysis session (Figure 14). As mentioned above in one staff member’s learning experience, this break in the pump tubing is where blood, under pressure from the machine, has the potential to spray if not properly accessed, and can spray or drip onto the dialysis machine surface.
Staff were asked by the investigator what they did to handle these unique situations that are not specifically spelled out in the protocol. Responses ranged from using toothbrushes, which are made available by the facility to assist in deep cleaning in these difficult situations, or threading the Oxivir wipe through the port and simply cleaning as best they could. Two staff members mentioned pulling the dialysis machine out of service, or simply taking it off the floor to be wiped down and have pieces replaced when they become grossly contaminated. When prompted to explain more of their learning process in these unique situations, staff commented that they learned these tips and tricks from experienced staff members when they were mentored, or developed their own practices over time.

**Defining the patient zone.** A common area of confusion regarding station disinfection was the definition of the patient zone. Healthcare personnel are often taught that the patient zone is not only where the patient physically occupies space, but is an area that helps practitioners categorize what items or areas may be potentially
contaminated, or dirty, prior to moving on to the next patient. Because of the open concept of dialysis floors and the frequency with which spaces are shared, the clear delineation of a patient zone was ambiguous to 45% \((n = 9)\) of the staff interviewed. Additionally, of the more than half of the staff that mentioned this theme, 25% \((n = 5)\) mentioned it two or more times throughout their interview. One staff member stated:

The stations are so close together that if I am cleaning a station, but their neighbor is sitting there, just as close to the machine as the patient, how is that any better? It makes no sense. I mean, the six-foot patient zone thing doesn’t make sense, we don’t have six-feet in any direction from them to spare.

Another area noted in the interviews was clear zone definition of the nurses’ counter. A vital area for setting equipment, papers, medications, and charting, this space was not consistently wiped down between each patient, as there was confusion if this is part of the dialysis station or considered a clean area. As with many counter spaces in healthcare settings requiring multiple pieces of equipment, the space is utilized frequently during dialysis sessions, and the potential for contamination could be likely.

**Layout of the unit.** While not directly related to the station disinfection process, when staff were asked if they could change anything about the layout of the unit, 45% \((n = 9)\) commented on the acid and water hook-up as well as the oxygen flow regulator being difficult to reach on the wall behind the patient chair. Every dialysis patient must be hooked up to oxygen during their treatment, and their dialysate solution adjusted by turning knobs at the hookup on the wall. Staff have to navigate the cords, lines, and hook-ups from behind the patient in order to reach them. The frequent use of the back wall, behind the patient chair, may not only indicate the need for future layout planning, but
examined from an infection control standpoint due to the frequency in which this area is accessed during patient dialysis treatments.

**Chair arm rest.** Also observed in the ATP testing of the highly contaminated arm chair rest surface, 30% (n = 6) of staff remarked on this area as being a trouble spot for contamination and cleaning. Not only was the gross contamination evident by the investigator’s observations during the audits and interviews, but staff members remarked at the difficulty of cleaning the zipper in the supplemental arm rest piece. The coarse and complex texture of the zipper, along with the absorbent foam inside, makes for a nearly impossible material to clean and disinfect in between patients.

**Communication of responsibilities and back side of machines.** Thirty percent (n = 6) of staff made comments related to confusion around communication of responsibilities as it relates to cleaning or disinfecting different areas of the dialysis station. This included comments such as wiping down other common patient areas like the railings near the scale or bathroom. Only 20% (n = 4), commented on the protocol of cleaning the back side of the machine. No other staff members remarked on this topic. Three staff members noted that they were unsure of whose responsibility it was and how it was ensured that cleaning was being completed. One of the staff members stated that they didn’t feel it was practical to clean the back side of the dialysis machine during the turnaround time they had in between patients. The principal investigator further explored the cleaning of the back side of the dialysis machine with leadership. Per GHS protocol, the backs of the machine are to be cleaned every Wednesday of the week, by the nurses or dialysis technicians. Leadership clarified that the custodial staff, who are hired to clean the floors, bathrooms, and other common areas of the dialysis center every evening, do
not touch the dialysis machines. To further understand the confusion of whose responsibility it is to clean the machine, one only needs to observe the fast-paced workflow that occurs in an outpatient dialysis facility.

More detail will be discussed in the observations section below; however, it is important to note that the confusion of whose responsibility it is to clean the back side of the machine is warranted, as it is not often that one staff member will complete the entire dialysis station cleaning process from start to finish, without being interrupted by other tasks and responsibilities. In this manner, one may begin to understand that specific and unique disinfecting instructions, like wiping down patient thermometers at check-in or the scale railings, may be lost in everyday tasks.

**Defining the “why”**. A broad theme that emerged from the interviews was defining the why behind certain actions. While mentioned in 20% (n = 4) of the interviews, this theme was interspersed throughout the conversations and did not show up consistently under one question or category. Defining the why, or giving the specific reason of why you must do something a certain way, was mentioned in the disinfection protocol itself, educational needs, or when discussing audits or CMS surveys. This theme may be a precursor, or a subtheme, to the “checking the box” theme that also emerged from the interviews.

**Checking the box**. Another theme that emerged in various conversations, both with staff and with patients, was the “checking the box” mentality, or doing a task because they are required to do so according to protocol. Fifteen percent (n = 3) of staff remarked on this theme, and all three (100%, n = 3) of the patients interviewed, discussed this topic. For example, in the last year, CMS regulation and facility protocol has
changed the disinfection process. Up until last year, staff were able to turn the face of the dialysis machine away from the chair and begin disinfecting the dialysis machine while the patient was still sitting in the chair. This was done as the patient held their fistula site the required amount of time post-treatment, and received their final nursing assessment. Now, the dialysis station must be completely vacated by the patient prior to the machine being disinfected. This recommendation is also reiterated in the CDC Coalition best practices materials.

However, one staff member and one key informant from leadership pointed out that due to the physical layout of the dialysis center, even if one patient had vacated the dialysis station, the dialysis machine used might be physically closer to their neighbor, or the patient right next to them, who might still have been hooked up to dialysis. The patient in the next seat would have a greater likelihood of blood spill or contamination than the disconnected patient sitting in their own station. When this example was brought up to the investigator, the feeling of doing a task because you have to, despite doing something with a more common-sense, or critical thinking approach, was conveyed in the conversations.

Additionally, the process of disinfecting the medication scanner, which enters the patient zone only to scan the patient identification bracelet for medication administration, must be wiped down each and every time the patient is scanned. The medication scanner is utilized on all patients. However, the staff member never physically touches the scanner to the patient or places it in the patient zone (unless they set the scanner on the patient’s chair or side tray table). While staff understand the need to wipe this down if contaminated, the specificity and frequency of wiping down the scanner seem like they
are merely “checking the box” in their work routine. In contrast, they feel that the pens, and several other items that actually come into contact with the patient, do not get disinfected nearly as often but may have more potential of being contaminated. For instance, they may be filling out forms and touching the patient as they finish obtaining the patient’s vital signs, completing the final assessment, and helping them leave the dialysis unit.

**Principal Investigator Observations**

During the interview and auditing process, the principal investigator was able to observe the workflow from an outside perspective. Several actions took place repeatedly that helped connect some of the themes that began to emerge from the interviews, which the investigator deemed significant enough to report out. The following actions occurred routinely as the stations were disinfected.

After a patient was escorted out of the unit by a staff member, Oxivir disinfection wipes were pulled out and placed on top of the dialysis machine, chair, and TV. When queried about this process, two or three staff members commented that it was a sort of placeholder, or a way to communicate to themselves and other staff members that the vacated dialysis station was dirty and needed to be disinfected. Staff were constantly multi-tasking, and the disinfection process rarely occurred uninterrupted start to finish. In fact, many times one staff member would start the process (clean the dialysis machine) and another would jump in and help finish (wiping down chair and TV area), as the original staff member would be called away to help with a patient.

Therefore, while constant multi-tasking and teamwork were occurring, and while the process ensured that everything went smoothly for staff and patients, the disinfection
task was fragmented. The more the task was broken up, the longer the Oxivir wipes sat on the machine, drying out. Per manufacture instructions, in order to properly disinfect, these wipes must be saturated enough to have a wet surface contact time of one full minute. During the interviews, only one staff member commented on this process and the frustration she feels that they are not being as thorough with the disinfection due to the wipes drying out.

**Key Informant Leadership Interviews**

Dialysis leadership provided insight into the organizational structure and detailed information on what they perceive to be gaps or areas of need for the staff performing station disinfection. Four leaders interviewed for this project mentioned time as a perceived issue for the staff members (Table 4). Key informants expressed understanding that staff sometimes feel rushed to complete multiple tasks like provide patient care and disinfect the dialysis station. C. Wittenberg pointed out that leadership is aware of this constant time constraint challenge, and they have made adjustments within the schedule to allow more time to occur between patients in the middle of the day. J. Lisowski, however, points out that patient’s dialysis run times are getting longer (she mentioned that increasing evidence-based practices in the nephrology specialties have been due to increased dialysis run times to improve patient outcomes). The increase in dialysis run times mean that shifts are getting longer, and staff end up rushing to complete their tasks to get out on time. One leadership member pointed out that time constraints and feelings of being rushed to complete the disinfection process are often felt most by the inexperienced staff members who have not yet had a chance to develop or establish a workflow that multitasks and addresses all the demands of their job. Despite the
differences in the theme regarding time and management of time in the workflow process, the fact that this theme emerged from both the staff members and leadership demonstrates that this topic merits attention.

Additionally, leadership recognized the challenge of disinfecting the dialysis machine and station when blood spills occur (60%, \( n = 3 \)) and the fact that multiple nooks and crannies (40%, \( n = 2 \)) make for unique, and time consuming, cleaning.

Table 4. Themes Identified in Key Informant Leadership Interviews

<table>
<thead>
<tr>
<th>Theme Identified</th>
<th>Interviews Mentioning Theme = 1</th>
<th>Interviews Mentioning Theme ≥ 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Needs – Hands On</td>
<td>60 (3)</td>
<td>40 (2)</td>
</tr>
<tr>
<td>Educational Needs – Other</td>
<td>60 (3)</td>
<td>20 (1)</td>
</tr>
<tr>
<td>Time</td>
<td>-</td>
<td>80 (4)</td>
</tr>
<tr>
<td>Checking the Box/CMS Guidelines</td>
<td>60 (3)</td>
<td>-</td>
</tr>
<tr>
<td>Nooks &amp; Crannies</td>
<td>20 (1)</td>
<td>40 (2)</td>
</tr>
<tr>
<td>Defining the Why</td>
<td>40 (2)</td>
<td>20 (1)</td>
</tr>
<tr>
<td>Transparency</td>
<td>-</td>
<td>40 (2)</td>
</tr>
<tr>
<td>Defining the Patient Zone</td>
<td>20 (1)</td>
<td>-</td>
</tr>
<tr>
<td>Communication of Responsibilities</td>
<td>20 (1)</td>
<td>-</td>
</tr>
</tbody>
</table>

*\( n = 5 \)

**Educational needs.** Clearly articulated by all key informants, or 100% \( n = 5 \) of the group interviewed, was the need for station disinfection education to be hands-on.

Bridget Pfaff mentioned that the process itself is detailed and nuanced, and simply reading about the process will not help staff perform the task better. Staff need to perform the task themselves. Following this theme was the need for other forms of education
(80%, n = 4) to accompany the station disinfection process. These comments included reinforcement, often in the form of auditing (60%, n = 3), in order to gauge the compliance and emphasize the proper techniques of the protocol. Other suggestions included using in-person demonstrations or visuals (e.g., videos, forensic Luminol demonstrations) to help reinforce the disinfection messages for staff. Additionally, clearly representing and educating the “why” message (40%, n = 2) behind the protocol and process and through use of critical thinking and conversation in staff education were mentioned.

Checking the box/transparency. Three of the key informants mentioned the pivotal role that CMS has in helping guide protocols and procedures for the dialysis population. However, juxtaposed within the compliance of CMS regulations and protocols was the need to create high standards and safety for the patients and staff members. As Bridget Pfaff stated during the interview:

I don’t necessarily want to change or do something because a Medicare surveyor tells us we should, I want to do it because it is the right thing to do. It is important to instill practices that protect our staff and patients. It is important to disinfect things and keep our patients safe, not because Medicare says we have to, but because it’s the right thing to do.

While complying with the CMS guidelines, a sense of transparency regarding quality measures, audits, and guidelines conveyed to staff was mentioned in 40% (n = 5) of the interviews.
Patient Interviews

Checking the box and patient queries. The patients felt directly affected by the “checking the box” mentality, and they were quite aware of what staff were required to ask them for Medicare purposes. Dialysis patients are at the dialysis facility so frequently during the week that one patient commented they see dialysis staff members more often than they see their own family. Despite the fact that they develop personal relationships with many of the staff members and are known quite well on a personal level at the facility, per protocol, staff must ask them specific questions every day of treatment in order to ensure consistency of practice and safety in the delivery of treatment. Two patients interviewed remarked on how redundant and meaningless these questions were to them. In fact, one patient commented: “They just ask us so they can chart it and check it off. Like, are you in pain? I mean, yes, but they only have Tylenol to give me. They can’t treat me with anything else, so why even ask, really?”

Another patient stated:

Some things I think they do that are Medicare regulated, are overkill, and I think that they are unnecessary. Like the fact that they can’t clean the machine until I leave the station. I think that’s silly. I’m sitting here and blood isn’t going to squirt on the machine, or I’m not going to spit on the machine. I think it cuts down on their efficiency of time because they can’t clean it until I leave the station…I think sometimes Medicare comes around and their job is to just think up things that waste the nurses’ time, and I just think it’s crazy. I think that our higher ups that sit around and think up things to waste our time. They think Medicare is going to come in and tell them they are not doing something right.
Like, they’re not supposed to carry pens in their pockets! I don’t know why that rule is.

While Medicare surveys and regulations are meant to help protect patients, it is clear that both staff and patients feel the facelessness of regulatory measures. It is as if the patients feel they are part of a machine, not assessed or seen on a true individual level. Conversely, staff feel that the critical thinking aspect is removed when they are required to apply a “one size fits all” mentality or set of instructions to every patient they interact with. Additionally, the redundancy of the questions or assessments that staff must complete at each dialysis visit for the patients emerged from the interviews. These themes may be useful in determining what educational topics may need to be prioritized and addressed with this patient population as a way to help them understand why certain protocols and procedures are in place to keep patients safe.

Cleanliness and speaking up. All three of the patients felt comfortable in their chair and station. When asked about the cleanliness level, everyone assumed and believed that the staff wiped the station down adequately prior to their arrival. When asked about specific actions they take themselves to prevent infections, all remarked on how they bathe frequently, keep their dressings and access sites clean, and watch for any potential signs of infection. All three patients were happy with the treatment they received from staff members and stated that they would feel comfortable speaking up to staff if they had an issue or concern. When the patients were asked about ways staff can provide or reinforce infection control education to them, all three had difficulty answering the question. One patient noted how different personality and learning styles of individuals would make it difficult to teach certain topics; “It’s very difficult depending on the level
of intelligence and level of [personal] hygiene…Most people don’t even read the pieces of paper that you give them. I’m even guilty of that.” Another patient stated; “They got to make us do it or you’re not gonna get on it! I don’t know, I think we just get lax about it and we don’t think about it.”

**Limitations**

**ATP Testing**

In two of the tests performed (the silence alarm button and tray table), the RLU results increased after the initial swabbing. In theory, the ATP results should be lower. The first swab would physically wipe away any potential organic matter in the sample area, thus leaving a lower reading for the second swab. In the tray table swabbing, the RLU increased for all three of the swabbing tests, even after the disinfecting process of the patient station. These results were confounding. Unfortunately, due to the limited number of ATP swabs available to test with, additional swabs could not be performed to determine if this would be a consistent result on other dialysis stations. It is possible that the investigator did not swab in the exact same spot as the first swab, thus picking up additional organic material present on the surface. Further discussion with Infection Preventionist Megan Meller explained the possibility that a build-up of detergents or cleaning agents on certain surfaces could result in falsely high ATP readings (M. Meller, personal communication, February 5, 2019). Unfortunately, this project is unable to confirm or deny that this may be occurring on the tray table tested. However, the principal investigator deems it important to mention as a possibility for these results.
Forensic Luminol

While the process of utilizing forensic Luminol and capturing photographs of the results are highly informative in understanding where invisible blood may be present, it is important to note that some surfaces may have shown false positives. During the testing process, many metallic surfaces appeared to have a bright but very diffuse glow on every surface. The principal investigator acknowledges limited experience with the product used: Bluestar Forensic. The company, Bluestar Forensic, notifies users that false positives can occur with certain varnishes. Determining the sensitivity (the true positive results) and specificity (the true negative results) of the Bluestar Forensic product on a variety of different surfaces or varnishes that all have the potential to be contaminated with blood was difficult.

Without knowing specific varnishes that may exist on the metallic surfaces tested and acknowledging the novice interpretations of the investigator, the possibility of false negatives is most certainly a risk for misinterpreting blood contamination—a limitation in this testing process. The principal investigator contacted Bluestar Forensics and asked them to examine the photos to determine if any false positives could be detected by a highly trained individual with the product. The individual that responded stated that it was difficult to tell over the emailed photos and was not willing to confirm or deny false positives (J. Lefebvre-Despeaux, personal communication, January 22, 2019).

Staff Interviews

Staff interviewed for this project were all part of the Onalaska dialysis center. This facility is the largest of all the dialysis centers in the GHS region and has unique unit layouts, support, and supplies. Interviews only reflect opinions and views from the
Onalaska staff members. Staff dynamic and opinions in other dialysis centers within the region (e.g., small facilities where there may only be two full-time staff members) may have significantly different views or needs compared to the Onalaska group.

**Leadership Interviews**

Gaining insight and uniquely in-depth information from staff, leaders, and patient representatives was undertaken with this research in the dialysis and infection control domain. No previous research or studies were found of this nature to better understand the needs and gaps in station disinfection as it relates to dialysis. Consequently, the principal investigator was in a position to make determinations of the sample size and create delimitations for purposes of project completion. While care was taken to gain a variety of different perspectives within the leadership group in the key informant interviews, only five interviews were completed. All five represented the administrative management within the dialysis facilities, specifically the Onalaska center.

**Patient Interviews**

Additionally, only three patients were interviewed for this project. The patients selected for these interviews were all highly motivated, outspoken personalities, and, despite being on dialysis, otherwise healthy individuals. One-on-one conversations provided the opportunity to go in-depth with each question; however, the limited amount of time and number of patients interviewed demonstrate a lack of depth and breadth into the patient perspective. Additionally, all three patients represented an older age demographic and did not fully represent different generations that rely on dialysis care.
Section IV

DISCUSSION

Introduction

Throughout this graduate project, a process to enhance the understanding and complexities of infection control-related practices as it relates to dialysis station disinfection was performed. As stated earlier, infection remains the second leading cause of hospitalization and death for individuals living with chronic kidney disease. The time-consuming and complex care related to dialysis patients often makes infection control-related education for both staff and patients difficult to convey. Additionally, funding and regulatory agencies, like Medicare, continue to be a consistent oversight partner with healthcare facilities, ensuring that standards of practice and patient safety measures are met. Therefore, it is important for outpatient dialysis facilities to closely examine their protocols, practices, and guidelines as they relate to infection control practices and look for opportunities of improvement.

However, just because protocols and guidelines are present, does not mean staff and patients are adhering to these practices. Unique situations like time constraints, bleeding issues, or patient care responsibilities may interfere with infection prevention practices, as was discovered in this assessment project. Additionally, if staff and patient education are not adequate to address these issues, significant gaps may be occurring during dialysis treatments. These examples may lead to staff creating “work-arounds,” or
in-the-moment solutions, in order to complete their tasks. Leadership should be cognizant that these creative solutions may be occurring (or, conversely, not occurring) and take time to understand existing gaps and needs of staff and patients, and address potential solutions. Gathering and implementing solutions should be a collaborative effort, one that involves bringing in key stakeholders and experts from multiple disciplines. During this project, collaboration among Infection Control Department Gundersen Health System (GHS) leadership, staff, patients, as well as support and resources from the Centers for Disease Control and Prevention (CDC) Making Dialysis Safer for Patients Coalition, were of priority in addressing the gaps that emerged and creating sustainable solutions for the future.

**Conclusions and Recommendations**

To determine feasibility, recommendations for the conclusive themes that emerged from the assessment process were developed following a review of the literature and with the assistance of the renal dialysis leadership team at GHS. Through discussion and a multi-disciplinary approach, additional experts from throughout GHS were contacted to ensure that recommendations were accessible for the dialysis center and in line with current hospital guidelines. For example, when considering protocols and available products on the market for dealing with blood spills or sprays, experts in the quality and environmental services departments were contacted for their knowledge.

Due to the importance of infection prevention in the dialysis patient population, collaboration with and use of experts in infection control are of utmost significance for dialysis centers. In addition to the clearly-established CDC Coalition core recommendations regarding dialysis station disinfection, the following are potential
contributors to solutions for outpatient dialysis centers to consider when examining the education and task of disinfecting the dialysis station.

**ATP & Forensic Luminol Testing**

Dialysis centers typically do not have a dedicated environmental services team that can be readily available to clean and disinfect the patient station during the day. What dialysis centers and management can do, however, is utilize tools and checklists that are often found in evaluating the cleanliness of surfaces in the hospital setting, as outlined by the CDC in their *Options for Evaluating Environmental Cleaning* resource (CDC, 2010). These tools include the following:

- Direct observations with timely feedback (auditing of staff)
- Adenosine triphosphate (ATP) testing
- Use of fluorescent gel (a product that can mark surfaces and is illuminated under ultraviolet [UV] light to determine if cleaning of the surface occurred) to highlight missed surfaces

These tools and products cannot only be used to monitor and track overall cleanliness levels but they also can be applied to help engage staff in the learning process of station disinfection.

As mentioned in the results, 70% (n = 14) of staff remarked that they think the disinfection process is best learned with a hands-on approach. Engaging with tools that environmental cleaning departments utilize may be helpful. Additionally, the investigator recommends employing ATP testing or forensic Luminol methods as an objective and hands-on approach to demonstrate the cleanliness of the surfaces with which nurses are working. Through the experiences of the principal investigator, it is difficult to convey
importance or urgency in topics that individuals cannot readily see, such as germs and viruses. By physically showing staff members, through the use of forensic Luminol and ATP testing, the importance of disinfecting surfaces may be clarified.

During an in-depth search of the literature, the principal investigator found one study in which the authors utilized forensic Luminol to illustrate the presence of latent blood in the dialysis setting, thus demonstrating the importance of proper disinfection for infection control (Bergervoet, van Riessen, Sebens, & van der Zwet, 2008). Future investigators examining latent blood present in healthcare settings due to inadequate surface cleaning may want to explore methods utilized by crime-scene and forensic investigators.

Unfortunately, ATP testing can be somewhat costly for facilities. Low-cost products that require little equipment, like a fluorescent gel or powder, may help create memorable learning opportunities. Fluorescent gel pens can mark a surface and only be visualized under UV light. Infection preventionists may date a routinely high-touch surface area surface with the fluorescent gel pen or powder in order to monitor the environmental cleaning. If the surface is cleaned effectively by environmental services or the responsible staff member, the mark should be absent when examined with UV light. These methods are supported by the CDC (2010) and should be recommended for dialysis facilities that have limited budgets. The fluorescent powder or gel pens and UV lights are the only equipment needed and can be economically obtained from major retail stores.

The CDC and many other online forums have ideas and pre-planned activities on how to use the fluorescent powder for infection control teaching purposes (CDC, 2010).
Due to the numerous companies that sell fluorescent gel and powder, simply typing “fluorescent powder or gel in infection control” or “infection control activities with fluorescent gel” in any major online search engine will provide ample resource options for infection control educators. These methods have been utilized frequently in the inpatient hospital setting with environmental services staff, and may be a practical and functional approach to monitoring and educating environmental surface cleaning in the outpatient dialysis facilities where they rely on other staff members to perform disinfection and cleaning.

**Time**

Management should be cognizant of providing sufficient turnover time between patient shifts. Adequate time suggested by the GHS dialysis leadership team include at least one full hour in between patients to ensure that every patient is safely taken off dialysis and the station is cleaned and set up prior to the next patient starting their treatment (J. Adams & J. Lisowski, personal communication, February 22, 2019). Other ideas that may help manage staff responsibilities and ensure they have adequate time to clean and disinfect the station include the following:

- Staggering dialysis treatment start times
- Staggering staff shift start times
- Employing a float staff member to help during unique situations (e.g., blood spill or spray, patient deteriorating condition) throughout the shift

Managing the complex schedules of dialysis patients and staffing could potentially allow adequate time for station disinfection to occur. By scheduling dialysis shifts differently to stagger the time patients are coming off dialysis, or staggering staff
shift start times to accommodate different dialysis treatment run times, the mid-shift rush of turning patient stations around (i.e., taking the first shift of patients off of dialysis and putting the second shift of patients on) at the same time may be mitigated. In addition to staggering dialysis start times, management could stagger staff shift start times to fully utilize staff members during busy turn-over periods.

Management may want to examine their current scheduling system and determine if improvement could be made in this area. As mentioned above, scheduling patient dialysis shifts differently, like staggering treatment start times, may help optimize staff time to clean the dialysis station between the first and second patient shift. However, due to patient complexities (e.g., different prescribing dialysis run times, the addition of a new patient into the facility), it may be difficult to effectively track and manage patient and staff schedules. One option would be to utilize dialysis scheduling software products. Current dialysis scheduling software products on the market may be of use in assisting management to adequately schedule complex staff and dialysis treatment times to ensure that proper time is allowed between the first and second shift of patients.

Another potential solution to help with situations where time is a perceived issue is employing a float staff member whose only responsibility is to help assist during the patient turnover time. The staff member would help out specifically during turnover times to ensure that the disinfection process is not being broken up by multiple team members, due to their varying responsibilities, but rather completed in a timely and thorough manner to the highest degree possible. Additionally, this may free up dedicated nursing staff to attend to the more challenging task of assessing and treating the patient if any complex therapy-related situations arise.
Recommendations for further review would be in examining the utilization of environmental cleaning services in the outpatient setting. The practice of having nursing staff clean and disinfect may be the current norm; however, future studies may be able to provide more clarity in the financial feasibility and appropriateness of employing dedicated environmental service staff.

**Blood Spills and Sprays, Nooks and Crannies, and Other Unique Situations**

Throughout this project, the principal investigator learned that if a staff member had a seamless day, without any unique situations arising during their routine, station disinfection was not a problem. When their shift was going smoothly, the majority of staff reported that they had adequate tools and time to perform their tasks, and they felt confident that they completed the disinfection process per protocol. However, when unique or unexpected situations arose (e.g., when a patient’s fistula bled or the patient had other medical issues that had to be dealt with), infection control and station disinfection became a lower priority, as time was more limited and nurses’ responsibilities for the patient increased.

Staff reported learning from their experiences and previous mistakes, and often relied on tips and techniques of other nurses or solutions they developed over time in order to tackle complex cleaning and disinfecting situations (e.g., fistula bleeds, blood sprays). A practical solution may be to develop a tool kit that provides resources and trouble-shooting guides highlighting unique situations and how to deal with them. For example, facilities should be providing tools like toothbrushes, small cotton-tipped swabs, or other common products that can easily be threaded into the nooks and crannies of the dialysis machine, in order to effectively clean these difficult spaces. Training new
staff on the process and informing them that these products and resources are readily available may help them tackle complex cleaning and disinfecting situations when the need arises.

Additionally, facilities should provide products that can easily absorb blood pools from surfaces. Simply having a washcloth or other absorbent product readily available to wipe up small amounts of blood prior to cleaning and disinfecting with the Oxivir wipe may be useful to staff. After reviewing the policies and inquiring with the leadership team, it was discovered that no policy or guideline regarding the management of smaller, more frequent blood spills is currently available. At this time, the spill policy at GHS is specifically applicable for very large amounts of blood and chemical spills. One spill kit is currently available on the Onalaska unit should this situation occur. However, as unique spills frequently occur in dialysis, having additional resources readily available to ensure that regular cleaning is occurring may be helpful for staff.

As Jennifer Tucker, nurse educator for GHS dialysis staff, pointed out in her interview, when teaching staff about the disinfection process, it is important to emphasize cleaning versus disinfecting. Cleaning the surface of grossly contaminated blood is essential prior to disinfecting. In some cases where pools of blood have formed, this may mean that the staff member will need to take these steps:

1. Absorb blood pool with cloth (dispose of cloth in biohazard bin)
2. Wipe remainder of visible blood off with Oxivir wipe
3. Disinfect with Oxivir wipe (ensuring a one-minute wet contact time for complete disinfection to occur)
These additional steps should be clearly communicated by leadership and included in the guidelines for station disinfection. Additionally, staff should know what other resources are available to them if they feel unable to handle the spill themselves. For example, encourage a member of staff to pull the machine from service and have another staff member with the time and resources to thoroughly clean or replace parts on the unit before using it on another patient. Create small spill kits with all the tools (e.g., toothbrushes, cotton swabs, syringes) needed to clean and disinfect the machine.

**Educational Needs**

Providing hands-on education has been communicated through this project as the preferred method in which to address station disinfection education. It is important for managers and administrators to be aware of the limitations and multiple responsibilities in which staff are working under, and they should attempt to simulate the process during new employee training. Learning thorough and accurate techniques as a new employee can help build the muscle memory that some experienced staff members discussed during their interviews. Simulative-type education may be an option to facilitate this method of learning during new-employee or skill-refreshing training. Incorporating the use of visual fluorescent powder or forensic Luminol with the simulated education training may help imprint the importance of infection control on staff members’ minds.

When educating experienced staff members or creating tools and resources to reinforce policy and procedures, utilizing detailed photos and videos may be of help. As the disinfection task is one that staff members complete repetitively, it is important to layer the education and information continually over time. Keeping these interactions short and relevant may increase staff engagement with infection control practices.
Defining the Patient Zone

Having clear, physical demarcations on the floor and counter surrounding the dialysis patient can easily communicate where the patient zone is to staff. One staff member suggested using electrical-type tape to mark off areas on the floor defining the patient zone. Unfortunately, utilizing electrical or other forms of tape can harbor bacteria, and should not be applied as a way to mark the patient zone. However, using an approved paint or other permanent indicator, like a different tile or counter color, may be a solution.

Dialysis administrators and managers should think ahead and work closely with architects, contractors, and other essential planning staff when designing new outpatient dialysis centers in the future to include these types of permanent solutions for distinct patient zones. As the dialysis center is in the unique situation of being a shared space with multiple patients, innovative and adaptable methods may need to be employed and communicated to staff in order to define the patient zone.

Layout of the Unit

In planning for future dialysis units, dialysis leadership should continue collaborating with engineers, architects, and building planners to determine the best layout for staff and patient safety, while ensuring that infection control is easily attainable in the dialysis station. To make it safer and easier for staff to adjust the dialysate solution (per staff recommendation) water and acid hookups should be in front, or to the side, instead of behind the patient. It is important to note, however, that this area should be clearly defined as either in or out of the patient zone, depending on the exact physical layout of the unit. The inclusion or exclusion of the water and acid hookups in the patient
zone definition should be clearly communicated with staff to ensure that disinfection of this area is occurring, especially if there is a possibility of contamination during patient treatments (e.g., staff members touch the knobs frequently).

**Chair Arm Rest and Back Side of the Dialysis Machine**

The chair arm rest was a common site for gross blood contamination, complicated by zippers or uneven surface areas where blood can drip. As this area was sometimes missed, or difficult to clean during the disinfection process, it may be useful to consistently utilize a disposable cloth or under pad with a leak-proof barrier during the patient session (commonly used for incontinent patients and known to nurses as a “chux,” or soaker pad). Any time the extra arm rest pillow support is utilized, it should be covered with this disposable sleeve. Staff should be instructed that if the arm rest pillow is contaminated with blood, it needs to be properly discarded and a replacement for the facility re-ordered.

As referenced in Section I, one initial question that led to the station disinfection project was borne out of the Medicare citation of not cleaning the backs of the dialysis machine. The current GHS process for cleaning the back side of the machine is to be completed by staff members on Wednesdays of each week. Per the results from the staff interviews, there was confusion surrounding who was ultimately responsible and when the task should be completed. Clear communication regarding this task is a recommendation for the dialysis unit, as it was demonstrated to be a gap in the disinfection practice during the project. When tasks are not required to be a part of the daily flow for nursing, it may be helpful to have a physical checklist for staff to initial after each date they complete the cleaning of the backs of the machine. This is a current
practice with other daily or weekly tasks at the dialysis center, such as the glucometers and other equipment that are periodically checked. Leadership may want to audit this weekly practice to provide additional accountability. Perhaps another way to audit would be to use the fluorescent gel pens to date the back side of the machine following each cleaning. On the next day, UV light might reveal if the surface was wiped down or not by the previous shift.

Prior to auditing, creating checklists, or surveying the surfaces, leadership should take the time to refresh staff members’ education regarding the responsibility of cleaning the backs of the machine and inform them of how follow-up to the task will occur. This may help decrease feelings staff may have that they are not doing something right or are being watched during the auditing process. Additionally, helping staff understand the why behind what they are doing will give meaning to their crucial tasks and clarify the importance of their job. Clear, non-punitive feedback and praise where praise is due should be communicated to staff in order to acknowledge their efforts and dedication to the disinfection process.

At this time, the principal investigator agrees with the policy of cleaning the back sides of the machine once a week, and not after each patient. When completing this project, after spraying the backs with forensic Luminol, very little, if any, latent blood appeared on the surface. While a few spots and the metallic surface of the blood pressure cuff appeared to glow, the back side of the machine is not a high-touch area and is not routinely exposed or contaminated between each patient treatment. Perhaps showing the forensic Luminol photographs to staff members would be an effective way to convey the
importance of thoroughly cleaning the back side once a week and wiping the blood pressure cord daily.

Further research is needed to examine the backs of the machines, particularly in dialysis units where the layout may have backs of machines more exposed to potential blood spills or sprays. Examining processes of pulling the dialysis machines or chairs from service and performing detailed cleaning away from patient care areas (to include the base, back side, and crevices of machines), may be areas that facilities can explore. This may take the burden of time constraints and other patient responsibilities off of staff in order to focus their attention on thoroughly disinfecting.

**Patient Education**

Focusing on patient perspectives should be researched further, with additional patient interviews and other assessment procedures to gain a better understanding of their thoughts surrounding dialysis station cleanliness and the disinfection process. Seeking patient perspectives from varying generations or age, race, gender, and ethnicity may expand on clinicians’ tools to help provide the best possible educational opportunities. Oftentimes, healthcare workers are good at telling patients what to do but not how to do it. Facilities should encourage and foster a culture of openness and accountability. Patients should be addressed individually to determine what way they best learn about infection prevention methods. Education should meet them where they are at, and be layered and repeated over and over again. As one patient pointed out, she tends to get lax about certain things over time and needs to be reminded or encouraged by staff.
Checking the Box & Defining the “Why”

Healthcare is a highly regulated system, and the dialysis operation is no different. In fact, some may argue that dialysis is one of the most regulated compared to other outpatient health clinics. The majority of patients who utilize dialysis are Medicare funded, and therefore must abide by federal rules to ensure the facility continues to get paid. Borne out of the regulatory agencies are best practices that are meant to keep patients and staff members safe. Regulations, however, can sometimes become misinterpreted as meaningless to patients and staff members in their redundancy. These regulations and protocols should be clearly defined, both to the agency and to their staff, so that the education and meaning behind the protocols are passed along to patients. Providing concrete examples as to why the regulations are in place, the history behind them, and the importance of the protocol to ensure overall safety may help individuals understand the importance.

The process of defining the “why” is not an easy one. If there were a simple solution, this theme may not have emerged during this project. A culture of transparency in which leadership is able to share successes as well as failures or deficiencies within the organization is important. Creating relationships among patients, staff, and leadership and ensuring that crucial conversations are being held in an authentic and meaningful manner may help garner trust and foster learning. Additionally, when staff and patients connect and feel valued, they may feel less like a number or an occupant in a chair and more like a person who is being heard, despite the redundancy of questions that are being asked.

A practical and perhaps feasible way to do this would be to shift perspectives for staff members. Have staff shadow a patient through their dialysis treatment for a few
hours. Go through what it is like, step-by-step, to get checked in, questioned, assessed, and sit for three hours at a time. Have staff sit and observe the work-pace around them from the patients’ perspective. By trading places with the patient, staff members may develop empathy and a greater understanding of the “why” behind what they do every day, in order to provide life-sustaining care to these patients.

Additionally, leaders within facilities should encourage partnerships among the patients, staff, and leadership. Healthcare is not, and should not be, practiced in silos, but rather, should be a continuing collaborative effort among all pertinent disciplines. Leaders should be looking around their table as they make guidelines and protocols, and take note of who is absent or not represented. Instead of simply telling staff what they should do, leaders may want to ask those individuals who are not represented to sit at the table and share their experiences and perspective. Front-line staff members and patients most likely will not volunteer for these positions; therefore, leadership should extend invitations to those individuals for a seat at the table.

By investing in the natural leaders within the staff, leaders can tap into resources that provide perspective from their vantage point and training. Staff leaders can help management develop creative solutions to their problems, or conversely, ensure that leadership is aware of emerging issues or needs as they arise. Finally, involving and engaging motivated patients to share their experiences with leadership, to help foster communication and develop educational materials for other patients, may be highly beneficial for this population.
Summary

At first glance, many might assume that cleaning and disinfecting a dialysis station is a simple task. This project has demonstrated that it is, indeed, much more nuanced and complicated than one might imagine. While staff members who perform daily station disinfection report that it is relatively easy, when observed and examined closely, staff are actually continually multi-tasking and problem solving during the process. Often, it is easier to jump to solutions or recommendations without inquiring about the opinions or needs of the people who are being directly affected by decisions. Taking the time to assess the process from multiple vantage points can help leaders identify where specific gaps exist within the overall system and make the right steps toward improvement. As healthcare becomes more specialized and complex, unique solutions to problems arise when affected individuals are brought together to share their ideas and expertise. Leaders should be willing to invite all unrepresented individuals to come forward and participate, as everyone may not always feel comfortable coming forward on their own.

Balance must be struck between tasks that need to be completed on a daily basis, and the overall health and safety of the patients and staff members. Staff members expressed wanting to help their patients and provide excellent care, and, overwhelmingly, the patients interviewed felt their caring compassion. Regulatory agencies are meant to provide safety nets and guidelines to ensure that all facilities are providing appropriate care to individuals. However, it is up to leaders and staff to interpret these findings and provide the human interaction side with their patients. Understanding the history and the “why” behind what is required may empower staff to not only better understand the
importance of what is required, but also understand when it might be appropriate to question and dig deeper into problems. In this way, best-practices and excellent patient care can evolve with the ever-changing landscape that is healthcare.

Infection control within the dialysis patient population is an emerging priority that demands the interest of multiple stake-holders. Through collaboration with groups and organizations from CDC’s *Making Dialysis Safer for Patients Coalition* to individual staff members and patients, progress will continue to move forward in creating safe dialysis care.
REFERENCES


APPENDIX A

GHS Commitment Letter
April 27, 2018

Ms. Rebecca Cook, MPH
Senior Program Officer
RCook@cdcfoundation.org
CDC Foundation
600 Peachtree Street NE
Suite 1000
Atlanta, GA 30308

Dear Ms. Cook:

Gundersen Health System (GHS) is a committed partner of the Making Dialysis Safer for Patients Coalition. GHS has six End Stage Renal Disease (ESRD) facilities and a home peritoneal dialysis program. At any one point in time, the patient census in the service line is 225-250 patients; the program serves a large geographical area that includes many rural communities. Our goal as a committed partner organization is to improve adherence to CDC Core Interventions and Guidelines to reduce bloodstream infections among hemodialysis patients and engage dialysis facilities, patients undergoing hemodialysis, and other partners to reduce infections.

As a committed Coalition partner we will conduct activities to increase awareness among our organizational members through communication and educational efforts about CDC Core Interventions and Guidelines to reduce bloodstream infections; implement CDC Core Interventions by facilitating adoption through use of the Making Dialysis Safer materials and resources; and share experiences and findings by providing a summary of our activities and metrics, sharing implementation strategies, and collaborating with other Coalition participants.

Gundersen Health System plans to conduct the following health activities through spring, 2019 to reduce the incidence of bloodstream infections among hemodialysis patients.

- Staff training
  - Develop and share an educational video teaching to Infection Control and Dialysis Station Cleaning.
  - Evaluate policies related to access and infection control (audit practice, design education as needed).
- Collect central line infection data.
  - Monitor for effectiveness/improvement based upon these activities.
  - Share best practices.
- Conduct pre- and post-education evaluations and establish ongoing staff competency.
- Patient Engagement and Education.

We are dedicated to reducing bloodstream infections among hemodialysis patients and look forward to continued collaboration with the Making Dialysis Safer for Patients Coalition in this important effort.

Sincerely,

Dr. Kumari Usha
Medical Director, Renal Dialysis

Bridget Pfaff, MS
Administrative Director, Renal Dialysis

Gundersen Health System
APPENDIX B

GHS Dialysis Station Disinfection Checklist
## GHS DIALYSIS STATION DISINFECTION CHECKLIST

**Cleaning and Disinfection of the Dialysis Station**

<table>
<thead>
<tr>
<th>ACTION</th>
<th>OBSERVATION 1</th>
<th>OBSERVATION 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove all bloodlines and disposable equipment; discard in biohazardous waste; dialyzer for reprocessing; all ports capped, dialyzer and bloodlines transported in a manner to prevent contamination of other surfaces (V122)</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
<tr>
<td>Empty prime waste receptacle, if present on machine</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
<tr>
<td>Remove gloves, hand hygiene, don clean gloves (V113)</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
<tr>
<td>Use disinfectant-soaked cloth/wipe to visibly wet all machine top, front and side surfaces, dialysate hoses, Hansen connectors, and outside surfaces of dialysate concentrate containers (V122)</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
<tr>
<td>Wipe wet all internal and external surfaces of prime waste container and allow to dry if present; prime waste container must be disinfected before used to prepare for another patient's treatment (V122)</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
<tr>
<td>When chair vacated; discard unused disposable supplies (or dedicate to that patient); chair fully reclined, fresh disinfectant cloth/wipe used to visibly wet all external front-facing and side chair surfaces, including down sides of seat cushion and tops of side tables (V116, 122)</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
<tr>
<td>Non-disposable items: BP cuff &amp; tubing, TV controls, call button, data entry station and counters around dialysis station wiped wet with disinfectant (V122)</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
<tr>
<td>If clamps are used, cleaned of visible blood and disinfected (V116)</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
<tr>
<td>Discard cloths/wipes; remove gloves, hand hygiene (V113)</td>
<td>Y/N</td>
<td>Y/N</td>
</tr>
</tbody>
</table>

**Attention:** It is not a regulatory requirement that the dialysis station is vacated before surface cleaning and disinfection and set up of the dialysis machine is done. The patient should only be removed from the station once they have completed treatment and it is clinically safe to do so. If the previous patient remains in the chair while the machine is cleaned/disinfected and prepared for the next patient, pay close attention to staff adherence to separation (changing gloves, hand hygiene) when moving between the patient and the disinfected and/or prepared machine.
APPENDIX C

CDC Dialysis Station Disinfection Checklist
CDC DIALYSIS STATION DISINFECTION CHECKLIST

Checklist: Dialysis Station Routine Disinfection

This list can be used if there is no visible soil on surfaces at the dialysis station. If visible blood or other soil is present, surfaces must be cleaned prior to disinfection. The proper steps for cleaning and disinfecting surfaces that have visible soil on them are not described herein. Additional or different steps might be warranted in an outbreak situation. Consider gathering necessary supplies prior to Part A.

Part A: Before Beginning Routine Disinfection of the Dialysis Station

☐ Disconnect and takedown used blood tubing and dialyzer from the dialysis machine.
☐ Discard tubing and dialyzers in a leak-proof container.
☐ Check that there is no visible soil or blood on surfaces.
☐ Ensure that the priming bucket has been emptied.
☐ Ensure that the patient has left the dialysis station.
☐ Discard all single-use supplies. Move any reusable supplies to an area where they will be cleaned and disinfected before being stored or returned to a dialysis station.
☐ Remove gloves and perform hand hygiene.

PART B: Routine Disinfection of the Dialysis Station – AFTER patient has left station

☐ Wear clean gloves.
☐ Apply disinfectant to all surfaces in the dialysis station using a wiping motion (with friction).
☐ Ensure surfaces are visibly wet with disinfectant. Allow surfaces to air-dry.
☐ Disinfect all surfaces of the emptied priming bucket. Allow the bucket to air-dry before reconnection or reuse.
☐ Keep used or potentially contaminated items away from the disinfected surfaces.
☐ Remove gloves and perform hand hygiene.

Do not bring patient or clean supplies to station until these steps have been completed.

Centers for Disease Control and Prevention
National Center for Emerging and Zoonotic Infectious Diseases

Making Dialysis Safer Coalition
Important Notes:

1. Necessary supplies may include, but are not limited to: leak-proof disposal containers, gloves and other appropriate personal protective equipment (PPE), properly diluted Environmental Protection Agency (EPA)-registered hospital disinfectant, and wipes/clothes.
2. If used dialyzers and blood tubing are transported out of the station before being discarded, they should be transported in a manner that prevents any leakage.
3. Perform this step if machine is equipped with a bucket for prime waste. If waste-handling option (WHO) ports are used, separate steps for disinfection are required and are not described here (follow manufacturer’s instructions).
4. Patients should not be removed from the station until they have completed treatment and are clinically stable. If a patient cannot be moved safely, routine disinfection of the dialysis station should be delayed until the station can be vacated in a safe manner. If patients are moved to a separate seating area prior to removing cannulation needles or while trying to achieve hemostasis, the chairs and armrests in those areas must be disinfected in between patients.
5. Disposal/removal of used supplies may occur before and/or after the patient has departed the station.
6. Follow the manufacturer’s label instructions for proper dilution, preparation, and use of the disinfectant. Surfaces to disinfect include but are not necessarily limited to: all surfaces in contact with the patient (e.g., dialysis chair, tray tables, blood pressure cuffs) and frequently contacted by healthcare personnel (e.g., control panel, top, front and sides of dialysis machine; touchscreens; countertops; computer keyboards).
7. Air-drying is recommended to allow for sufficient contact time with the disinfecting agent.
APPENDIX D

AHRQ Dialysis Station Disinfection Checklist
Cleaning and Disinfection of the Dialysis Station Procedural Checklist #4

- Don gown, gloves, and impermeable mask/eye protection or face shield
- Remove all bloodlines and disposable equipment and discard in biohazardous waste; reprocess dialyzer, with all ports capped; transport dialyzer, bloodlines, etc. in a manner that prevents contamination of other surfaces; remove gloves
- Hand hygiene
- Don clean gloves; obtain EPA-registered disinfectant; use tuberculocidal disinfectant if blood is visible
- Wipe machine top, front, and side surfaces and dialysate hoses wet with disinfectant per manufacturer directions for use; if blood is visible, do second application of tuberculocidal disinfectant
- Empty prime waste receptacle: wipe all internal and external surfaces wet with disinfectant per manufacturer directions for use
- When chair is vacated, remove and discard all disposable supplies
- Fully recline chair and clean with disinfectant; wipe all external front-facing and side chair surfaces wet with disinfectant per manufacturer directions for use, including down sides of seat cushion and side tables
- Wipe all nondisposable items with disinfectant, including blood pressure cuff, TV controls, call button, data entry station, and counters around station
- If clamps are used, clean off visible blood and dirt and disinfect
- Discard cloth/wipe; remove gloves
- Hand hygiene

Note: Allow disinfectant contact time per manufacturer’s recommendations for all checklist items. In other health care settings, patients vacate treatment area before cleaning and disinfection. This practice should be considered for dialysis facilities.
APPENDIX E

IRB Approval from the University of Wisconsin-La Crosse
To: Leah Bonesberger

From: Bart Van Voorhis, Coordinator
Institutional Review Board (IRB) for the Protection of Human Subjects
bvanvoorhis@uwlaax.edu
608.785.6352

Date: November 14, 2018

Re: RESEARCH PROTOCOL SUBMITTED TO IRB

The IRB Committee has reviewed your proposed research project entitled: “Assessing and Identifying Gaps in the Practice of Outpatient Dialysis Station Disinfection at Gundersen Health System in La Crosse”.

The Committee has determined that your research protocol will not place human subjects at risk. The attached protocol has been approved and is exempt from further review per 45CFR46, 46.101(b)(2).

However, it is strongly suggested that Informed Consent always be used. Remember to provide participants a copy of the consent form and to keep a copy for your records. Consent documentation and IRB records should be retained for at least 3 years after completion of the project.

Since you are not seeking federal funding for this research, the review process is complete and you may proceed with your project.

Good luck with your project.

[Signature]

CC: IRB File
APPENDIX F

IRB Approval from Gundersen Health System
November 20, 2018

Leah Bomesberger, RN, BSN
Gundersen Clinic, Ltd.
La Crosse, WI 54601

Dear Ms. Bomesberger,

I have looked at the submission ASSESSING AND IDENTIFYING GAPS IN THE PRACTICE OF OUTPATIENT DIALYSIS STATION DISINFECTION AT GUNDERSEN HEALTH SYSTEM IN LA CROSSE, WI. This project does not constitute research under 45 CFR 46.102(d), and does not require IRB review.

Please feel free to call with any questions.

Sincerely,

[Signature]

Thomas Harter, Ph.D.
Chair, Institutional Review Board
APPENDIX G

Questions and Consent Form for Leadership Interview
QUESTIONS AND CONSENT FORM FOR LEADERSHIP INTERVIEWS

Interview Questions for Renal Dialysis Leadership:

These questions will be used as a starting point to encourage conversation. Follow-up questions will be asked to clarify responses or elicit more information based on the response given.

1) Tell me about the role you play in infection control and prevention, specifically related to the dialysis station disinfection process.

2) In your opinion, what do you think is the most important part of the disinfection process?

3) Describe what you think is the greatest challenge surrounding the observed station disinfection process.

4) What are the strengths in GHS’s station disinfection protocols?

5) Do you feel staff members have the adequate tools and resources to effectively disinfect the dialysis station?

   Prompt: Do you feel adequate resources (e.g., time, funds, staff, and staff education) are readily available for staff to perform disinfection tasks?

6) In your experience, what are the most effective ways to teach staff regarding infection control and station disinfection?

7) Is there anything else you would like to share, or discuss that we missed in this conversation?
Informed Consent
Renal Dialysis Leadership

Protocol Title:
Assessing and Identifying Gaps in the Practice of Outpatient Dialysis Station Disinfection at Gundersen Health System in La Crosse, WI

Principal Investigator:
Leah Bomesberger RN, BSN
720.474.6060
Bomesber.leah@uwlax.edu

Faculty Advisor & Emergency Contact:
Dr. Gary Gilmore MPH, Ph.D.
University of Wisconsin - La Crosse
1725 State Street
La Crosse, WI 54601
608.785.8163
ggilmore@uwlax.edu

Purpose and Procedure:
The purpose of this quality improvement project is to assess and identify gaps in the practice and education of outpatient dialysis station disinfection as it relates to infection prevention. The project will gather trends and themes from key individuals within the dialysis setting. The project will involve interviewing key informants, and individuals within the GHS dialysis system, to gain perspective and a better understanding of the infection control process regarding dialysis station disinfection and infection prevention measures. All participants must be 18 years or older and be willing to be interviewed by the principal investigator. The principal investigator will be taking notes during the interview and ask you to clarify responses periodically to ensure that accurate responses are captured.

Potential Risks:
No more than minimal risks are anticipated in this project. The interview may take up to an hour of your time.

Rights & Confidentiality:
Participation in this study is completely voluntary. Participants may discontinue participation at any time or refuse to answer specific questions without penalty. Staff employment will be in no way affected by choice to participate. Results from this study may be professionally disseminated and will be provided as de-identified grouped data only. All information collected for the purpose of this study will be kept confidential and will not be linked with personally identifiable information.

Possible Benefits:
Data from this project will provide insight into the gaps in station disinfection protocols, and the learning or education needs of the dialysis unit employees regarding infection control. Results will be utilized to guide the development and implementation of staff education and updates to official protocol practices. If a proposed intervention or update is found in the assessment, this could serve as an intervention or model for other
outpatient dialysis units. The ultimate benefit may be seen in the reduction of infection-related events and increased safety for dialysis patients.

**Questions:**
Questions regarding study procedures may be directed to the principal investigator, Leah Bomesberger (720.474.6060 or bomesber.leah@uwlax.edu) or the emergency contact faculty advisor Dr. Gary Gilmore, Department of Health Education and Health Promotion, University of Wisconsin - La Crosse (608.785.8163 or, ggilmore@uwlax.edu). Questions regarding the protection of human subjects may be addressed to the University of Wisconsin - La Crosse Institutional Review Board for the Protection of Human Subjects (608.785.8124 or irb@uwlax.edu). Additionally, for more information about your rights, you may contact Thomas Harter, Ph.D., Chairperson of the Gundersen Clinic, Ltd. Institutional Review Board at 608-782-7300 or 1-800-362-9567. An institutional review board (IRB) is a group of healthcare professionals and community members who review research studies to protect the welfare of research participants.

I have read through the informed consent and understand the information presented to me. I have had the chance to ask questions regarding the project and am willing to participate.

__________________________________________________________
Participant Signature  Date

__________________________________________________________
Leah Bomesberger  Date
Principal Investigator
APPENDIX H

Questions and Consent Form for Patient Interviews
QUESTIONS AND CONSENT FORM FOR PATIENT INTERVIEWS

Interview Questions for Patient Representatives

These questions will be used as a starting point to encourage conversation. Follow-up questions will be asked to clarify responses or elicit more information based on the response given.

1) Describe the process of a typical day as you come in and start dialysis.

2) Tell me about the environment that you sit in during your dialysis treatment.
   Prompts: What are things that you notice around you? What are things that bother you or make you more uncomfortable as you receive your dialysis treatment? What are things that make you comfortable during your dialysis treatment?

3) What are specific actions that staff members do that make you feel safe and well cared for during your dialysis treatment?

4) Are there specific actions that you have done to help prevent infections from occurring in yourself?

5) Do you feel comfortable speaking up when you feel something is off or not normally part of your dialysis routine? Prompt: Have you spoken up about something in the past?

6) Is there anything else you would like to share, or discuss that we missed in this conversation?
Protocol Title:
Assessing and Identifying Gaps in the Practice of Outpatient Dialysis Station Disinfection at Gundersen Health System in La Crosse, WI

Principal Investigator:
Leah Bomesberger RN, BSN
720.474.6060
Bomesber.leah@uwlax.edu

Faculty Advisor & Emergency Contact:
Dr. Gary Gilmore MPH, Ph.D.
University of Wisconsin - La Crosse
1725 State Street
La Crosse, WI 54601
608.785.8163
ggilmore@uwlax.edu

Purpose and Procedure:
The purpose of this quality improvement project is to assess and identify gaps in the practice and education of outpatient dialysis station disinfection as it relates to infection prevention. The project will gather trends and themes from key individuals within the dialysis setting. The project will involve interviewing patients, and other individuals within the GHS dialysis system, to gain perspective and a better understanding of the infection control process regarding dialysis station disinfection and infection prevention measures. All participants must be 18 years or older and be willing to be interviewed by the principal investigator. The principal investigator will be taking notes during the interview and ask you to clarify responses periodically to ensure that accurate responses are captured.

Potential Risks:
No more than minimal risks are anticipated in this project. The interview may take up to an hour of your time.

Rights & Confidentiality:
Participation in this project is completely voluntary. You may discontinue participation at any time or refuse to answer specific questions without penalty. If you choose to participate or not, your care received will not be affected. Results from this project may be professionally disseminated and will be provided as de-identified, grouped data only. All information collected for the purpose of this study will be kept confidential and will not be linked with personally identifiable information.

Possible Benefits:
Data from this project will provide insight into the gaps in station disinfection protocols, and the learning or education needs of the dialysis unit employees regarding infection control. Results will be utilized to guide the development and implementation of staff education and updates to official protocol practices. If a proposed intervention or update is found in the assessment, this could serve as an intervention or model for other
outpatient dialysis units. The ultimate benefit may be seen in the reduction of infection-related events and increased safety for dialysis patients.

Questions:
Questions regarding study procedures may be directed to the principal investigator, Leah Bomesberger (720.474.6060 or bomesber.leah@uwlax.edu) or the emergency contact faculty advisor Dr. Gary Gilmore, Department of Health Education and Health Promotion, University of Wisconsin - La Crosse (608.785.8163 or ggilmore@uwlax.edu). Questions regarding the protection of human subjects may be addressed to the University of Wisconsin - La Crosse Institutional Review Board for the Protection of Human Subjects (608.785.8124 or irb@uwlax.edu). Additionally, for more information about your rights, you may contact Thomas Harter, Ph.D., Chairperson of the Gundersen Clinic, Ltd. Institutional Review Board at 608-782-7300 or 1-800-362-9567. An institutional review board (IRB) is a group of healthcare professionals and community members who review research studies to protect the welfare of research participants.

I have read through the informed consent and understand the information presented to me. I have had the chance to ask questions regarding the project and am willing to participate.

________________________________________________________________________
Participant Signature                                      Date

________________________________________________________________________
Leah Bomesberger                                      Date
Principal Investigator
APPENDIX I

Questions and Consent Form for Staff Interviews
QUESTIONS AND CONSENT FORM FOR STAFF INTERVIEWS

Interview Questions for Staff Members:

These questions will be used as a starting point to encourage conversation. Follow-up questions will be asked to clarify responses or elicit more information based on the response given.

1) Do you feel like you have all of the adequate supplies and tools needed to effectively clean the dialysis station?

   Prompts: Describe what products or supplies you like or dislike to complete your tasks.

2) To what degree do you feel that the protocol and expectations are clear regarding patient station disinfection? Why or why not?

3) Describe some challenges or barriers you may have experienced with station disinfection.

   Prompt: What is your least favorite part or most difficult part of the disinfection process?

4) What do you feel you need more clarification about, or education on, regarding station disinfection?

5) How do you learn these tasks best, or, what is the best way to be taught about these topics?

6) How do you feel this facility performs in terms of infection prevention practices in the dialysis setting?

7) Is there anything you would change on the layout of the unit in order to perform the disinfection process better? Please describe.

8) Is there anything else you would like to share or discuss with me?

   Prompts: For example, something we missed in this conversation? Something you wish to emphasize
Informed Consent
Staff Member

Protocol Title:
Assessing and Identifying Gaps in the Practice of Outpatient Dialysis Station Disinfection at Gundersen Health System in La Crosse, WI

Principal Investigator:
Leah Bomesberger RN, BSN
720.474.6060
Bomesber.leah@uwlax.edu

Faculty Advisor & Emergency Contact:
Dr. Gary Gilmore MPH, Ph.D.
University of Wisconsin - La Crosse
1725 State Street
La Crosse, WI 54601
608.785.8163
ggilmore@uwlax.edu

Purpose and Procedure:
The purpose of this quality improvement project is to assess and identify gaps in the practice and education of outpatient dialysis station disinfection as it relates to infection prevention. The project will gather trends and themes from key individuals within the dialysis setting. The project will involve interviewing staff members, and individuals within the GHS dialysis system, to gain perspective and a better understanding of the infection control process regarding dialysis station disinfection and infection prevention measures. All participants must be 18 years or older and be willing to be interviewed by the principal investigator. The principal investigator will be taking notes during the interview and ask you to clarify responses periodically to ensure that accurate responses are captured.

Potential Risks:
No more than minimal risks are anticipated in this project. The interview may take up to 15 minutes of your time.

Rights & Confidentiality:
Participation in this project is completely voluntary. You may discontinue participation at any time or refuse to answer specific questions without penalty. Staff employment will not be affected by your choice to participate. All information collected for the purpose of this project will be kept confidential and will not be linked with personally identifiable information. Results from this study may be professionally disseminated and will be provided as de-identified grouped data only.

Possible Benefits:
Data from this project will provide insight into the gaps in station disinfection protocols, and the learning or education needs of the dialysis unit employees regarding infection control. Results will be utilized to guide the development and implementation of staff education and updates to official protocol practices. If a proposed intervention or update is found in the assessment, this could serve as an intervention or model for other
outpatient dialysis units. The ultimate benefit may be seen in the reduction of infection-related events and increased safety for dialysis patients.

Questions:
Questions regarding study procedures may be directed to the principal investigator, Leah Bomesberger (720.474.6060 or bomesber.leah@uwlax.edu) or the emergency contact faculty advisor Dr. Gary Gilmore, Department of Health Education and Health Promotion, University of Wisconsin - La Crosse (608.785.8163 or ggilmore@uwlax.edu). Questions regarding the protection of human subjects may be addressed to the University of Wisconsin - La Crosse Institutional Review Board for the Protection of Human Subjects (608.785.8124 or irb@uwlax.edu). Additionally, for more information about your rights, you may contact Thomas Harter, Ph.D., Chairperson of the Gundersen Clinic, Ltd. Institutional Review Board at 608-782-7300 or 1-800-362-9567. An institutional review board (IRB) is a group of healthcare professionals and community members who review research studies to protect the welfare of research participants.

I have read through the informed consent and understand the information presented to me. I have had the chance to ask questions regarding the project and am willing to participate.

________________________________________  __________________________________
Participant Signature                        Date

________________________________________________________________________

Leah Bomesberger
Principal Investigator                       Date
APPENDIX J

Complete Data Tables of Thematic Coding
### COMPLETE DATA TABLES OF THEMATIC CODING

**Staff**

<table>
<thead>
<tr>
<th>A</th>
<th>1 2 1 1</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>1 1 2 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1 3 1 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>1 3 1 2 1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>1 3 2 1 2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1 1 3 1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>1 1 4 4 2 1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>1 2 1 2</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>3 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1 2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>3 3 2 2 2 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>2 2 1 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>1 1 1 2 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>1 1 1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>1 1 1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>1 1 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>1 2 2 1</td>
<td>2 1 1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>1</td>
<td>1 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>1</td>
<td>1 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total (N=20)**

<table>
<thead>
<tr>
<th>17</th>
<th>12</th>
<th>11</th>
<th>6</th>
<th>14</th>
<th>3</th>
<th>9</th>
<th>6</th>
<th>4</th>
<th>14</th>
<th>13</th>
<th>4</th>
<th>9</th>
<th>6</th>
</tr>
</thead>
</table>

**Mention ≥1**

| 17 | 5 | 7 | 4 | 5 | 2 | 4 | 2 | 3 | 14 | mistake | 5 | 4 | 9 | 4 |

**Mention ≥2**

| 0 | 7 | 4 | 2 | 9 | 1 | 5 | 4 | 1 | 0 | visuals | 4 | 0 | 0 | 2 |

*Total 9 of times theme mentioned in all interviews*
### Leadership

<table>
<thead>
<tr>
<th>Interview</th>
<th>Blood Spills</th>
<th>Nurse &amp; Crewmates</th>
<th>Time</th>
<th>Checking the Box</th>
<th>Defining Patient Role</th>
<th>Communication of Responsibilities</th>
<th>Educational Needs (Handwash)</th>
<th>EM Needs (Gloves, Slicker)</th>
<th>Giving the “why”</th>
<th>Auditing</th>
<th>Transparency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1 (Repetition)</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td>4 (reinforce through audit/feedback)</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>3 (visible)</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td>4</td>
<td>1 (pt. leaving)</td>
<td>1</td>
<td>1 (Visual like video, luminol)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 (problem solving, clean vs. disinfect)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL (N=5)</td>
<td>3 (6)</td>
<td>2 (4)</td>
<td>4 (11)</td>
<td>3</td>
<td>1</td>
<td>5 (9)</td>
<td>4 (7)</td>
<td>2 (4)</td>
<td>3 (4)</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Mention = 1:
- 1
- 1
- 3
- 1
- 1
- 3
- 2
- 2

Mention ≥ 2:
- 2
- 1
- 4
- 2
- 1
- 2
- 1

* Total # of times theme mentioned in all interviews

### Patients

<table>
<thead>
<tr>
<th>Interview</th>
<th>Time</th>
<th>Checking the Box</th>
<th>Giving the “why”</th>
<th>Personal Cleanliness</th>
<th>Cleanliness of Station</th>
<th>Speak Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt. A</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pt. B</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pt. C</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL (N=3)</td>
<td>1</td>
<td>3 (#7)</td>
<td>1</td>
<td>3 (#5)</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

* Total # of times theme mentioned in all interviews
APPENDIX K

Abstract Submission for National Renal Administrators Association Annual Conference, 2019
ABSTRACT SUBMISSION FOR NATIONAL RENAL
ADMINISTRATORS ASSOCIATION ANNUAL CONFERENCE, 2019

Background and Context (Practice Gap) Why is this topic important to you and other speakers?

What does long exposure photography, auditing, patient interviews, and infection control have in common? Infections continue to be the second leading cause of hospitalization and death in the dialysis patient population, with a 2008 estimate of one in four patients dying from complications. Staff members in the outpatient dialysis setting clean and disinfect the dialysis station, educate patients, and perform additional infection prevention practices. These tedious infection prevention practices are critical in preventing hospitalization and death in the patients that we serve. Therefore, understanding the specific needs and gaps in infection control practices of staff members and patients are important in determining how to educate and reinforce infection prevention practices in the future.

This presentation will focus on the journey of discovering gaps in infection prevention practices, demonstrate multi-faceted approaches in improving education and policies, and provide tips on how to collaborate and engage with the patient and dialysis team. Attendees will be able to identify protocol and procedure barriers related to infection prevention, which may exist for staff members and patients. Additionally, attendees will be able to gain resources to help engage staff members and patients in infection prevention practices.

Learning objectives:

Define the importance of infection prevention in the outpatient dialysis setting, as it relates to staff and patients.

Identify barriers that exist for staff members in disinfecting the dialysis station.

List two ways you can engage staff and patients in infection prevention practices.
APPENDIX L

Presentation for APIC Badger Regional Meeting 3.12.19
Assessing Gaps in Dialysis Station Disinfection Practices

APIC MEETING 3.12.19
LEAH BOMESBERGER, RN BSN (AND, HOPEFULLY BY MAY 2019: MPH)

Background


- Approximately 37,000 infections occurring in outpatient hemodialysis centers in 2008 (CDC, 2011).

- One in every four dialysis patients may die from complications of infection (CDC, 2015).
We need your help!

WE NEED YOU

MAKING DIALYSIS SAFER

COALITION

CDC Centers for Disease Control and Prevention

APIC Association for Professionals in Infection Control and Epidemiology

V Tag: Deficiency Citation

<table>
<thead>
<tr>
<th>V Tag*</th>
<th>Deficiency Citation</th>
<th>Occurrences</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>V113 IC</td>
<td>Wear Gloves/Hand Hygiene</td>
<td>10</td>
<td>83.33</td>
</tr>
<tr>
<td>V122 IC</td>
<td>Disinfect Surfaces Equipment/Written Protocol</td>
<td>10</td>
<td>83.33</td>
</tr>
<tr>
<td>V116 IC-JF</td>
<td>To Station = Dispose/Dedicate or Disinfect</td>
<td>5</td>
<td>41.67</td>
</tr>
<tr>
<td>V115 IC</td>
<td>Shields/Masks-No Staff Eat/Drink</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>V117 IC</td>
<td>Clean/Dirty; Med Prep Area; No Common Carts</td>
<td>2</td>
<td>16.67</td>
</tr>
<tr>
<td>V147 IC</td>
<td>Staff Education-Catheters/Catheter Care</td>
<td>4</td>
<td>33.33</td>
</tr>
<tr>
<td>V132 IC</td>
<td>Training and Education</td>
<td>3</td>
<td>25</td>
</tr>
</tbody>
</table>

*V Tag: computer identifier tag identified by Medicare Surveyor
The Problem(s)

- What are the common trends or citations during Medicare surveys related to infection control?

- What gaps or needs exist surrounding these infection control issues for frontline staff?
Results

- Adenosine triphosphate (ATP) Testing Sites

Forensic Luminol Results

(Chemiluminescent Marker testing)

If I can’t see it, it doesn’t exist. Right?
Forensic Luminol Results

All low light photographs courtesy of GHS Medical Media Department
Interviews
Qualitative Data

<table>
<thead>
<tr>
<th>Themes Identified from Staff Interviews</th>
<th>Interview 1</th>
<th>Interview 2</th>
<th>Interview 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate Tools</td>
<td>85 (37</td>
<td>-</td>
<td>45 (9)</td>
</tr>
<tr>
<td>Turn</td>
<td>25 (5)</td>
<td>-</td>
<td>45 (9)</td>
</tr>
<tr>
<td>Educational Needs – Hands On</td>
<td>30 (14)</td>
<td>-</td>
<td>30 (13)</td>
</tr>
<tr>
<td>Educational Needs – Other</td>
<td>30 (10)</td>
<td>85 (3)</td>
<td>-</td>
</tr>
<tr>
<td>** Mistakes or Repetition</td>
<td>15 (3)</td>
<td>10 (2)</td>
<td>-</td>
</tr>
<tr>
<td>Visual or Video Refresher</td>
<td>15 (3)</td>
<td>5 (1)</td>
<td>-</td>
</tr>
<tr>
<td>Blood Spills or Sprays</td>
<td>25 (5)</td>
<td>35 (7)</td>
<td>-</td>
</tr>
<tr>
<td>Nicks &amp; Cuts</td>
<td>35 (7)</td>
<td>20 (4)</td>
<td>-</td>
</tr>
<tr>
<td>Defining the Patient Zone</td>
<td>20 (4)</td>
<td>25 (5)</td>
<td>-</td>
</tr>
<tr>
<td>Layout of the Unit</td>
<td>45 (9)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chair Arm Rest</td>
<td>20 (4)</td>
<td>10 (2)</td>
<td>-</td>
</tr>
<tr>
<td>Communication of Responsibilities</td>
<td>10 (2)</td>
<td>20 (4)</td>
<td>-</td>
</tr>
<tr>
<td>Back of Dialysis Machine</td>
<td>15 (3)</td>
<td>5 (1)</td>
<td>-</td>
</tr>
<tr>
<td>Defining the Why</td>
<td>20 (4)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Checking the Box</td>
<td>10 (2)</td>
<td>5 (1)</td>
<td>-</td>
</tr>
</tbody>
</table>

Spills, Sprays & Other Unique Situations

“You do the best you can”
- Provide the tools and time
- Clearly communicate and educate
- Simulate real-life experiences to develop muscle memory

Checking the Box - Patient Perspective

"Some things I think they do, that are Medicare regulated, are overkill, and I think that they are unnecessary. Like the fact that they can’t clean the machine until I leave the station. I think that’s silly. I’m sitting here and blood isn’t going to squirt on the machine, or I’m not going to spit on the machine. I think it cuts down on their efficiency of time because they can’t clean it until I leave the station."

Thank you!
Shift Perspectives

Beef Noodle Soup
CONDENSED SOUPS

Retrieved from Campbell's soup website, 2019

Shift Perspectives

Campbell's Soup Cans
Andy Warhol
(1928–1987)

Retrieved from the MoMA Learning website, 2019
Encourage Collaboration

"You can do what I cannot do. I can do what you cannot do. Together we can do great things."
- Mother Teresa

References Cited


MANY THANKS!

- Gundersen Infection Control Department
- GHS Renal: staff, patients, and leadership
- Bridget Pfaff & Dr. Gary Gilmore
- GHS Medical Media Department
- Google Images and funny people who create Memes
- My Couch (Grad School + Writting/ stats homework x μ sin α ± sin β = 2 sin ½ (α ± β) cos ½ (α ± β)= really nice naps)
- Family & Friends
- APIC Badger! (For being the test run for my oral defense - THANK YOU)
APPENDIX M

Executive Summary
Executive Summary

ASSESSING GAPS IN DIALYSIS STATION DISINFECTION PRACTICES AT A LOCAL OUTPATIENT DIALYSIS FACILITY

MARCH, 2019
Dr. Gary Gilmore, Faculty Advisor
Bridget Pfaff, Advisor
Leah Bomesberger
Background

Hemodialysis is a complex, time-consuming process which provides life-saving and life-sustaining treatment for 87.7% of the estimated 30 million patients who suffer from chronic kidney disease in the United States. Infection is the second leading cause of hospitalization and death in dialysis patients, after cardiovascular disease (United States Renal Data System, 2017). According to the Centers for Disease Control and Prevention (CDC) Morbidity and Mortality Weekly Report (2011), an estimated 37,000 infections occurred in outpatient hemodialysis centers in 2008, with one in every four patients dying from complications of infection. This clearly demonstrates the need for improved infection control for outpatient dialysis patients.

The complexity and invasiveness of hemodialysis contributes to a myriad of safety and infection issues for the patient. At the national level, the CDC launched an initiative in 2016, the Making Dialysis Safer for Patients Coalition (the Coalition), to bring attention to the unique infection-related issues facing dialysis patients, and to improve safety and health outcomes for the individuals requiring hemodialysis care (CDC, 2018). The main goals of the Coalition are to facilitate and implement the core interventions recommended by the CDC, provide education to staff and patients about the core interventions, and share experiences and findings from work done at local sites with other coalition partners. Additionally, as Medicare continues to be a main source of funding for dialysis care reimbursement, and as long as hemodialysis patients require complex care in facilities that have potential to spread infection through their environment, it is imperative that leaders in infection control examine the factors that are contributing to infection rates in this sensitive population.

Utilizing data from Medicare surveys and researching to understand the physical environment in which dialysis staff and patients are a part may help provide insight into infection control and patient safety. At a local dialysis facility in the Midwest, surface disinfection of the patient dialysis station was consistently a top citation during Medicare surveys. A unique opportunity to review the current station disinfection protocols at a local dialysis facility, the recommendations put forth by the Coalition, and improve practices based on themes emerging from Medicare survey reports, has allowed this project to emerge.

Hemodialysis requires direct access to the patient’s blood, and therefore, the area that the patient inhabits during treatment has the potential to be contaminated. Nursing staff are required to disinfect the patient station between each patient that utilize the dialysis machine. The purpose of this project was to better understand the multi-layered approach at reducing patient infections at an outpatient dialysis facility with station disinfection. A needs assessment was performed to determine future protocols and sustainable educational objectives regarding station disinfection. This summary is the result of the work completed by the author in partial fulfillment for the degree of Master of Public Health in Community Health Education at University of Wisconsin-La Crosse.

Methods

Infection control environmental surveillance methods were used to objectively determine the cleanliness level of the surfaces in the dialysis station. These included utilizing adenosine triphosphate (ATP) bioluminescence testing and chemiluminescent marker (forensic Lumirad) testing, and in-depth interviews with leadership, staff members and patients. Trends and themes were identified from the interviews and consolidated to identify specific insights into future recommendations for dialysis station disinfection practices. Descriptive data analysis was performed to describe the aggregated project results. Analysis of qualitative data obtained from the interviews were approached by open coding with a single coder review. Utilizing open coding allowed the exploration of new themes to emerge that may have
otherwise been missed. The themes that emerged guided the overall conclusions as they related to the
gaps in station disinfection processes. Finally, two reviewers were consulted with the final categories of
themes. This two-reviewer process allowed discussion, exploration, and feedback of the categories to be
considered based on data collected.

Results

ATP Testing

ATP testing is a method that evaluates surface cleanliness levels. It reads the amount of ATP,
which exists in all living cells that are residing on the surface. Therefore, it can identify if the surface has
been properly cleaned and disinfected. The readings are reported in a unit of measurement for ATP
called relative light units, or, RLUs. The instrument utilized at this facility for ATP testing states that a
RLU reading of 250 or below is considered background noise, or insignificant. Readings above 250
RLUs suggest an unclean, or potentially contaminated, surface. Each surface of the vacated dialysis
station was swabbed three times (Figure 1). The first swab test gave an initial reading. The second
swabbing was performed over the same surface. The entire station was then disinfected, per protocol, by
the principal investigator, and allowed to dry. Finally, the third and final ATP swabbing of the surface
area was completed.

Prior to cleaning the dialysis machine surfaces (on/off button, silence alarm button and blood
pump area), the highest reading of all three testing points recorded was 157 RLUs. After cleaning, the
surface level RLUs decreased to 15-38. The readings demonstrate that the dialysis machine is clean, even
prior to the disinfection step. The surrounding patient area of the dialysis station proved to be more
problematic, the chair arm rest most so, with a result of 8,560 RLUs. Second swabbing of the same area
resulted in 7,219 RLUs. Protocol was followed in disinfecting the chair. After following station cleaning
protocol, the final ATP swab demonstrated a total of 1,585 RLUs. This result was problematic, as it
reveals that while the overall contamination decreased, it wasn’t enough to meet the standard of at least
250 or fewer RLUs.

Figure 1. Vacated Dialysis Station with Sites Marked Where ATP Testing Was Conducted.
Forensic Luminol

Chemiluminescent markers, such as Bluestar Forensic or Luminol brands, can detect minute amounts of dried or washed away blood that may be invisible, but still present on surfaces. When chemiluminescent markers bind to hemoglobin, the result is a glowing blue light, indicating the presence of blood. Forensic Luminol was tested on multiple dialysis machines, objects, and surrounding patient areas in two different outpatient clinics within the local dialysis system. Low light photographs were taken to capture the reaction. In addition to the dialysis machine and patient chair, other items that were frequently brought into the patient zone were tested to determine if these items were inadvertently contaminated during a patient dialysis session. Some of these items included the thermometer, pens from the nurse station, and a staff member’s protective face shield for blood splatters (Figure 2). Surprisingly, none of the objects appeared to glow. The chairs varied. At one center, the chairs, including the side tables, had no tell-tale blue glow and appeared clean (Figure 3). Chairs and dialysis machines were also tested at another center, and appeared quite different (Figure 4). The inside arm of one chair was notably glowing blue.

High touch areas of the dialysis machine were clean and free of microscopic blood. Areas with small cracks, divots, and rough surfaces that were small and not frequently touched or cleaned, such as the base of the machine, were glowing. (Figures 5, 6 & 7).

Figure 2. Low Light Photos of Common Objects Brought into Patient Zone, After Luminol Application.

Figure 3. Patient Chair, After Luminol Application.
Figure 4. Patient Chair: Blood Stains Illuminated After Luminol Application.

Figure 5. Upper Portion of Dialysis Machines, After Luminol Application.

Figure 6. Close-up of Upper Portion of Dialysis Machines, After Luminol Application.

Figure 7. Base of Dialysis Machine, After Luminol Application.
Interview Results

Blood Spills and Sprays

A total of 20 staff interviews took place (Table 1). Eighty-five percent of staff (n = 17) felt confident that they have all the tools they need to adequately clean the dialysis station. Sixty percent (n = 12) of staff discussed the difficult and unique situation of having to clean and disinfect larger blood spills or sprays. Staff remarked that they did not always have adequate tools, supplies, and time to clean and disinfect the dialysis machine and station when gross contamination occurred. For example, one staff member pointed out that the disinfecting Oxivir wipes provided are inadequate at soaking up blood. Of the 12 staff that commented on blood spills, 35% (n = 7) mentioned the theme two or more times. Time issues became emphasized when blood spills or excessive bleeding occurred, or when a patient developed symptoms that required interventions. Both leadership and staff commented on time, making this theme evident across disciplines. Six staff members remarked that they clean the best they can with the time and resources they have. However, they acknowledged that they are not as thorough or detailed as they needed to be when these situations arise.

<table>
<thead>
<tr>
<th>Theme Identified</th>
<th>Interviews Mentioning Theme = 1</th>
<th>Interviews Mentioning Theme ≥ 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate Tools</td>
<td>85 (17)</td>
<td>-</td>
</tr>
<tr>
<td>Educational Needs – Hands On</td>
<td>70 (14)</td>
<td>-</td>
</tr>
<tr>
<td>Educational Needs – Other</td>
<td>50 (10)</td>
<td>15 (3)</td>
</tr>
<tr>
<td>**Mistakes or Repetition</td>
<td>15 (3)</td>
<td>10 (2)</td>
</tr>
<tr>
<td>Visual or Video Refresher</td>
<td>15 (3)</td>
<td>5 (1)</td>
</tr>
<tr>
<td>Time</td>
<td>25 (5)</td>
<td>45 (9)</td>
</tr>
<tr>
<td>Blood Spills or Sprays</td>
<td>25 (5)</td>
<td>35 (7)</td>
</tr>
<tr>
<td>Nooks &amp; Crannies</td>
<td>35 (7)</td>
<td>20 (4)</td>
</tr>
<tr>
<td>Defining the Patient Zone</td>
<td>20 (4)</td>
<td>25 (5)</td>
</tr>
<tr>
<td>Layout of the Unit</td>
<td>45 (9)</td>
<td>-</td>
</tr>
<tr>
<td>Chair Arm Rest</td>
<td>20 (4)</td>
<td>10 (2)</td>
</tr>
<tr>
<td>Communication of Responsibilities</td>
<td>10 (2)</td>
<td>20 (4)</td>
</tr>
<tr>
<td>Back Side of Dialysis Machine</td>
<td>15 (3)</td>
<td>5 (1)</td>
</tr>
<tr>
<td>Defining the Why</td>
<td>20 (4)</td>
<td>-</td>
</tr>
<tr>
<td>Checking the Box</td>
<td>10 (2)</td>
<td>5 (1)</td>
</tr>
</tbody>
</table>

*N = 20

**Mistakes or Repetition. Staff learning from a blood spill incident or other mistake, or doing the disinfection task repeatedly.
Nooks and Crannies

The small crevices were a common theme of frustration for staff members. Of the staff interviewed, 55% (n = 11) remarked that they were difficult to clean thoroughly, and 20% (n = 4) mentioned this theme two or more times throughout their interview. Staff identified that these areas were likely the most contaminated. The port near these knobs are where medications are administered and blood sampling occurs during the dialysis session. One staff member noted that this break in the pump tubing is where blood, under pressure from the machine, has the potential to spray if not properly accessed, and can spray or drip onto the dialysis machine surface. This theme is also evident from the forensic Luminol photos, as you can see the glowing areas on the machine most often in the cracks and smaller crevices (Figure 6).

Educational Needs

When asked about how staff best learn station disinfection practices, 70% (n = 14) reported that a hands-on approach was best. Staff felt that you have to do the task, and do it within the constraints of your other responsibilities, to learn it and create a work flow so that you don’t forget certain parts of the protocol. Other educational needs that were most frequently reported were learning the process through making mistakes, or simply in the repetitiveness of the task (13%, n = 3), and another 13% (n = 3) said that having visual reminders or videos to refresh their knowledge on the specifics of the protocol or task could be helpful.

Defining the “why” and “checking the box”

A broad theme that emerged from the interviews was defining the “why” behind certain actions. While mentioned in 20% (n = 4) of the interviews, this theme was interspersed throughout the conversations and did not show up consistently under one question or category. Defining the why, or giving the specific reason of why you must do something a certain way, was mentioned in the disinfection protocol itself, educational needs, or when discussing audits or Medicare surveys. This theme may be a precursor, or a subtheme, to the “checking the box” theme that also emerged from the interviews. Staff, patients and leaders commented on the “checking the box” mentality, or doing a task because they are required to do so according to protocol. Fifteen percent (n = 3) of staff remarked on this theme, and all three (100%, n = 3) of the patients interviewed, discussed this topic. Patients often spoke about this theme in detail. Two patients interviewed remarked on how redundant and meaningless some questions or rules were, and how it applied to them. One patient commented: “They just ask us so they can chart it and check it off. Like, are you in pain? I mean, yes, but they only have Tylenol to give me. They can’t treat me with anything else, so why even ask, really?”

Key Informant Leadership Interviews

Dialysis leadership provided insight into the organizational structure and detailed information on what they perceive to be gaps or areas of need for the staff performing station disinfection. Four leaders interviewed for this project mentioned time as a perceived issue for the staff members. Additionally, leadership recognized the challenge of disinfecting the dialysis machine and station when blood spills occur (60%, n = 3), and the fact that multiple nooks and crannies (40%, n = 2) make for unique, and time consuming, cleaning.

Clearly articulated by all five Key Informants, or 100% (n = 5) of the group interviewed, was the need for station disinfection education to be hands-on. Following this theme was the need for other forms of education (80%, n = 4) to accompany the station disinfection process. These comments included reinforcement, often in the form of auditing (60%, n = 3) in order to gauge the compliance and reinforce the proper techniques of the protocol. Other suggestions included using in-person demonstrations or
visuals (e.g., videos or forensic LuminoLite demonstrations) to help reinforce the disinfection messages for staff. Additionally, clearly representing and educating the “why” message (40%, n = 2) behind the protocol and process, and through use of critical thinking and conversation in staff education were mentioned.

Conclusions

Station disinfection, while not highly complex, can become tedious and time consuming when staff have to deal with circumstances that are outside of normal situations. As evidenced by the interview results and the forensic LuminoLite photos, the nooks and crannies of the machine and station are problematic when a blood spill or spray occurs. When unique or unexpected situations arose (e.g., when a patient’s fistula bled or had other medical issues that had to be dealt with) infection control and station disinfection became a lower priority, as time was more limited and nurses’ responsibilities for the patient increased.

The patients interviewed felt directly affected by the “checking the box” mentality, and were quite aware of what staff were required to ask them, versus what they actually need or do with the information that is being sought after. While Medicare surveys and regulations are meant to help protect patients, it is clear that both staff and patients feel the facelessness of regulatory measures. Additionally, staff feel that the critical thinking aspect is removed when they are required to apply a “one size fits all” mentality or set of instructions with every patient interaction.

Health care is a highly regulated system, and the dialysis operation is no different. Borne out of the regulatory agencies are best practices that are meant to keep patients and staff members safe. These regulations, however, can sometimes become misinterpreted as meaningless to patients and staff members in their redundancy. Regulations and protocols should be clearly defined, both to the agency and to their staff, so that the education and meaning behind the protocols are passed along to patients.

The process of defining the “why” is not an easy one. If there were a simple solution, this theme may not have emerged during this project. A culture of transparency in which leadership is able to share successes as well as failures or deficiencies within the organization is important. Creating relationships among patients, staff, and leadership and ensuring that crucial conversations are being held in an authentic and meaningful manner may help garner trust and foster learning. Additionally, when staff and patients feel connected with and valued, they may feel less like a number or an occupant in a chair, and more like a person who is being heard, despite the redundancy of questions or procedures that are required.

Recommendations

Dialysis facilities may want to utilize tools and checklists found in evaluating the cleanliness of surfaces in the hospital setting, as outlined by the CDC in their Options for Evaluating Environmental Cleaning resource (CDC, 2010). These tools and products, like ATP testing, forensic LuminoLite or fluorescent gels, cannot only be used to monitor and track overall cleanliness levels, but also applied to help engage staff in hands-on learning processes of station disinfection. Providing hands-on education has been clearly communicated through this project as the preferred method in which to address station disinfection education. It is important for managers and administrators to be aware of the limitations and multiple responsibilities in which staff are working under, and should attempt to simulate similar processes during new employee training.

8
When addressing the unique situations of blood spills or sprays within the dialysis setting, a practical solution may be to develop a toolkit that provides resources and trouble-shooting guides highlighting unique situations and how to deal with them. Simply ensuring adequate tools (e.g., toothbrushes or syringes and small, absorbent cloths) to clean the nooks and crannies are readily available for staff may be helpful.

Facilities should encourage and foster a culture of openness and accountability. Patients may prefer to be addressed individually to determine what way they best learn about infection prevention methods. Education should meet them where they are at, and be layered and repeated over and over again. Additionally, leaders within facilities should encourage partnerships among the patients, staff, and leadership. Healthcare is not, and should not be, practiced in silos, but rather, should be a continuing collaborative effort among all pertinent disciplines. Leaders should be looking around their table as they make guidelines and protocols, and take note of who may be absent or not represented. Instead of simply asking what they should do, they may want to ask those individuals who are not represented to sit at the table and share their experiences and perspective.

Summary

As healthcare becomes more specialized and complex, unique solutions to problems arise when affected individuals are brought together to share their ideas and expertise. Leaders should be willing to invite all individuals they may be missing perspectives from to come forward and participate, as everyone may not always feel comfortable coming forward on their own.

Balance must be struck between tasks that need to be completed on a daily basis, and the overall health and safety of the patients and staff members. Regulatory agencies are meant to provide safety nets and guidelines to ensure that all facilities are providing appropriate care to individuals. However, it is up to leaders and staff to interpret these findings and provide the human interaction side with their patients. Understanding the history and the “why” behind what is required may empower staff to not only better understand the importance of what is required, but when it might be appropriate to question and dig deeper into problems. In this way, best-practices and excellent patient care can evolve with the ever-changing landscape that is healthcare.

Infection control within the dialysis patient population is an emerging priority that demands the interest of multiple stakeholders. Through collaboration with groups and organizations from CDC’s Making Dialysis Safer for Patients Coalition to individual staff members and patients, progress will continue to move forward in creating safe dialysis care.

REFERENCES


