An Education Intervention to Improve Nurses' Knowledge to Reduce Catheter-Related Bloodstream Infection in Hemodialysis Unit

Dr. Issa bin Salim Al Salmi¹, Mohammed Jawad Kadium²

¹Nephrology Consultant, Royal Hospital, Oman ²DNP Student, Walden University

Abstract: Central venous catheters (CVCs) are commonly used for vascular access for patients who require hemodialysis. Infectious complications remain a serious clinical problem associated with high rates of morbidity and mortality, prolonged hospital stay and increased cost of medical treatment. The purpose of this educational project is to evaluate the effectiveness of educating registered dialysis nurses regarding central venous catheter (CVC) maintenance care in order to reduce catheter-related bloodstream infection (CRBSI) in a hemodialysis unit. The project question focuses on the educational program derived from the evidence-based guidelines recommended by Centers for Disease Control and Prevention (CDC) to improve registered dialysis nurses' knowledge regarding CVC maintenance care. The theoretical foundation of the study is based on Donabedian's structure-process-outcomes model. In this project, nurses are regarded a structural element and using a self-study module education intervention to improve the process of providing CVC maintenance care. The study will use descriptive statistics, including percents, means, and standard deviations, to identify the predicted relationships between the nurses' knowledge of the evidence-based guidelines and demographic variables (age, gender, years of experience, level of education, infection control training). The t- tests will be conducted to analyze the pretest and posttest results of nurses' knowledge regarding CVC maintenance care. An understanding of the dialysis nurses' current knowledge level will allow adaptation of helpful strategies regarding patient outcomes in the context of CVC maintenance care.

Keywords: central venous catheter infection, educational intervention, nurses' knowledge, CRSBI educational intervention, CRSBI bundle and Hemodialysis infection prevention, impact of nurses' knowledge, and characteristics of nurses.

Section 1: Overview of the Evidence-Based Project

1.Introduction

Central venous catheters (CVCs) have become necessary components of hemodialysis patient care and may result in catheter-related bloodstream infections (CRBSIs). Complications associated with CVC use are known to increase patient morbidity and mortality, as well as increase medical treatment costs and length of stay (Jeong et al., 2013). Relatively little is currently known about the costs and length of stay associated with CRBSIs in the Sultanate of Oman. Some studies in the literature provide estimates (O'Grady et al., 2002; Pronovost et al., 2010; Burden et al., 2012; Halton et al., 2010), but many come from other countries and, therefore, may not be generalizable to the Oman population. The cost of CRBSIs in the hemodialysis unit is between \$21,000- \$24,000 (National Healthcare Safety Network, 2013). The annual cost to the healthcare system of CRBSIs in U.S. Intensive Care Units (ICUs) was \$296 million- \$2.3 billion (O'Grady et al., 2002). National data from the U. S. Renal Data System show that hospitalizations for CRBSI among hemodialysis patients have increased 47% since 1993 (NHSN, 2013). CRBSI occurs in 21-31% of hemodialysis patients, and it increases the length of a hospitalization stay by 9-13 days (NHSN, 2013). Approximately 19% of hemodialysis patients die within 12 weeks of the infection. Eighty thousand CRBSI occur in U.S. hospital ICUs nationwide, causing an estimated 28,000 deaths annually (Pronovost et al., 2010). CRBSI risk varies with a number of factors, including the type of device, the insertion site, the adherence to preventive measures, patient hygiene, previous CRBSI, recent hospitalization, duration of catheter use, hypoalbuminemia, iron overload, *Sta. aureus* nasal carriage and the immune-compromised host (Han, Liang, & Marschall, 2010; Urbanes, 2013).

One recent study found that the use of an educational intervention program significantly increased nurses' knowledge regarding care of the patient with CVC, thereby improving patient outcomes (Shrestha, 2013). However, although there is growing evidence that these infections are preventable with evidence-based educational interventions, no studies have been conducted in hemodialysis units concerning CRBSI. The Centers for Disease Control and Prevention (CDC) recently published guidelines for the prevention of CRBSI (CDC, 2011), which is the benchmark for all CVC care recommendations. The guidelines refer to recommendations for hand hygiene, maximal sterile personnel protection equipment (PPE), chlorhexidine for skin preparation, catheter site dressing regimens, and the site chosen for catheter placement. Several studies have validated the use of these factors in reducing CRBSI (Kim, Holtom, & Vigen, 2011). This study focuses on an educational intervention, and a self- study module will be developed to educate registered dialysis nurses regarding CVC maintenance care based on evidence-based guidelines recommended by CDC to reduce CRBSI in the hemodialysis unit.

2.Problem Statement

Central venous catheters (CVCs) are commonly used for vascular access in patients who require hemodialysis; CVC use is associated with bloodstream infections (BSI) because of skin breaks during insertion (O'Grady et al., 2011). CRBSI contributes to hospitalization and death in the hemodialysis population (Jeong et al., 2013). Like many hospitals, the hemodialysis units have struggled with CRBSIs for many years, and efforts to treat this have focused on treatment of infection with antibiotics, or removing the catheter and replacing it with another one. There were recognized 148 bacteremic episodes, in 102 patients. The CRBSI rate was 0.52 per 1000 patient-days. Of the 148 episodes, 28 in patients with permanent tunneled central catheters (1.03/1000 patient-days); and 67 in those with temporary- catheter (3.18/1000 patient-days). The CRBSI ratio was 4.85 with permanent central venous catheter (P < .001), and 14.88 with a temporary catheter (P < .001) .001). Catheter-related were 41 episodes (28%). Grampositive organism were responsible for 96 episodes (65%); the infection was polymicrobial in 14 (9.5%). During hospitalization 18 patients (18%) died. Septic shock (p < .001) and polymicrobial infection (p = .041) were associated with in-hospital Mortality (Tozawa, Iseki, & Fukiyama, 2000; Fysaraki et al., 2013).

There is a need for more innovative strategies to tackle this ongoing, complex problem. Recently, significant attention has been paid to CRBSI prevention; the priority of the Ministry of Health in Oman (MoH) is to maintain patient safety and reduce morbidity and mortality among patients. In the last few years, there have been attempts to stop CRBSI, but in Oman, there is limited published data regarding the incidence of CRBSIs in hemodialysis units. Instead, dialysis nurses are responsible for applying their knowledge to reduce infection episodes. Non-adherence to recommended evidence-based guidelines for preventing CRBSI may be due to nurses' lack of knowledge of the guidelines. Pravikoff, Tanner, and Pierc (2005) found that not every nurse was skillful in database searching to find the best evidence on the clinical issue, as well as the professional literature was not available to the nurses in the workplace, furthermore, the lack of time was regarded barrier to applying research to practice. Labeau et al. (2007) reported that nurses' knowledge deficiency was shown as a barrier for adherence to evidence-based practice.

An education intervention provided to health-care providers on the prevention of CRBSI may lead to a decrease in the incidence of primary bloodstream infections. These education programs may also result in a significant reduction in the cost of medical treatment and patient morbidity due to CRBSI, when mandatory implemented (Warren et al., 2004). The focus of this study is to educate registered dialysis nurses regarding CVC maintenance care.

Purpose Statement and Project Outcomes

The purpose of this educational project is to evaluate the effectiveness of educating registered dialysis nurses regarding central venous catheter (CVC) maintenance care in order to reduce catheter-related bloodstream infection (CRBSI) in a hemodialysis unit. As a result of the educational intervention regarding CVC maintenance care, the following outcomes will be met:

 Registered dialysis nurses will demonstrate an improvement in their knowledge regarding CVC maintenance care as evidenced by verbalize understanding the content of self-study module, and/or perform desired CVC maintenance care.

• Catheter-related bloodstream infection rates will decrease due to improvement in registered dialysis nurses' knowledge as evidenced by reducing CRBSI incidence rate in the hemodialysis unit by 50%.

3.Significance and Relevance to Practice

The study is the first nurse-led intervention project to seek to improve clinical practice in the hemodialysis units in Oman. It is important to assess the ability of nurses to create positive change in the practice. The continuous advances in technology increase the complexity of hemodialysis treatment and put patients at a higher risk for infection, due to several etiologies related to chronic disease. CRBSI increases the likelihood of mortality, cost, and length of stay (Cooper et al., 2014; Burden et al., 2012). Patients and families demand evidence-based care in order to reduce risks and complications. The findings of this study are significant to MoH, hemodialysis units, clinicians, researchers, policymakers, patients, families and nursing education institutes.

Nurses are knowledge dependent workers, and knowledge plays a critical role in the quality of health care today. Improving nurses' knowledge results in nurses' high selfefficacy when providing CVC maintenance care, and it is important that the nurse feel capable of providing evidence– based care. Nurses with high self-efficacy will structure the situation of hemodialysis treatment, and affect patient outcomes. Hemodialysis patients are a unique population, and their survival depends on the quality of hemodialysis treatment and the responsibility of health care providers, particularly registered dialysis nurses, in protecting patients by providing high-quality care. Patients put a trust in the registered dialysis nurses who need to guard that trust.

The financial costs affect the quality of services. CRBSI places a significant burden and increased risk of positive patient outcomes (Al-Lawati, Mabry, & Mohammed, 2008; Al Riyami et al., 2012). Prolonged hospitalization increases the costs to the Ministry of Health, and the resulting financial burden can affect resource allocation within the Ministry of Health, which operates on a finite budget. Cost containment and reform within the health care system does affect patient care. Implementing and adhering to the CDC guidelines will help reduce these infections and potentially free up resources. The Ministry of Health in Oman is concerned with the health of the population and provides universal coverage health services to the entire population. The evaluation of the system will look for effectiveness and safety. Nursing Sensitive Indicators, such as the incidence rates of CRBSI, are measures of efficacy in the dialysis unit. intervention programs Educational regarding CVC maintenance care to reduce CRBSI incidence rate will help to improve the outcomes of hemodialysis patients.

In summary, CRBSI is a critical problem in the hemodialysis setting. Patient risks include increased length of stay, risk of long-term complications, and even death. Systemic issues include increased expenses and the inability to meet quality and safety standards. For these reasons, preventing CRBSI is essential.

3.1 Project Question

The project question is: Will the education program for one month, based on the evidence- based guidelines recommended by CDC, improve registered dialysis nurses' knowledge regarding central venous catheter maintenance care?

3.2 Evidence-Based Significance of the Project

Active CRBSI prevention requires multiple interventions and adherence to evidence- based practices. Evidence-based guidelines published by the Society for Healthcare Epidemiology of America/Infectious Disease Society of America (SHEA/DSA) (2008), Centers for Disease Control and Prevention (CDC) (2011), and Agency for Healthcare Research and Quality (AHRQ) (2013) provide guidelines for best practices regarding prevention and monitoring CRBSI in hemodialysis units before, during, and after CVC care. Guidelines are used to reduce the discrepancies in the delivery of care and to ensure it is high quality and evidence- based care. Furthermore, they provide a means by which dialysis nurses can be held accountable for clinical activities (Vanholder et al., 2010). According to O'Grady et al. (2011), healthcare providers should obtained the proper periodically education, and their knowledge assessed regarding the indications for CVC use, catheter insertion, and maintenance care, and appropriate infection control measures used to prevent CRBSI. Continued research and dissemination of evidence to support nurses' knowledge regarding CVC maintenance care to reduce CRBSI is essential to patient safety.

3.3 Implications for Social Change in Practice

The project will improve registered dialysis nurses' knowledge regarding central venous catheter maintenance care. Registered dialysis nurses play a significant role in the hemodialysis treatment; they contribute to the preventive, promotive and curative aspects of the dialysis unit. The CVC maintenance care will be promoted when nurses will use what they will learn from the program. This study will consider as an opportunity to create a quality improvement project for the hemodialysis units. This study will provide evidence for conducting studies to determine the rates of CRBSIs in hemodialysis units in Oman. The content of the educational program in this study will be appropriate for nursing education in nursing schools. Participants in this study will be a role model and preceptors for other dialysis nurses. This study has relevance for the educational programs in healthcare institutions. The study will improve registered dialysis nurses' knowledge regarding CVC maintenance care that will lead to save lives, improve quality of care, result in better patient outcomes, reduces CRBSI rates, improve satisfaction for the nurses, physicians, clients, and their families, and is cost efficient to implement.

3.4 Definitions of Terms

For the purpose of this project, the following terms will be defined below.

bloodstream *Catheter-related* infection (CRBSI): bacteremia/fungemia in a patient with an intravascular catheter with at least one positive blood culture obtained from a peripheral vein, clinical manifestations of infection (i.e., fever, chills, and/or hypotension), and no apparent source for the BSI except the catheter. One of the following should be present: a positive semiquantitative (>15 CFU/catheter segment) or quantitative (> 10^3 CFU/catheter segment catheter) culture, whereby the same organism (species and antibiogram) is isolated from the catheter segment and peripheral blood; simultaneous quantitative blood cultures with a >5:1 ratio CVC versus peripheral; or a differential period of CVC culture versus peripheral blood culture positivity of >2 hours (Shah, Bosch, Thompson, & Hellinger, 2013, p. 144).

Catheter care bundle: a structured way of improving the processes of care and patient outcomes: a small, straightforward set of evidence-based practices — generally a set of five steps to help prevent "catheter-related bloodstream infections," deadly bacterial infections that can be introduced through an IV in a patient's vein supplying food, medications, blood or fluid. The steps are simple, common sense tasks: using proper hygiene and sterile contact barriers; properly cleaning the patient's skin; finding the best vein possible for the IV; checking every day for infection; and removing or changing the line only when needed (Institute for Healthcare Improvement, 2014, n. p.).

Central venous catheter (CVC): catheter inserted into a centrally located vein with the tip residing in the vena cava; permits intermittent or continuous infusion and/or access into the venous system. (Association for professionals in infection control and epidemiology, 2009, p. 30).

Dialysis nurses: registered nurses who are working in the nephrology nursing specialty, addressing the protection, promotion, and optimization of the health and well-being of individuals with kidney disease. These goals are achieved through the prevention and treatment of illness and injury and the alleviation of suffering through patient, family, and community advocacy (American Nephrology Nurses' Association, 2011, p.1).

Evidence-based practice guidelines: a set of systematically developed statements, usually based on scientific evidence, to assist practitioners and patient decision making about appropriate healthcare measures for specific clinical circumstances (Marquez, 2001, p. 5).

Knowledge: essential content or body of information for a discipline that is acquired through traditions, authority, borrowing, trial, personal experience, role- modeling and mentorship, intuition, reasoning, and research (Grove, Burns, & Gray, 2013, p.698).

Registered Nurse (RN): a nurse who has graduated from an accredited school of nursing and has been registered and

licensed to practice by state authority (Medical Dictionary, 2007, n. p.).

Self- directed learning: a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies and evaluating learning outcomes (Knowles, 1975, p. 18).

Self- study module: Educational self-study format designed to provide information about CVC maintenance care (CDC, 2014, n. p).

3.5 Assumptions and Limitations

The project will face a number of limitations because the duration of the study is relatively short and small sample size. Participants' learning styles are not assessed. In pre and post-intervention of this nonrandomized study, there is a possibility that changes in the registered dialysis nurses' knowledge may be due to the awareness that the outcome is being measured. The study will be carried out in a single hemodialysis unit and the results may not correlate with those from other units with different populations and medical policies, therefore, the results are not generalizable to any other population other than the population included in the sample.

The study sample will be selected from a registered dialysis nurses who are working in the largest hemodialysis unit in Oman. There may be characteristics of this group that differs both individually and significantly from dialysis nurses working in hemodialysis units in other regions.

3.6 Summary

CRBSI is among the most frequent healthcare-associated infections and causes significant morbidity and mortality, as well as increased costs to the health care system. The section highlights the dilemma of CRBSI and presents its significance for dialysis nurses. The importance of educating dialysis nurses is imperative. Through this project, registered dialysis nurses will better understand the need for evidencebased guidelines regarding CVC maintenance care to prevent CRBSI. A literature review was performed before the project started in order to enhance the project methods and provide a context within which to evaluate the results. A literature review is presented in section two.

Section 2: Review of Scholarly Evidence

The purpose of this section is to present a review of the literature that is relevant to educational interventions to reduce catheter-related bloodstream infection (CRBSI) in hemodialysis units. This section highlights the search methodology and search results.

4.Search Methods

The literature was searched via the e-Journals of the Walden University library. Databases included the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and MEDLINE, as well as Google Scholar (2009 to 2014). By reviewing the topics of the literature found, the relevant articles were retrieved and examined by reviewing the abstracts. The keywords used in the search included central venous catheter infection, educational intervention, nurses' knowledge, CRSBI educational intervention, CRSBI bundle and Hemodialysis infection prevention, impact of nurses' knowledge, and characteristics of nurses.

Inclusion and exclusion criteria were developed to define the eligibility of studies to be included in the review. The search focused on selecting only studies that met the inclusion criteria. The literature was excluded if it did not meet any one of the inclusion criteria. The inclusion criteria were:

- Primary studies
- Written in English
- Full text available
- Study participants were adult patients with CVC (age 18 years and above)
- CVC infection and reported educational intervention

Exclusion criteria:

• Pediatric literature

5.Review of Literature

After searching the electronic databases, 96 articles were retrieved. A selection of these studies based on the inclusion and exclusion criteria, 18 studies were potentially eligible. The 18 studies fulfilled the selection criteria, and no local relevant studies (studies those are concerned with the analysis and solving of CRBSI nationally or regionally) were found. The review consists of two sections: a general review of the literature and specific review of the literature.

5.1 General Review of the Literature

Boonma et al. (2014) conducted a target surveillance study to reduce the rate of CRBSI at Bangkok Hospital by using 2002 CDC evidence-based guidelines as a preventive of CRBSI. The result indicated that CRBSI incidence rate in 2010 approached zero per 1000 catheter-day. The study demonstrated the contents of educational intervention and method of education without indication of the duration and frequency of education. The study suggested that all healthcare personnel must take responsibility for preventing nosocomial infections.

Cooper et al. (2014) conducted a comprehensive epidemiological and economic review to estimate the additional costs and health benefits from introducing such interventions and the costs associated with CRBSI. A comparison was made between introducing an educational intervention with clinical practice and clinical practice without the intervention. The result showed that the educational intervention to prevent CRBSI improved patient life expectancy and reduced overall costs.

Dumyati et al. (2014) conducted a prospective pre intervention-post intervention study. The study comprised three phases (pre-intervention [baseline], intervention, and post-intervention) over a 4.5-year period (2008-2012) and

was implemented through a collaborative of 37 adult non-ICU wards at 6 hospitals in the Rochester, NY area. The purpose of the intervention was to prevent CRBSI through engagement, education of nursing staff, and standardization of best practices for CVC care and maintenance. The educational intervention was implemented during phase 2 through the computer-based education module. Completion of the module was mandated by each hospital and was tracked electronically. More than 90% of nursing staff on the surveyed units completed the module. Quarterly CRBSI rates were compared over time in relation to intervention implementation. The result indicated that the overall CRBSI rate for all participating units decreased from 2.6/1000 linedays pre-intervention to 2.1/1,000 line-days during the intervention and to 1.3/1,000 line-days post-intervention, a 50% reduction (95% confidence interval, .40-.59) compared with the pre-intervention period (P .0179). The authors noted that engagement and education of nursing staff on an evidence-based guideline for CVC maintenance resulted in a sustainable reduction in CRBSI rates outside the ICU in 6 diverse hospitals. The sample size was large which may increase the statistical significant of the data. The outcomes were clearly defined and the results of this study directly applicable to the patient. Confidence intervals were provided.

Abdelsatir (2013) conducted a descriptive study that included 50 HD nurses practicing in Khartoum State. Nurses were selected randomly from four HD centers. The purpose of the study was to evaluate nurses' awareness and practice of HD access care in Khartoum state, focusing on the application of proper hand hygiene and HD access care. Data was collected between July and September 2010 in two stages. Nurses' knowledge was evaluated using a questionnaire filled by respondents, including items related to the benefits of hand washing, glove use, and HD access care. Nurses' practice was assessed by on-the-job monitoring of hand-washing, use of gloves and HD access care. The result showed that females composed 72% of study participants, and 85% were university graduates, and 50% of the participants had more than two years experience in HD work. Structured training on HD access care was received by 56%. The participants reported that proper HD access care helps prevent access infection, but only 54% indicated that it assisted in preserving access function. Nurses with a bachelor degree tended to be more adherent to hand hygiene (72.5 versus 42.9%, P = 0.1) and the use of gloves (100% versus 85.7%, P = 0.1) compared to nurses with a diploma degree, but the difference was not statistically significant. The outcomes were clearly defined, and the study suggested that HD units are required to organize adequate training on HD access care for their nursing staff.

Chu, Adams, & Crawford (2013) conducted a project aimed to use a practice development framework derived from New South Wales 2009. The study addressed an appropriate and clearly focused question, and comparison of two consecutive 12 months was done to assess the effects of practice development framework. The result indicated that rates of dialysis CRBSI have decreased from 4.39 per 100 patientmonths to 3.42 per 100 patient-months (p <.001) 12 months after the implementation of the project. There was a statistically significant association between improved staff practice and infection outcome measures. The potential confounding factors of the observed relationship between nurses' practice and CRBSI were addressed adequately. The outcomes were clearly defined and the results of this study directly applicable to the patient. Confidence intervals were not provided.

Khanna et al. (2013) conducted a case-control study in tertiary care hospital. The number of participants in this study was 50 cases and 50 controls. The purpose of the study was to was undertaken to identify catheter-related pathogenic bloodstream infections, to isolate microorganisms present in intravascular catheter-related local infections, exit site infections, and to determine the predisposing factors for the development of such infections and antibiotic sensitivity pattern of the isolated organisms in tertiary care hospital. The results indicated that the commonest premorbidity among the controls and patients with CRBSI was renal failure (36% versus 36.4%) while that among the patients with local catheter infections was diabetes (28.2%). The study highlighted the increasing rate of CRBSI and helped in better management of patients as well as in prevention of nosocomial bloodstream infection, mainly due to multidrug-resistant organisms.

Aiken et al. (2011) conducted a cross-sectional study to measure the relationship between the levels of nurse-topatient staffing, nurse work environment, nurse education and inpatient mortality and failure to rescue across 665 adult acute care general hospitals. The study addressed a clearly defined research question, and a comprehensive literature search was carried out. Descriptive statistics was provided to show characteristics of the study hospitals, and logistic regression models were used to estimating the effects of nurse staffing, nurse work environment, and nurse education on patient outcome. The result of this study was directly applicable to the patient, and indicated positive effect of increasing percentages of BSN nurses is consistent across all hospitals, lowering the patient-to-nurse ratios markedly improves patient outcomes in hospitals with healthy work conditions. The study used appropriate methods to combine the individual research findings.

Apisarnthanarak et al. (2010) conducted a prospective quasiexperimental study, provided an educational intervention for nurses. The purpose of the study was to evaluate the longterm impact of bundled infection control practices on the reduction of CRBSI in a tertiary care center in Thailand. The results recorded in the first period, 88 episodes of CRBSI, and the CRBSI rate decreased by 54.1 % in the second period, then 78% in the third period. The study focused on conducting the educational course periodically, and the components were derived from CDC's Healthcare Infection Control Practices Advisory Committee's and WHO's hand hygiene guideline. The study supported the role of a bundle of care in achieving and maintaining low incidence of CRBSI.

Guerin, Wagner, Rains, & Bessesen (2010) conducted surveillance for CRBSI by trained infection preventionists using National Health Safety Network case definitions and device-day measurement methods. The sample size was large; more than a thousand and comparison of preintervention and post-intervention was done to assess the effects of post insertion care bundle on the incidence density for CRBSI. After the implementation of the interventions, there were 2825 catheter-days and 3 CRBSIs, for an incidence density of 1.1 per 1000 catheter-days. The relative risk for a CRBSI occurring during the post-intervention period compared with the pre-intervention period was 0.19 (95% confidence interval, 0.06-0.63; P = .004). In the study, the basic clinical characteristics of the patients in both periods were similar. The surveillance methods were described clearly. The potential confounding factors of the observed relationship between catheter insertion and infections were addressed adequately, for example, nurse-topatient ratio and some critical steps of routine CVC care.

Kim et al. (2011) conducted interventional study to evaluate the effectiveness of a central venous catheter bundle in intensive care units. An education program was initiated to nursing staff and fellows in the ICU about central venous catheter bundle, as well as their importance. The result indicated that changing the CRBSI rate is better with use of a central venous catheter bundle that can improve patient care while reducing hospital stays, costs, and possible mortality (P = .05). The potential confounders were explicitly addressed, for example, antibiotic use before the infection.

Marra et al. (2010) conducted a quasiexperimental pre-and post- intervention study to reduce the incidence of CRBSI in a medical-surgical intensive care unit (ICU) and two stepdown units (SDUs). The result of the study indicated that the mean incidence density of CRBSI per 1000 catheter-days in the SDUs was 4.1 in period one and 1.6 in the period two at P = .005. In this study, the clinical characteristics of the patients in both settings were similar. The intervention methods were described clearly. The potential confounding factors of an observed CRBSI were addressed adequately, for example, nurse-to-patient ratio and some critical steps of routine CVC care. The study suggested that reducing CRBSI rates in an ICU setting is a complex process and requires multiple interventions that can be applied to SDU settings.

Pronovost et al. (2010) conducted collaborative prospective cohort study to implement and evaluate interventions to improve patients' safety in intensive care units predominantly in Michigan, USA. Intervention conceptual model was used to develop clinicians' use of five evidence-based recommendations to reduce rates of CRBSI. The resulted showed there is a significant decrease in incidence rate ratios of CRBSI 0.68 (95% confidence interval 0.53 to 0.88) at 0-3 months to 0.38 (0.26 to 0.56) at 16-18 months and 0.34 (0.24-0.48) at 34-36 months post-implementation. The potential confounders were not addressed, for example, previous antibiotic therapy, and the sample size was large which may increase the statistical significant of the data.

5.2 Specific Review of Literature

Deshmukh and Shinde (2014) conducted quasi-experimental study with pre-test-post-test design. The sample size for the study was 60 purposive sampling technique by the investigator. The purpose of the study was to assess the

impact of structure education on knowledge and practice regarding venous access device among nurses. The study was conducted in three phases. The result showed that the structured education was effective in knowledge and practice of staff nurses regarding venous access device car. The sample size is not large enough; only 30 in the control group and 30 in the case group; a small sample size may reduce the statistical significant of the data.

Pushpakala and Ravinath (2014) conducted preexperimental study to inform the recommendations concerning nursing care of the patient with central venous catheter among staff nurses working in ICU. The sample size was 50 staff nurses working in intensive critical care units, coronary intensive care unit and cardiovascular intensive care unit. The result showed that a significant increase in the staff nurses' knowledge scores after selfinstructional module. The mean pre-test score was 9.80 %, and the mean post-test score was 16.58 % and the difference between pre-test and post-test knowledge scores was 6.78%. The study indicated that the staff nurses in post-test were having average of moderately 30 % knowledge and adequate 70 % of knowledge regarding nursing care of patients with central venous catheter. Self-instructional module is effective in increasing the knowledge regarding nursing care of patients with central venous catheter among staff nurses. The potential confounder was addressed, for example, the behavior changes and the compliance of personnel. The sample size is not large enough; a small sample size may reduce the statistical significant of the data.

Shrestha (2014) conducted a pre-experimental study design (pre-intervention, intervention, and post- intervention) which determine the effectiveness of educational intervention in improving nurses' knowledge regarding care of patients with CVC among nurses. Forty nurses were selected by randomization sampling method to participate in the study. The results indicated that there was a significant difference between the pre-intervention and post-intervention knowledge score (p = .039). The study showed that educational intervention program significantly improved the nurses' level of knowledge about care of the patient with CVC. Overall, mean knowledge score between preintervention and post- intervention was found to be significant. The outcomes were clearly defined and the results of this study directly applicable to the patient. Confidence intervals were not provided.

Bianco et al. (2013) conducted a cross-sectional selfadministered survey, taking place from September to December 2008; the target population comprised health care workers (HCW) who insert CVCs and responsible for CVC management. The purpose of the study was to acquire information about the level of knowledge, attitudes, and frequency of evidence-based practices associated with insertion and maintenance of CVCs for the prevention of CRBSI. The anonymous self-administered instrument for data collection included questions designed to capture information in the following areas: (1) sociodemographic and practice characteristics, including queries about gender, age, ward of activity, position, and total number of years in practice; (2) knowledge, attitudes, and practice regarding evidence-based procedures associated with insertion and

care of CVC for the prevention of CRBSI; (3) formal education received by HCWs and main sources of information concerning CVC insertion, use, and care; (4) availability of written hospital policies regarding CVC management. The result showed that correct answers about the knowledge of physicians and nurses ranged from 43% to 72.9% and were significantly higher in respondents who worked in intensive care unit (ICU) wards in hospitals that had a written policy about CVC maintenance and had active formal training. The study illustrated that written policies, formal training, and years of experience contributed to an increase in knowledge, practice and positive attitudes toward CRBSI prevention. The authors noted a lack of consistent adherence to the CDC guidelines.

El Nemr, Fahmy, El Razek, & El Salam (2013) conducted an educational interventional study in surgical and emergency ICUs. The patients with CVC, health care providers, working in ICU were enrolled in the study, and the study was done at three periods. The results showed there was statistically significant improvement in physician practice post-intervention, and detected that implementation of simple education program promoted level of knowledge, and developed practice of healthcare providers as well as reduced CRBSI by 50% in ICUs during the period of the study. The patient characteristics were comparable across the study phases.

Parra et al. (2010) conducted an observational, pre and postintervention study during the period from February 2006 through August 2007 in 3 adult ICUs. The aims of the study were to analyze the effect of a single, evidence-based educational intervention on the incidence of CRBSI in ICUs with acceptable baseline incidences and to assess the knowledge of standards for CRBSI prevention among healthcare workers in a large teaching hospital. Researchers gave 30 lectures, covering all shifts in all three ICUs. Six months after the educational intervention, 74 healthcare workers completed the post-intervention tests. The mean duration of work experience among ICU staff was 8.9 years (95% CI, 7.8-10.1 years) for nurses and 8.1 years (95% CI, 5.3–10.8 years) for physicians. The results showed that the overall incidence of CRBSI in all 3 ICUs was significantly lower during the post-intervention period: 34 CRBSI episodes were diagnosed during 11,582 CVC-days (2.94 episodes per 1,000 CVC-days) after the intervention. The outcomes were clearly defined and the results of this study directly applicable to the patient.

6.Summary

There has been a great deal of studies on CRBSI prevention, but the majority of them focused on the ICU setting and very limited on hemodialysis setting. Studies demonstrated many prevention strategies for CRBSI prevention particularly at the time of catheter insertion. Although, these strategies; the incidence rates were very high specifically in hemodialysis setting. Studies reported critical interventions to reduce CRBSI, and the central theme was education to health caregivers with continuous assessment of the competencies and barriers. Most of the studies have their research purpose or objective clearly stated, and most of them aimed at examining the effects of the intervention for preventing CRBSI. Outcome measures were entirely consistent in the reviewed studies. Studies provided evidence of effects of improving nurses' knowledge on reducing CRBSI. Some studies provided training modules to develop the required skills for health workers. In an effort to reduce CRBSI, it may be necessary to look at the evidence to support equipment that could leverage success with other efforts in infection prevention such as CHG bathing or re-evaluation of dressing techniques. Greater part of the studies proposed that the educational intervention could improve or enhance nurses' knowledge in reducing CRBSI rates. There was overlapping between educational and non-educational interventions because planning was unclear. In all of the studies reviewed, pre-intervention data about the CVC maintenance care considered acceptable for the time leading up to the educational intervention. One can no longer at once accept practice as usual for CRBSI prevention. Based on the evidence, there is understanding that any intervention to prevent CRBSI is better than no intervention at all. The individual studies and evidence-based guidelines may serve as a guide, and the responsibility of dialysis nurses is to implement these guidelines successfully to reduce CRBSI to improve safety and quality for CVC dependent patients.

In conclusion, this section has reviewed the evidence regarding CRBSI reducing and has identified the gaps in the literature. A project will design to address these disparities in the literature and to build on the work of the previous studies. There is lack in the literature relevant to hemodialysis unit, and majority of reviewed literature provides promising evidence regarding the impact of educational and/or intervention programs directed at ICU doctors and nurses on the theoretical knowledge of prevention of CVC related infections.

7.Theoretical Framework

The conceptual framework for this project is based on Donabedian's model (Figure 1). The components of the model are structure, process, and outcome. Donabedian (1997) explained that the structure denotes the attributes of the settings in which care occurs. This includes the characteristics of material resources (facilities, equipment, and funds), human resources (medical staff and qualifications of dialysis nurses), and organizational structure (leadership style, and policy of reimbursement). Process is defined as the actual action in providing care. It includes a nurse's activities in making a diagnosis and recommending or implementing treatment. The concept of outcome refers to the consequences of a nurse's knowledge of the health status of dialysis patients.

The evidence supports the linking between nursing care (process) and patient outcomes (Duffy & Hoskins, 2002, Deshmukh & Shinde, 2014). The inference is that the three-part approach to quality assessment is possible only because significant structure increases the likelihood of proper process, and the right process increases the likelihood of good outcomes (Donabedian, 1988). Using Donabedian's framework to improve the process will also affect the outcomes. In this project proposal, nurses are regarding a structural element and use a particular education intervention to improve the process of providing the CVC

maintenance care, improving outcomes by reducing catheter-related bloodstream infection. It is important to identify the literature that supports the particular characteristics identified in Donabedian's structure-processoutcomes model when providing the CVC maintenance care. The structural component of Donabedian's model focuses on characteristics of registered dialysis nurses, patients, and dialysis unit characteristics. The process components include those specific interventions of care practices that dialysis nurses provide; in this project, it includes the CVC maintenance care. Outcomes are the effects or results of the health care process (Duffy & Hoskins, 2003).

In this project, the data will be collected about nurse characteristics include age, gender, education, years of experience, infection control training, and hours worked. Then the characteristics listed above will be analyzed and evaluated to determine their effects on registered dialysis nurse' knowledge. Using Donabedian's framework allows us to define and identify variables as they relate to the structure-process-outcomes model.

Structure Component-Nurse Characteristics

The recent studies support particular nurse characteristics as they relate to health outcomes. The particular features included nurse education and years of experience. An increase in the percentage of nurses with higher educational degrees decreased the risk of mortality and failure to rescue (Aiken, Clarke, Sloane, & Silber, 2003). Aiken et al. (2003) found "each 10% increase in the proportion of nurses with higher degrees decreased the risk of mortality and failure to rescue by 5%" (p.1617). Tourangeau, A. (2002) described an association between nurses' experience and patients' death, suggesting nursing units with more experienced nurses provide higher-quality care (Blegen, Vaughn & Goode, 2001). The quality of nurse communication is higher on units where nurses have a higher level of education (Doran, Sidani, Keatings, & Doidge, 2002).

Structure Component-Patient Characteristics

The literature has identified numerous risk factors that are associated with increasing patients' risks of CRBSI. In an article published the most common risk factors that increase bloodstream infection includes increasing severity of illness, integrity of the skin, and presence of distant infection recently (Shah, Bosch, Thompson, & Hellinger, 2013).

Process Component- CVC maintenance care

The process component of Donabedian's model involves interventions or practices that registered dialysis nurses offer (Duffy & Hoskins, 2003). The project focuses on the effect of the CVC maintenance care on patient outcomes. A catheter care bundle includes educational and noneducational interventions to prevent CRBSI. The bundle contains the five elements of evidence–based guidelines for CRBSI prevention: hand hygiene, use of maximum sterile barriers with catheter maintenance, use of chlorhexidine for skin preparation, avoiding use of the femoral and jugular sites for catheter insertion, and prompt removal of unnecessary catheters (Rinke et al., 2012).

Self- directed learning

Self-directed learning (SDL) is an essential skill for nurses to have in order to meet the challenges in today's healthcare environment. In SDL, learners take the initiative and responsibility in using learning resources (Ramnarayan and Hande, 2005). The aim of SDL is to develop the skills and acquire new knowledge. The concept supports the intervention of the project that in turn helps the process that is defined by Donabedian's framework.

In conclusion, this section reviewed the existing literature on research related to educational intervention to improve nurses' knowledge regarding the CVC maintenance care in hemodialysis unit. In addition, the section discussed the conceptual framework for this project. The theoretical framework of Donabedian regarding structural, process and outcomes was presented and will serve as a basis for the development of educational intervention. Using Donabedian's framework, improving the process will also affect the outcomes. In this project, nurses will consider as a structural component, and the educational intervention as part of the process. A self-study module will utilize to improve registered dialysis nurses' knowledge. The method used to carry out the project will be prescribed in section three.

Section 3: Approach

8.Project Design and Methods

This project utilizes a pretest-posttest educational intervention design. This design helps for investigating the effectiveness of a nursing intervention in achieving the desired outcome in a natural setting (Grove, Burns& Gray, 2013). The educational intervention will be administered to the registered dialysis nurses as self-study module regarding CVC maintenance care. The investigator will contact the nurse manager of hemodialysis unit to discuss the recruitment of the registered dialysis nurses who will meet the inclusion criteria. The manager will introduce the investigator to the staff working in the hemodialysis unit, and the investigator will make a verbal announcement in the hemodialysis unit inviting all registered dialysis nurses for voluntary participation in the current study. The investigator will communicate privately with participants at convenient times in the dialysis unit. The investigator will provide verbal information about the significance and the purpose of the study, explain what the subject will be asked to do, time commitment, name and address of the investigator, setting of the project, and name of the person to contact for further information. The investigator does not have any influence on the employment of the participants, and they have their nursing manager for supervisory functions.

The plan for implementation of the educational intervention was shared with the hemodialysis unit, and a signed approval was obtained on 15.9.2014 (Appendix E). The hemodialysis unit provides an excellent support to facilitate the implementation of educational intervention; hence, a committee made up of an infection control nurse, a staff development nurse, a statistic nurse, and the medical director of the hemodialysis unit to provide administrative assistance to the investigator during the period of the study.

The educational program will be implemented after obtaining the approval of the Institutional Review Board (IRB) at Walden University. The education program will consist of a one-hour lecture and the administration of the self-study module. The study will be conducted in three phases. Phase I will include assessment of nurses' knowledge regarding CVC maintenance care. Phase II will include the delivering of educational lecture, and distributing the self-study module, the duration of this phase will be 30days to allow participants sufficient time for completing the self-study module. Bausher Hemodialysis Center is responsible to oversee the quality of lecture and self-study module.

Phase III will include the assessment of nurses' knowledge regarding CVC maintenance care after the education intervention. The pre-post test that will run at the conference room in hemodialysis unit. The allocated time of the test will be 30 minutes. The participants will allow 30 minutes of their working hours; their patients and other duties will be assigned to other staff while they are taking the test. This will be organized by the manager of the dialysis unit.

Topics that will be covered in the pretest, posttest, and selfstudy module include (a) the epidemiology of catheterrelated bloodstream infection, (b) aseptic technique; the use of maximal barrier precautions during CVC maintenance care, (c) the need to avoid femoral insertion sites, (d) proper technique for obtaining blood cultures, and (e) guidelines for changing dressing. The self-study module was developed by the investigator and was reviewed by the medical director of the hemodialysis unit. The self-study module will discuss the necessary knowledge that is needed for a competent registered dialysis nurse when working with Central Venous Catheters (CVCs). The module will briefly cover the most common types of CVCs short-term and long-term. The emphasis will undertake signs and symptoms, CRBSI definition according to Centers for Disease Control and Prevention (CDC)/ National Healthcare Safety Network (NHSN) surveillance definition, potential routes of infection, modifiable risk factors for CRBSI, and CRBSI prevention measures based on CRBSI bundles. CRBSI has been known to be reduced by implementation of care bundles.

A care bundle is a grouping of best practices that individually improve care and when applied together results in greater improvement. Every component of the bundle is essential and indispensable. The CRBSI bundle consists of five essential elements: 1) Hand hygiene, 2) Maximal sterile barrier precautions including large sterile drape, sterile gown and gloves, mask, and a cap, 3) selection of optimal catheter insertion site with avoidance of the femoral vein for access in adults, 4) Chlorhexidine skin antisepsis, 5) Daily review of the line necessity and prompt removal of unnecessary lines.

Voluntary participants in this project will be nonprobability convenience sample of the registered dialysis nurses in the hemodialysis unit. The expected outcome of this educational intervention will increase knowledge about CVC maintenance care. Subjects will answer a 25-question pretest; the same questions will be answered as a posttest after completing a self- study module. There is a 25-question pretest of knowledge regarding CVC maintenance care (Appendix A). There is a 7-question demographic questionnaire. The demographic questionnaire is a selfreport sheet developed by the investigator to collect data about nurses' age, gender, level of education, years of experience, infection control training, and the amount of hours the nurse works. The demographic sheet will be filled out by the registered dialysis nurse before starting the educational program (Appendix B).

9.Instruments

The investigator developed a 25-question knowledge-based pre- and post-assessment tool. Each correct answer carries one score; the total score is 25. The level of knowledge score will be converted into a percentage and overall adequacy of knowledge will be graded according to the following criteria: if the score is >75%: high level of knowledge, if the score is 50% to 75%: moderate level of knowledge, and if the score is <50%: inadequate level of knowledge.

The reliability of test scores will be estimated from a single administration of a test using Kuder-Richardson Formula 20 (KR20), the reliability coefficients should be .70 or higher (Grove, Burns, & Gray, 2013). Content and face validity will be used to assess whether the test measures what it is supposed to measure (Grove, Burns, & Gray, 2013). Before conducting the intervention, the self-study module and questionnaire will present to a team of three experts for face and content validation. Each expert had at least ten years of experience in nursing education, a master's degree in nursing sciences. To accomplish face validity, the experts will ask if all questions are clearly worded and will not be misunderstood. For content validity, the experts will evaluate the nursing relevance by using a scale of 1 to 3, where 1 = not relevant, 2 = appropriate but not necessary, and 3 = necessary. Furthermore, the experts will ask if questions about any other educational intervention should be added to the questionnaire. The notes of the team will collect, discussed, and used to adjust the survey. After the revision, the experts will examine the questionnaire again, and they will affirm agreement on its content and clarity.

Furthermore, the quantitative method of assessing test validity will be used by reviewing the discrimination of each item. If an item has a discrimination ratio of 25 percent or higher (Grove, Burns, & Gray, 2013), it has a good validity, and able to discriminate between nurses that are knowledgeable and nurses that are not knowledgeable regarding CVC maintenance care. To avoid occurrence of any bias during data analysis, the investigator will delegate a panel of the 3- experts to analyze the data obtained from reviewing the questionnaire for face and content validation, and assess the level of difficulty and the discrimination of each item on the questionnaire. The experts will conduct the analysis process and unanimously declare the result with its content and clarity. The investigator's responsibility is to ensure that data analysis is suitably treated e.g. anonymized and in a format suitable for sharing.

The investigator has developed the demographic tool. It is a questionnaire that addresses the demographic data of the subjects, which includes age, gender, level of education, years of experience, infection control training, and the amount of hours the nurse works. The responses will be kept confidential.

10. Data Collection

The plan for collecting data will include the procedures to collect data, anticipate the required time and the cost of data collection, develop data collection forms that will ease data entry, and prepare a codebook that will help in coding the variables to be entered into a database. Institutional Review Board (IRB) approval will be secured prior to any data collection, and before data collection begins, the demographic data tool is designed to record demographic data. Data will be collected in raw form at the time of collection, and then will be coded.

Coding is the process of transforming data into numerical symbols that can be entered easily into the computer. Codebook will be developed before initiating data collection. The codebook will identify and define each variable in the study. Variable gender will be categorized and given numerical labels; the male will be identified by a "1" and the female category by a "2". Variable education level will be identified by a "1" for Basic Diploma in general nursing, a "2" for Nephrology Nursing Diploma and a "3" for BSN. Variable infection control training course will be categorized and given numerical labels, Yes category will be identified by a "1" and No category will be identified by a "2". A master list of participants and their code numbers will be developed and stored in a separate location and encrypted in an electronic file as well as they will be locked in a file drawer to ensure the participant's privacy. The investigator will be responsible for coding the data.

The data collection forms and questionnaire will be put together in a booklet to minimize the likelihood that a questionnaire or form will be missed. All the data from a single participant will be kept together until analysis initiation. Participant code number will be written on each form, and the forms will be checked for each participant to ensure that they are present. Furthermore, the database will be back up and stored on an encrypted flash drive to avoid loss of all data due to the computer crashing. Data collection flow diagram will be developed to illustrate data collection process in the study.

The study will be completed on the participants' time during work hour. The timeline for this project will be established depending on the Project Committee availability and IRB approval, with any significant adjustments that are necessary. The timeline will involve the conducting the pre and post-test data, and collecting participants demographic data. The practical and operational responsibility for study data throughout the lifecycle of the project is in the hands of the investigator. The investigator will hold the responsibility of distributing the pre/ post instruments to ensure data management plan has accomplished successfully in the dialysis unit.

Data Analysis

Descriptive statistics, including percents, means, and standard deviations will be used to identify the predicted relationships between the nurses' knowledge of the evidence-based guidelines and demographic variables (age, gender, years of experience, level of education, infection control training). The *t*- tests will be conducted to analyze the pretest and posttest results of the 25- questionnaire of knowledge regarding CVC maintenance care at P < .05% by using IBM SPSS Statistics for Windows (Version 21.0. Armonk, NY: IBM Corp). Protection of

Human Subjects

The study will be conducted in accordance with the Walden University Institutional Review Board as well as the Research and Ethical Review & Approve Committee (RERAC) Directorate of Research and Studies in the Ministry of Health in the Sultanate of Oman. The participants' privacy and confidentiality will be maintained. Informed consent will be obtained. The informed consent form contains all relevant material, including purpose, background, procedures, benefits, risks, and the right to refuse or withdraw, confidentiality, and any contact information. Collected data will be coded with numbers one to 60 for nurses and entered without any verifying information into a computerized database available only to the investigator. The consent forms will be kept in a locked file cabinet. The protocol will be submitted for approval by the Institutional Review Board (IRB) from Walden University. Prior to implementing the intervention, approval from the Research and Ethical Review & Approve Committee (RERAC) Directorate of Research and Studies in the Ministry of Health in the Sultanate of Oman will be obtained.

Project Evaluation Plan

Evaluation is a systematic investigation of the value and significance of the project. It facilitates recognizing the progress and effectiveness of the project. The purpose of the evaluation plan is to provide information for actions such as educational program adjustment, decision-making, reporting and problem-solving. It will present the entire picture of the project, including insight into the relationships between educational intervention and outcomes. Project evaluation will assess all the activities that are designed to achieve the purpose of the project. The impact of the educational intervention will be measured by comparing the pre-test and post-test dialysis nurses' knowledge scores about CVC maintenance care. Feedback is a critical part of the evaluation process to ensure that the results of evaluations are used for the program expansion and sustaining. For this reason, feedback mechanisms will establish, for instance, seminars and workshops, and follow-up procedures of CVC maintenance care. Informal means such as networking and internal communications will use for the dissemination of evidence-based guidelines and information on CVC maintenance care in order to promote registered dialysis nurses' knowledge and keep them updated.

11. Summary

CRBSI is a significant cause of morbidity and mortality in hemodialysis patients (Rosenbaum et al., 2006). An evidence- based educational intervention will be used to improve dialysis nurses' knowledge and reduce the incidence of CRBSI. The focus of the nursing education program is on enhancing the professional development of nurses. Dialysis nurses have the foundation and the opportunity to participate in shaping the future of hemodialysis patients.

References

- Abdelsatir, S. (2013). Evaluation of nurses' awareness and practice of hemodialysis access care in Khartoum state, Sudan. *Arab Journal of nephrology and transplantation*, 6(2), 119-121. Retrieved from http://www.ajol.info/index.php/ajnt/article/view/88699
- [2] Aiken, L. H., Cimiotti, J. P., Sloane, D. M., Smith, H. L., Flynn, L., & Neff, D. F. (2011). The effects of nurse staffing and nurse education on patient deaths in hospitals with different nurse work environments. *Medical care*, 49(12), 1047. doi:10.1097/MLR.0b013e3182330b6e.
- [3] Aiken, L., Clarke, S., Sloane, D., & Silber, J. (2003). Educational levels of hospital nurses and surgical patient mortality. *Journal of the American Medical Association, 290,* 1617-1623.
- [4] Al Riyami, A., Elaty, M. A., Morsi, M., Al Kharusi, H., Al Shukaily, W., & Jaju, S. (2012). Oman world health survey: part 1—methodology, sociodemographic profile and Epidemiology of non-communicable diseases in Oman. Oman Med J, 27(5), 425-43. Retrieved from http://omjournal.org/images/298_m_deatials_pdf_.pdf
- [5] Alfonso Pérez Parra, María Jesús Pérez Granda, María Jesús Tomey, Padilla, B., & Bouza, E. (2010). A simple educational intervention to decrease the incidence of central line–associated bloodstream infection (CLABSI) in intensive care units with low baseline incidence of CLABSI. *Infection Control and Hospital Epidemiology*, 31(9), 964-967. Retrieved from http://www.jstor.org/stable/10.1086/655841
- [6] Al-Lawati, J. A., Mabry, R., & Mohammed, A. J. (2008). Peer reviewed: addressing the threat of chronic diseases in Oman. *Preventing chronic disease*, 5(3). Retrieved from http://www.cdc.gov/pcd/issues/2008/jul/pdf/07_0086.pd f
- [7] Apisarnthanarak, A., Thongphubeth, K., Yuekyen, C., Warren, D. K., & Fraser, V. J. (2010). Effectiveness of a catheter-associated bloodstream infection bundle in a Thai tertiary care center: a 3-year study. *American journal of infection control*, 38(6), 449-455. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20006409
- [8] Association for Professionals in Infection Control and Epidemiology. (2009). *Guide to the elimination of catheter-related bloodstream infections*. Retrieved from http://www.apic.org/EliminationGuides
- [9] Bianco, A., Coscarelli, P., Nobile, C. G., Pileggi, C., & Pavia, M. (2013). The reduction of risk in central lineassociated bloodstream infections: Knowledge, attitudes, and evidence-based practices in health care

workers. *American journal of infection control*, 41(2), 107-112. Retrieved from http://www.sciencedirect.com/science/article/pii/S0196 655312007183

- [10] Blegen, M., Vaughn, T., & Goode, C. (2001). Nurse experience and education: effect on the quality of care. *Journal of Nursing Administration*, 31, (1), 33-39.
- [11] Boonma, P., Hiranniramol, S., Aiumpatoomsak, W., Leeyatikun, P., & Suwanarit, A. (2014). Infection control for the reduction of catheter-related bloodstream infection (CRBSI). *Bangkok Medical Journal*, 3. Retrieved from

http://www.bangkokmedjournal.com/issue/183

- [12] Centers for Disease Control and Prevention. (2014). *Self-study modules on tuberculosis*. Retrieved from http://www.cdc.gov/tb/education/ssmodules/
- [13] Centers for Disease Control and Prevention (2012). National Healthcare Safety Network. Device-Associated Module. Protocol and Instructions: Central Line-Associated Bloodstream Infection Event. Retrieved from http://www.cdc.gov/nhsn/psc_da.html.
- [14] Centers for Disease Control and Prevention. (2011). *Guidelines for the prevention of intravascular catheter related infections*. Retrieved from http://www.cdc.gov/hicpac/pdf/guidelines/bsiguidelines-2011.pdf
- [15] Centers for Disease Control and Prevention. (2011a). Vital signs: Central line-associated blood stream infections – United States, 2001, 2008, and 2009. MMWR Morbidity and Mortality Weekly Report. Mar 4:60(8); 243-248.
- [16] Centers for Disease Control and Prevention. (n. d.). C DC's core interventions for dialysis BSI prevention. Retrieved from http://www.njha.com/media/76926/CDCESRDClinical Tools.pdf
- [17] Chu, G., Adams, K., & Crawford, S. (2013). Improving catheter-related bloodstream infection in hemodialysis patients using a practice development framework. *Renal Society of Australasia Journal*, 9(1). Retrieved from http://www.renalsociety.org/Resources/Documents/RS AJ/2013.03/Chu.pdf
- [18] Cooper, K., Frampton, G., Harris, P., Jones, J., Cooper, T., Graves, N., ... & Cuthbertson, B. H. (2014). Are educational interventions to prevent catheter-related bloodstream infections in intensive care unit costeffective? *Journal of Hospital Infection*, 86(1), 47-52. Retrieved from http://www.sciencedirect.com/science/article/pii/S0195 670113003198
- [19] Deshmukh, M., & Shinde, M. (2014). Impact of structured education on knowledge and practice regarding venous access device care among nurses. *International Journal of Science and Research*, 3(1), 895-901. Retrieved from http://www.ijsr.net/archive/v3i5/MDIwMTMxOTYw.p df
- [20] Donabedian, A. (1988). The Quality of Care. How can it be Assessed? *JAMA*, 260, (12), 1743-1748.
- [21] Doran, D., Sidani, S., Keatings, M., & Doidge, D. (2002). An empirical test of the nursing role effectiveness model. Journal of advanced nursing, 38(1), pp29–39

Volume 4 Issue 4, April 2015

- [22] Duffy, J., & Hoskins, L. (2003). The quality caring model blending dual paradigms. *Advances in Nursing Science*, 26(1), 77-88.
- [23] Dumyati, G., Concannon, C., van Wijngaarden, E., Love, T. M., Graman, P., Pettis, A. M., ... & Shelly, M. (2014). Sustained reduction of central line–associated bloodstream infections outside the intensive care unit with a multimodal intervention focusing on the central line maintenance. *American journal of infection control*, 42(7), 723-730. doi.org/10.101/j.ajic.2014.03.353
- [24] El Nemr, W. A., Fahmy, H. H., El Razek, G. M. A., & El Salam, N. M. A. (2013). Interventional study to decrease central venous catheter-related bloodstream infection in intensive care units at zagazig university hospital. *Zagazig University Med J*, 19(6), 492–507.
- [25] Fysaraki, M., Samonis, G., Valachis, A., Daphnis, E., Karageorgopoulos, D. E., Falagas, M. E., ... & Kofteridis, D. P. (2013). Incidence, clinical, microbiological features and outcome of bloodstream infections in patients undergoing hemodialysis. *International journal of medical sciences*, 10(12), 1632. ; 10(12):1632-1638. doi: 10.7150/ijms.6710
- [26] Grove, S. K., Burns, N., & Gray, J. R. (2013). The practice of nursing research: Appraisal, synthesis, and generation of evidence (7th ed.). St. Louis, MO: Elsevier Saunders.
- [27] Guerin, K., Wagner, J., Rains, K., & Bessesen, M. (2010). Reduction in central line-associated bloodstream infections by implementation of a post insertion care bundle. *American journal of infection control*, 38(6), 430-433. doi:10.1016/j.ajic.2010.03.007
- [28] Halton, K. A., Cook, D., Paterson, D. L., Safdar, N., & Graves, N. (2010). Cost-effectiveness of a central venous catheter care bundle. *PLoS One*, 5(9), e12815. doi:10.1371/journal.pone.0012815
- [29] Han, Z., Liang, S. Y., & Marschall, J. (2010). Current strategies for the prevention and management of central line-associated bloodstream infections. *Infection and Drug Resistance*, *3*, 147–63. doi:10.2147/IDR.S10105.
- [30] Hentrich, M., Schalk, E., Schmidt-Hieber, M., Chaberny, I., Mousset, S., Buchheidt, D., ... & Karthaus, M. (2014). Central venous catheter-related infections in hematology and oncology: 2012 updated guidelines on diagnosis, management and prevention by the Infectious Diseases Working Party of the German Society of Hematology and Medical Oncology. Annals of Oncology. doi:10.1093/annonc/mdt545.
- [31] Institute for Healthcare Improvement. (2012). Implement the IHI central line bundle. Retrieved from http://www.ihi.org/knowledge

/ Pages/ Changes/ Implement the Central Line Bundle. a spx

- [32] Institute for Healthcare Improvement. (2014). What is a bundle? Retrieved from http://www.ihi.org/resources/Pages/ImprovementStories /WhatIsaBundle.aspx
- [33] Jeong, I. S., Park, S. M., Lee, J. M., Song, J. Y., & Lee, S. J. (2013). Effect of central line bundle on central lineassociated bloodstream infections in intensive care units. *American journal of infection control*, 41(8), 710-716. doi:10.1016/j.ajic.2012.10.010
- [34] Kim, J. S., Holtom, P., & Vigen, C. (2011). Reduction of catheter-related bloodstream infections through the

use of a central venous line bundle: Epidemiologic and economic consequences. *American journal of infection control*, *39*(8), 640-646. doi:10.1016/j.ajic.2010.11.005

- [35] Knowles, M. S. (1975). *Self-directed learning*. New York: Association Press.
- [36] Labeau, S., Vandijck, D. M., Claes, B., Van Aken, P., & Blot, S. I. (2007). Critical care nurses' knowledge of evidence-based guidelines for preventing ventilatorassociated pneumonia: an evaluation questionnaire. *American Journal of Critical Care*, 16(4), 371-377.
- [37] Marra, A. R., Cal, R. G. R., Durão, M. S., Correa, L., Guastelli, L. R., Moura Jr, D. F., ... & dos Santos, O. F. P. (2010). Impact of a program to prevent central lineassociated bloodstream infection in the zero-tolerance era. *American journal of infection control*, 38(6), 434-439.
- [38] National Healthcare Safety Network (NHSN). (2013). Dialysis Event Surveillance Manual Retrieved from http://www.cdc.gov/nhsn/dialysis/dialysis-event.html
- [39] O'Grady, N. P., Alexander, M., Burns, L. A., Dellinger, E. P., Garland, J., Heard, S. O., ... & Saint, S. (2011). Guidelines for the prevention of intravascular catheter-related infections. *Clinical infectious diseases*, 52(9), e162-e193.Retrieved from http://cid.oxfordjournals.org/content/52/9/e162.short
- [40] O'Grady, N. P., Alexander, M., Dellinger, E. P., Gerberding, J. L., Heard, S. O., Maki, D. G., ... & Weinstein, R. A. (2002). Guidelines for the prevention of intravascular catheter–related infections. *Clinical infectious diseases*, 35(11), 1281-1307. Retrieved from http://cid.oxfordjournals.org/content/35/11/1281.short
- [41] Pravikoff, D. S., Tanner, A. B., & Pierce, S. T. (2005). Readiness of U.S. nurses for evidence-based practice: Many do not understand or value research and have had little or no training to help them find evidence on which to base their practice. *American Journal of Nursing*, 105(9), 40-52.
- [42] Pronovost, P. J., Goeschel, C. A., Colantuoni, E., Watson, S., Lubomski, L. H., Berenholtz, S. M., ... & Needham, D. (2010). Sustaining reductions in catheter related bloodstream infections in Michigan intensive care units: an observational study. *Bmj*, 340. Retrieved from http://www.bmj.com/content/340/bmj.c309.long
- [43] Pushpakala, K. J., & Ravinath, A. (2014). Effectiveness of self-instructional module on central venous catheter care among ICU nurses. *Journal of Nursing and Health Science*, 3(5), 32-34. Retrieved from www.iosrjournals.org
- [44] Ramnarayan and Hande. (2005). *Thoughts on selfdirected learning in medical schools: making students more responsible*. Retrieved from http://education.jhu.edu/PD/newhorizons/lifelonglearnin g/higher-education/medical-schools/index.html br
- [45] Registered nurse. (n.d.) *The American Heritage* ® *Medical Dictionary*. (2007). Retrieved December 13 2014 from http://medicaldictionary.thefreedictionary.com/registered%20nurse
- [46] Rinke, M. L., Chen, A. R., Bundy, D. G., Colantuoni, E., Fratino, L., Drucis, K. M., . .. Miller, M. R. (2012). Implementation of a central line maintenance care bundle in hospitalized pediatric oncology patients. *Pediatrics*, 130, e996–e1004. doi: 10.1542/peds.2012-0295

- [47] Rosenbaum, D., MacRae, J. M., Djurdjev, O., Levin, A., Werb, R., & Kiall, M. (2006), Surveillance cultures of tunneled cuffed catheter exit sites in chronic hemodialysis patients are of no benefit, *International Society for Hemodialysis*, 10, 36–370.
- [48] Shah, H., Bosch, W., Thompson, K. M., & Hellinger, W. C. (2013). Intravascular Catheter-related bloodstream infection. *The Neuro Hospitalist*, 3(3), 144-151. DOI: 10.1177/1941874413476043
- [49] Shrestha, R. (2013). Impact of educational interventions on nurses' knowledge regarding care of the patient with central venous line. *Journal of Kathmandu Medical College*. Vol. 2. No. 1.Issue 3. Retrieved from http://www.jkmc.com.np/issue/3/28-30.pdf_br
- [50] Tourangeau, A. (2002). Nursing skill mix and experience reduce patient mortality. *Hospital Quarterly*, 5(3), 19. Retrieved from http://www.longwoods.com/content/16520
- [51] Tozawa, M., Iseki, K., & Fukiyama, K. (2000). Prevalence of hospitalization and prognosis of patients on chronic dialysis. *Clinical and Experimental Nephrology*, 4(3), 236-240. Retrieved from http://link.springer.com/article/10.1007/s101570070028
- [52] U.S. Renal Data System, USRDS 2013 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2013. Retrieved from http://wwrw.usrds.org/adr.aspx

- [53] Urbanes, A Q. (2013). *Decreasing CRBSI in Hemodialysis* [pdf slides].
- [54] Vanholder, R., Canaud, B., Fluck, R., Jadoul, M., Labriola, L., Marti-Monros, A., ... & Van Biesen, W. (2010). Diagnosis, prevention and treatment of hemodialysis catheter-related bloodstream infections (CRBSI): a position statement of European renal best practice (ERBP). *NDT Plus*, 3(3), 234-246. Retrieved from

http://ckj.oxfordjournals.org/content/3/3/234.extract

- [55] Warren, D. K., Zack, J. E., Mayfield, J. L., Chen, A., Prentice, D., Fraser, V. J., & Kollef, M. H. (2004). The effect of an education program on the incidence of central venous catheter-associated bloodstream infection in a medical ICU.CHEST Journal, 126(5), 1612-1618. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15539735
- [56] Worth, L. J., Brett, J., Bull, A. L., McBryde, E. S., Russo, P. L., & Richards, M. J. (2009). Impact of revising the national nosocomial infection surveillance system definition for catheter-related bloodstream infection in ICU: reproducibility of the national healthcare safety network case definition in an Australian cohort infection of control professionals. American journal of infection control, 37(8), 643-648. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19589619

Appendix A: Pre- Post- Test For Catheter-Related Bloodstream Infections Prevention (CRBSI) Answer all the following questions. Each correct answer rewards one grade.

<u>Please, do not write your name. Your answer will store with a high degree of security.</u> Circle the correct answer to the following questions:

- 1. The rate of catheter-related bloodstream infections (CRBSI) in Bausher hemodialysis center is lower than the national average.
 - a. True
 - b. False

2. The mortality rate due to CRBSIs is 10% to 20%.

- a. True b. False
- 3. The femoral site is the best site for a central vascular catheter if the subclavian site cannot be used.
 - a. True
 - b. False

4. Infections associated with the use of central venous catheters can increase

a. Morbidityb. Mortalityc. Hospital length of stayd. Costse. All of the above

5. All of the following factors increase the risk of CRBSIs except:

a. Low nurse to patient ratio

- b. Insertion into the femoral site.
- c. TPN and/or lipid administration

d. Use of a tunneled venous catheter for patients requiring long-term-access (>30 days)

- e. Multiple lumen catheters
- f. All of the above increases the risk of CRBSIs
- 6. Risk factors for CRBSIs include placement for more than 72 hours, inexperience of personnel inserting the central venous catheter, colonization of the catheter with organisms prior to insertion and
 - a. Inappropriate skin preparation.
 - b. Use of stopcocks.c. Lack of antibiotic prophylaxis.
 - d. All of the above.
 - e. a and b
 - e. a and b
 - f. a and c
- 7. Antimicrobial ointment should not be applied to the exit site of hemodialysis catheters because it does not help to decrease the incidence of CRBSIs.
 - a. True

b. False

8. The central catheter insertion site should be dressed:

- a. After the sterile barriers are removed
- b. While the field is still sterile
- c. After an x-ray has verified correct placement of the catheter
- d. As soon as the insertion site has stopped bleeding or oozing

9. In the insertion of a central venous catheter, the insertion site is oozing. You should:

- a. Apply a gauze dressing
- b. Apply a transparent dressing
- c. Apply both a gauze and a transparent dressing
- d. Wait until the site has stopped oozing to apply any dressing

10. You are not required to wash or gel hands if you wear clean gloves when checking the insertion site or changing the dressing of a central venous catheter.

- a. True
- b. False

11. When inserting a central venous catheter, maximal sterile barriers are required. This includes:

- 1. Face mask, cap, and sterile gloves
- 2. Sterile gown that is snapped and tied
- 3. Assistants wearing the same barriers
- 4. Use of fenestrated drape in kit only
- 5. Use of large sterile drape that covers the entire patient
- a. 1, 2, 3, 4
- b. 1, 2, 4
- c. 1, 2, 3, 5
- d. 1, 2, 5
- e. All of the above

12. After applying the ChloraPrep[®] to the insertion site, one should wait until the site is completely dry without fanning or blotting before proceeding.

- a. True
- b. False
- 13. The use of chlorhexidine as a skin preparation (as opposed to Povidone-iodine) is associated with decreased CRBSIs rates in studies.
 - a. True
 - b. False

14. Of the following, which actions will decrease the risk of CRBSIs.

- 1. Routine guidewire exchange of the central venous catheter.
- 2. IV antimicrobial prophylaxis.
- 3. Inserting a single lumen rather than multiple lumen central venous catheter.
- 4. Changing to a new set of sterile gloves before handling the new central venous catheter when performing a guidewire exchange.
- 5. Insertion of a central venous catheter through open techniques/cutdown.
- a. 1, 2, 3, 4 b. 2, 3, 4, 5 c. 1, 2 d. 3, 4 e. 1, 2, 5
- f. All of the above
- 15. Ms. M has an unexplained fever, and you suspect a Blood Stream Infection. Upon inspection of her internal jugular catheter insertion site, you see the erythema and a small amount of pus. What should you do?
 - a. Give vancomycin only
 - b. If the catheter is still necessary, remove the current catheter and replace it with a guidewire exchange and assess the need for antibiotics
 - c. If the catheter is still necessary, remove the current catheter and place another on a new site and assess the need for antibiotics
- 16. When requesting a catheter culture, submit a 5 cm segment that includes the tip.
 - a. True
 - b. False
- 17. If a catheter culture comes back positive, but the blood sample cultures are negative, evaluate the entire picture. Reassess the patient before giving antibiotics.
 - a. True
 - b. False
- 18. When attempting to diagnose a CRBSIs, two sets of blood samples should be drawn for culture. The proper sites to culture are:
 - a. One from a catheter hub, the other from a peripheral source.
 - b. Two different peripheral sources.
 - c. Both from a catheter hub.
- **19.** The proper procedure to culture blood from a suspected source is to draw 20cc of blood and place 10cc in each of two bottles.
 - a. True
 - b. False
- 20. The needleless access device should be scrubbed 10-15 seconds, every time the catheter is accessed thoroughly.
 - a. True
 - b. False
- 21. If dressing is loose, you should reinforce it with tape until the next scheduled dressing change.
 - a. True
 - b. False
- 22. Central venous catheter infections are preventable by focusing on proper insertion techniques, proper maintenance and care, and removing the catheter if no longer indicated.

a. True

b. False

23. The two common sources of CVC infections are from patient's skin flora and health workers hands.

a. True

b. False

24. Mask should be worn for all CVC dressing changes before the dressing is removed

a. True

b. False

25. Transparent dressing should be changed every 48 hours.

a. True

b. False

Appendix B: Nurse Demographic Sheet

Years of experience as dialysis nurse				
Current age				
Education level, e.g. Basic Diploma in general nursing	g, Nephrolo	gy nursing Diploma	, BSN, other,	
Male or Female (Please Circle)				
Amount of working hours daily				
Patient staff ratio				
Infection control training course (Please Circle)	yes	No		

Appendix C: Donabedian Model and Nurses' Knowledge Regarding CVC Maintenance Care



Figure 1. Donabedian's Structure-Process-Outcome Health Framework. Adapted from "Retrospective Study Of Medical Malpractice And Safety Comparing Physician Assistants To Physicians And Advanced Practice Nurses", by Jeffrey G. Nicholson, 2008, Doctoral Dissertation, P. 45. Copyright 2014 obtained from American Academy of Physician Assistants.

Appendix D: Permission To Use Donabedian Health Model

Dec 4
ints
d to it, if any) is ly for the addressee. are not the intended aken, or omitted to lf you have received is message (and the i may have created ou.
<u>com</u> >
PA Experts' from
oedian's health

Appendix E: Signed Approval From The Ministry Of Health In Oman

Sultanate of Oman	يت المنت الت
Ministry of Health	وَزَلْرَقَ لَلْتَحْجَتَتْنَ
Directorate General of Planning 🛛 🥕 📏	المنتغريتين ولعصا يمنا والتخطيط
and Studies	والبرراسات
RefMH/DGP/R&S/PROPOSAL_APPROVED/19/2014	لارتخف
Date : 15.09.2014	المظاريخ.
Dr. Mohammed Jawad Kadium Princinal Investigator	اللولوفي .
Infection Rates in Catheter-dependent Hemodialysis Patie After compliments	nts "
We are pleased to inform you that your research propos Educational Program on Nurses' Knowledge and Info dependent Hemodialysis Patients " has been approved by F and Approve Committee, Ministry of Health.	al " The Influence of an ection Rates in Catheter- tesearch and Ethical Review
We are pleased to inform you that your research propos Educational Program on Nurses' Knowledge and Info dependent Hemodialysis Patients " has been approved by F and Approve Committee, Ministry of Health. Regards,	al " The Influence of an ection Rates in Catheter- tesearch and Ethical Review
We are pleased to inform you that your research propos Educational Program on Nurses' Knowledge and Infe dependent Hemodialysis Patients " has been approved by F and Approve Committee, Ministry of Health. Regards, Dr. Ahmed Mohamed Al Qasimi Dr. Ahmed Mohamed Al Qasimi	al " The Influence of an ection Rates in Catheter- tesearch and Ethical Review
We are pleased to inform you that your research propose Educational Program on Nurses' Knowledge and Info dependent Hemodialysis Patients " has been approved by F and Approve Committee, Ministry of Health. Regards, Dr. Ahmed Mohamed Al Qasteri Director General of Planning and Studies Chairman, Research and Ethical Review and Approve Com Ministry of Health, Sultanate of Oman.	al " The Influence of an ection Rates in Catheter- tesearch and Ethical Review
We are pleased to inform you that your research propose Educational Program on Nurses' Knowledge and Infe dependent Hemodialysis Patients " has been approved by F and Approve Committee, Ministry of Health. Regards, Dr. Ahmed Mohamed Al Qasuai Director General of Planning and Studies Chairman, Research and Ethical Review and Approve Com Ministry of Health, Sultanate of Oman. Ce Day file	al " The Influence of an ection Rates in Catheter- tesearch and Ethical Review
We are pleased to inform you that your research propose Educational Program on Nurses' Knowledge and Infe dependent Hemodialysis Patients " has been approved by F and Approve Committee, Ministry of Health. Regards, Dr. Ahmed Mohamed Al Qasuai Director General of Planning and Studies Chairman, Research and Ethical Review and Approve Co Ministry of Health, Sultanate of Oman. Ce Day file	al " The Influence of an ection Rates in Catheter- tesearch and Ethical Review
We are pleased to inform you that your research propose Educational Program on Nurses' Knowledge and Info dependent Hemodialysis Patients " has been approved by F and Approve Committee, Ministry of Health. Regards, Dr. Ahmed Mohamed Al Qasuai Director General of Planniag and Studies Chairman, Research and Ethical Review and Approve Com Ministry of Health, Sultanate of Oman. Ce Day file	al " The Influence of an ection Rates in Catheter- tesearch and Ethical Review
We are pleased to inform you that your research propose Educational Program on Nurses' Knowledge and Infe dependent Hemodialysis Patients " has been approved by F and Approve Committee, Ministry of Health. Regards, Dr. Ahmed Mohamed Al Qasuai Director General of Planning and Studies Chairman, Research and Ethical Review and Approve Com Ministry of Health, Sultanate of Oman. Ce Day file	al " The Influence of an ection Rates in Catheter- tesearch and Ethical Review

Appendix F: Consent Form

All registered dialysis nurses who had completed the orientation period in the hemodialysis unit are invited to take part in the study of **An Education Intervention to Improve Nurses' Knowledge to Reduce Catheter-Related Bloodstream Infection in Hemodialysis Unit**.

This study is being conducted by an investigator named Mohammed Jawad Kadium, who is a doctoral student at Walden University USA. You may know Mohammed Jawad Kadium, a Senior Consultant in the nursing sciences at the Ministry of Health, but this study is entirely separate from that role.

Background Information:

The purpose of this educational project is to evaluate the effectiveness of educating registered dialysis nurses regarding central venous catheter (CVC) maintenance care in order to reduce catheter-related bloodstream infection (CRBSI) in a hemodialysis unit.

Procedures:

If you agree to be in this study, you will be asked to:

- 1. Participate in a 5-minute a voluntary survey to provide demographic data
- 2. Answer a 25-question knowledge-based pretest
- 3. Attend one-hour lecture
- 4. Complete the 25-page education self-study module
- 5. Answer a 25-question knowledge-based posttest

Bausher Hemodialysis Center is responsible to oversee the quality of lecture and self-study module. Topics that will be covered in the pretest, posttest, and self-study module include (a) the epidemiology of catheter-related bloodstream infection, (b) aseptic technique; the use of maximal barrier precautions during CVC maintenance care, (c) the need to avoid femoral insertion sites, (d) proper technique for obtaining blood cultures, and (e) guidelines for changing dressing.

The education program will consist of a one-hour lecture and the administration of the self-study module. The study will be conducted in three phases. Phase I will include the informed consent distribution, collecting the demographic data, and assessment of nurses' knowledge regarding CVC maintenance care (pre-intervention). Phase II will include the participants receive a lecture, and the self-study module, overseen by Bausher Hemodialysis Center (intervention). The participants will read the self-study module and complete it, the duration of this phase will be 30-days to allow participants sufficient time for completing the self-study module. Phase III will include the assessment of nurses' knowledge regarding CVC maintenance care after the education intervention. The pre-post test that will run for the conference room in a hemodialysis unit. The allocated time of the test will be 30 minutes. The participants will be allowed 30 minutes of their working hours; their patients and other duties will be assigned to other staff while they are taking the test. This will be organized by the manager of the dialysis unit.

Voluntary Nature of the Study:

This study is voluntary. Everyone will respect your decision of whether or not you choose to be in the study. No one at hemodialysis unit will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:

Being in this study would not pose a risk to your safety or wellbeing. The results of the study may help improve registered dialysis nurses' knowledge to reduce catheter-related bloodstream infection in a hemodialysis unit.

Payment:

There is no payment for participation in the study.

Privacy:

Any information you provide will be kept confidential. The investigator will not use your personal information for any purposes outside of this project. In addition, the investigator will not include your name or anything else that could identify you in the study reports. Data will be kept secure by codes with numbers and entered without any verifying information into a computerized database available only to the investigator. The consent forms will be maintained in a locked file cabinet. Data will be kept for a period of at least five years as required by the university.

Contacts and Questions:

You may ask any questions you have now. Or if you have questions later, you may contact the investigator via 99840288. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University

representative who can discuss this with you. Her phone number is 001-612-312-1210. Walden University's approval number is 04-10-15-0420516 and it expires April 9, 2016.

Statement of Consent:

I have read the above information, and I feel I understand the study well enough to make a decision about my involvement.

Name of Subject Date of Consent Signature of Subject
