Nurses' Practices Toward Applying Infection Control Measures Using NOTICE Checklists at a Dialysis Unit

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Background: *Patients on maintenance hemodialysis therapy and health-care providers at unique, complex units such as hemodialysis outpatient clinics are susceptible for health care-associated infection. Nurses' compliance to follow infection control measures reduces transmission of infection.* **Aim:** *The study aimed to evaluate the nurses' practices toward applying infection control measures at a dialysis unit.* **Methods and Design:** *A cross-sectional study was applied to evaluate nurses' performance toward application of infection control measures using National Opportunity to Improve Infection Control in End-stage renal disease (NOTICE) checklists at a dialysis unit in Beni-Suef City, Egypt.* **Results:** *The overall nurses' performance regarding infection control at enrolled dialysis units were: the percentage of all NOTICE checklists demonstrated that half of nurses had met most steps for checklist #1c Access of AV Fistula or Graft for Initiation of Dialysis (55.87%), ICE Checklist #2: Parenteral Medication Preparation and Administration (48.13%), and ICE Checklist #3b: Access of AV Fistula or Graft for Termination of Dialysis and Post Dialysis Access Care (48.1%); the lowest level of performance found was ICE Checklist #1b: Central Venous Catheter (CVC) Exit Site Care (22.8%). In addition, the first and second observations noticed that nurses ignore hand hygiene, and were not committed to wearing clean gloves as needed.* **Conclusion:** *Based on the findings of this study, using of NOTICE assessment checklists and highlighting the importance of developing and following strict infection control systems at dialysis units focuses on nursing staff to prevent infection transmission especially, with chronic patients on maintenance hemodialysis therapy.*

Keywords: NOTICE; infection control; dialysis unit; Egypt

INTRODUCTION

The prevalence of patients with end stage renal disease (ESRD) on maintenance hemodialysis (HD) therapy is growing worldwide. In Egypt, the estimated annual incidence of ESRD is around 74 per million and the total prevalence of patients on dialysis is 264 per million. Patients on maintenance HD therapy are receiving three dialysis sessions per week, and each session duration is 4 hours. The average dialysis session cost depends on the health-care setting, with ranges from US $16 in government hospitals and around US$32 in the private sector. Each Egyptian center equipped with machines, synthetic membranes, and most of many centers using bicarbonate buffer. Definitely, all centers including private and government health care setting are under supervision of Egyptian Ministry of Health (MOH; Afifi & Karim, 1999; Barsoum, 2002; Ibrahim, 2010).

HD units are considered as unique unlike the general words at hospital. The risks of infection are increased because of the characteristics of

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patients, such as sharing dialysis machine which has a major role in the transmission of viral infection and sharing health care provider among patient at the same time (Hussein & Mooij, 2010; Sartor et al., 2004). Patients on maintenance HD therapy, and staff as well, are susceptible to healthcare-associated infections (HAIs) related to exposure to invasive therapeutic procedures (Karkar, 2018). Karkar, Bouhaha, and Dammang (2014) reported that the risk factors among patients on HD therapy that may increase the occurrence of HAIs included immune compromised status, invasive HD therapy which included prolonged blood exposure through vascular access and extracorporeal circuit, setting of patients close to each other while receiving dialysis session and between HD machines, frequent hospitalization and surgery, and the most importantly noncompliance of health care provider to follow infection control measures throughout practices.

World Health Organization (WHO), Centers for Diseases Control and Prevention (CDC), and Associated of Professionals in Infection Control (APIC) address the best practice for infection control at dialysis unit based on several evidence guidelines and recommend multiple safety measures such as hand hygiene, use of personal protective equipment (PPE), injection safety, handling patients' items, cleaning and disinfecting the external surface of dialysis, and the surrounding environment (Association for Professionals in Infection Control and Epidemiology [APIC], 2010; Centers for Disease Control and Prevention [CDC], 2016; WHO, 2012). Definitely, hand washing is one of the safety measures at a dialysis unit that can protect the patient on dialysis setting against infection, because patients on HD therapy are vulnerable to infections such as hepatitis B virus (HBV), hepatitis C virus (HVC), and human immunodeficiency virus (HIV) resulting from malpractice of proper hand hygiene, contaminated dialysate and equipment, or disinfection of machines and beds (Mashragi et al., 2014).

The infection control measures in healthcare settings by following specific guidelines at unique, complex units such as dialysis units should be implemented. Unfortunately, no Egyptian guidelines to standardize the practice of HD are available in Egypt (Ibrahim, 2010). Additionally, the international guidelines may not be applicable or suitable for Egypt because of different health system and unavailability of resources in Egypt. Thus, Ahmed et al. (2010) developed practice guidelines for HD in Egypt, and set Egyptian guidelines to standardize the practice at dialysis units, furthermore highlighted specific steps for following meticulous infection control measures at the dialysis unit.

Applying of infection control measures at dialysis unit is not evaluated or documented. The literature reported that nurses' knowledge is deficient and their performance is significantly related to their attitudes; furthermore, nurses should adhere to infection control practices (Al Qahtani & Almetrek, 2017). Nurses play an important role at the dialysis unit; they are the key healthcare givers responsible for applying the main principles of infection control throughout all skills. Furthermore, an application of infection control measures reflects their attitude based on powerful knowledge toward infection control principles. Nurses need to ensure that they provide a high standard of care by carrying out meticulous infection control measures in order to deliver safe and effective care for patients on maintenance HD therapy. Patients on maintenance HD therapy are vulnerable to HAIs, and the following of infection control measures by nurses is very important in prevention (Scheithauer et al., 2012). This study evaluated nurses compliance on applying infection control measures at a dialysis unit.

METHOD

Aim
The study aimed to evaluate the nurses' practices toward applying infection control measures at a dialysis unit.

Research Design
A cross-sectional study was applied.

Study Setting and Participants
This study was conducted in the HD unit at central Ehnasa' government hospital, Beni-Suef City from November 2016 to January 2017. All nurses who worked at the dialysis unit were included.

Measures and Measurements
Sociodemographic Variables. Nurses' sociodemographic data which included age, years of experience, working hours, job satisfaction were collected by a self-developed tool.

Practice of Infection Control Measures. Nurses' practice of infection control were measured by using National Opportunity to improve infection control in end stage renal disease (NOTICE) checklists (Health Research & Educational Trust, University of Michigan Kidney Epidemiology and Cost Center, Renal Network of the Upper Midwest, 2014). The NOTICE included eight checklists covering the following aspects:

- **Treatment Initiation:** (Checklist #1c Access of AV Fistula or Graft for Initiation of Dialysis, Checklist #1a: Access of Central Venous Catheter [CVC] for Initiation of Dialysis, Checklist #1b: CVC Exit Site Care).
- **Medication Administration** (Infection control evaluator [ICE] Checklist #2: Parenteral Medication Preparation and Administration).
- **Treatment Termination (**ICE Checklist #3a: Access of CVC for Termination of Dialysis, ICE Checklist #3b: Access of AV Fistula* or Graft for Termination of Dialysis and Post Dialysis Access Care).
- **Cleaning and Disinfection (**IICE Checklist #4: Cleaning and Disinfection of the Dialysis Station).
- **Dialysis Supply Management and Contamination Prevention** (ICE Checklist #5: Dialysis Supply Management and Contamination Prevention).

Ethical Considerations
This study was approved by the Ehnasa' government hospital, Beni-Suef City, oral verbal consent of the nurses was obtained prior to the administration of the questionnaire. The head nurse and nursing staff were informed about purpose of the study, the volunteer principle, the right to refuse to participate, and that all information was kept confidential.

Statistical Analysis
The Statistical Package for Social Sciences (SPSS ver.22) was used for data entry and analysis. Descriptive statistics in the form of frequencies and percentage were used to describe the met and unmet nurses' performance level.

RESULTS
Characteristics of the Participants
All nurses (17 nurses) working at the dialysis unit participated in the study. All nurses were female and held a diploma degree. More than two-thirds of the study sample were aged between 25 and 30 years old. Years of their experience ranged from 1 year to 12 years, with one-third of the study sample having experience between 1 and 3 years and around 40% having experience from 9 to 12 years. Furthermore, more than 75% were not satisfied with their job. Figure 1 presents the characteristics of the participants.

Practice of Infection Control Measures
Figure 2 illustrates the practice of infection control measures. In the first and second observation, nurses had noncompliance to perform hand hygiene before starting a procedure. Most of them assembled supplies beside the patients' bed or chair, all nurses washed patients' skin over the AV fistula, most nurses located the cannulation site but at the same puncture point which might result in re-cannulation.

Figure 1.   Nurses demographic data.
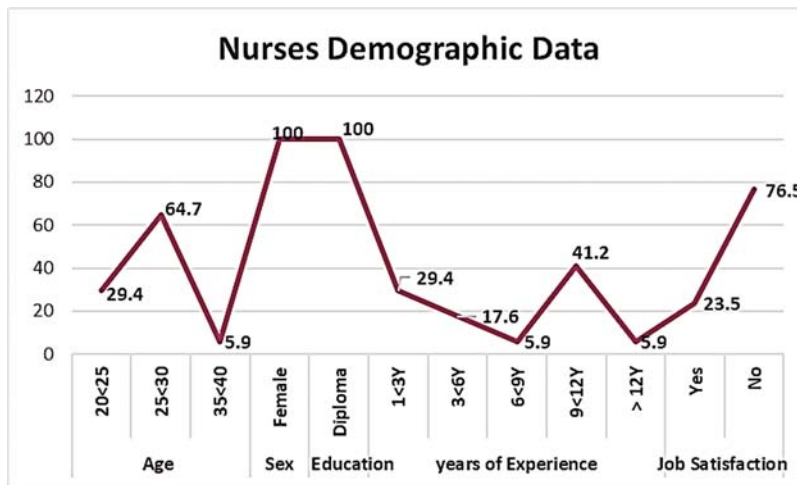
Figure 2.   Checklist #1c access of AV fistula or graft for initiation of dialysis.
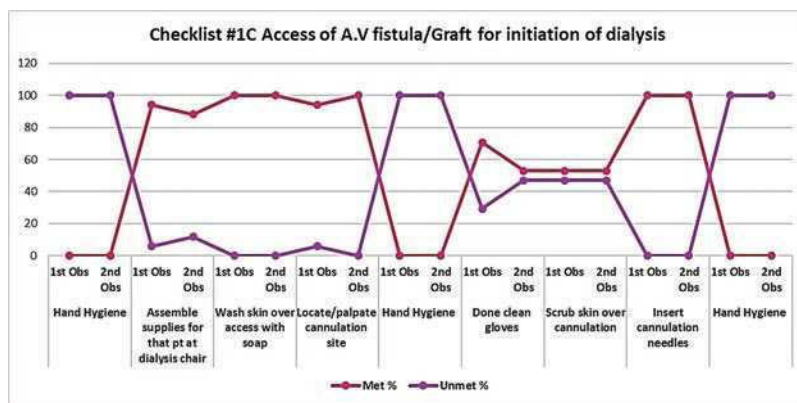

Figure 3 describes the nurses' performance at the initiation of treatment via access of CVC. Hand hygiene was completely ignored before, during, and after the procedure, all nurses assembled supplies before the procedure, and only 40% donned clean gloves and placed a clean waterproof sheet under the CVC port. Unfortunately, no scrubbing of exterior CVC hubs was reported. All nurses removed port caps, and only 41% connected sterile syringes.

Figure 4 shows the CVC exit site care. The only step that seems obligatory is assembling supplies to perform the procedure, and around 41% of nurses donned clean gloves and applied antimicrobial ointment.

Figure 5 illustrates the nurses' performance regarding parenteral medication administration. The first and second observations showed that all nurses assembled supplies, used single dose only for one patient and then discarded it. Multiple dose vials were only entered with a new, empty sterile syringe and needle and discarded within 48 days, and one vial of each medication was opened at a time. Syringes were discarded into sharps-containers.

For the termination of treatment for patients who had CVC, approximately half of the study sample assembled supplies and placed clean field under the CVC port and discarded unused supplies, and removed gloves. Furthermore, around two-thirds

Figure 3.   Infection control evaluator (ICE) checklist #1a: Access of central venous catheter (CVC) for initiation of dialysis.
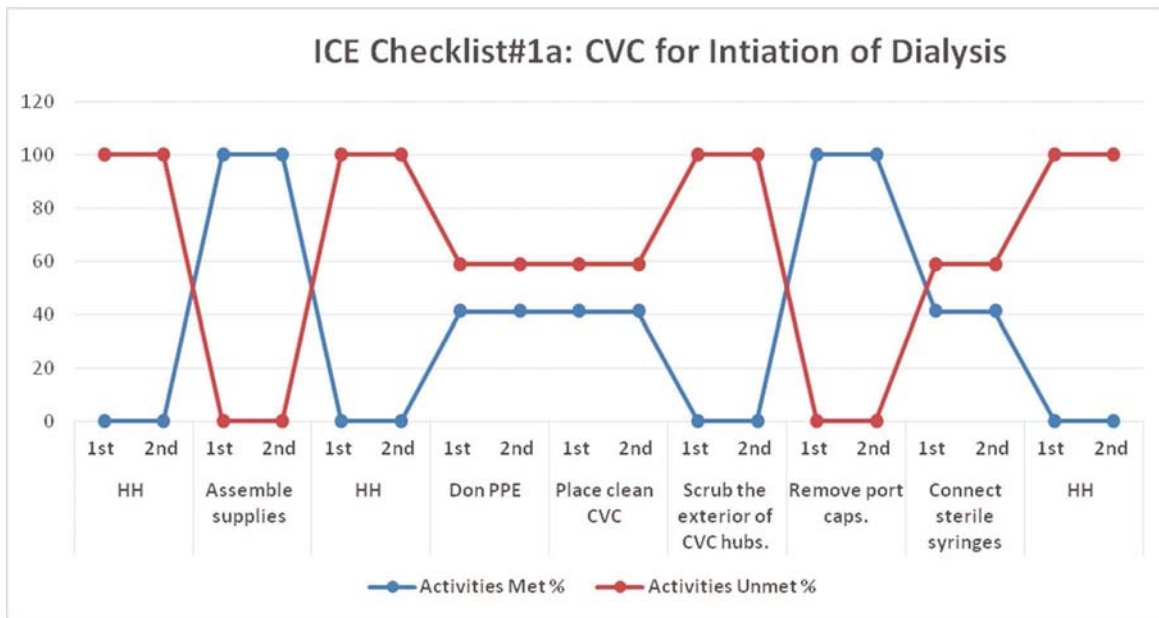
Figure 4.   Infection control evaluator (ICE) checklist #1b: Central venous catheter (CVC) exit site care.
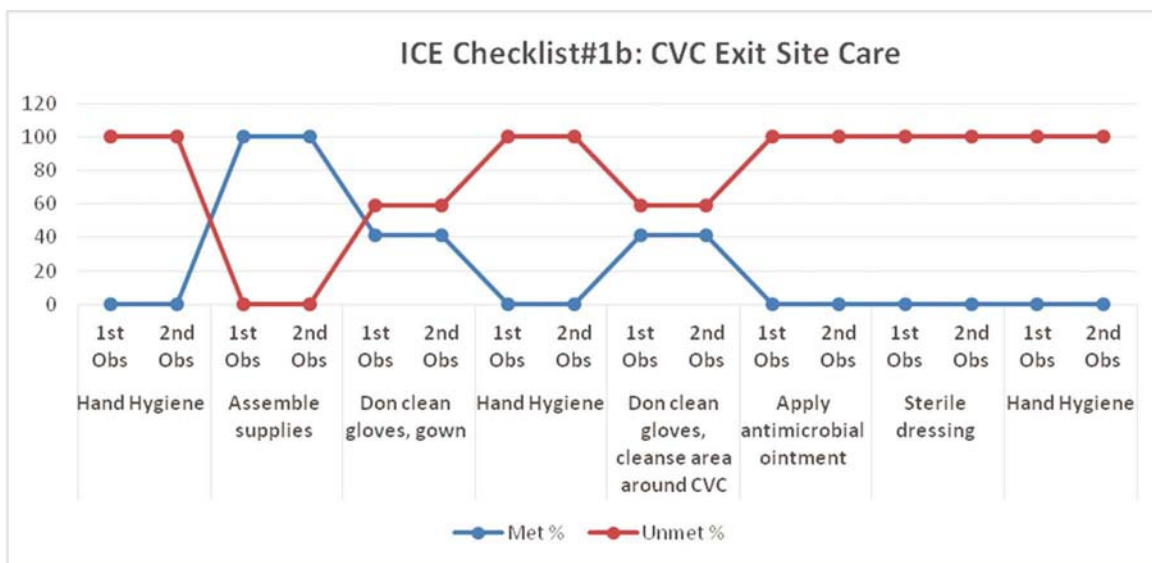
of the study sample reinfused extracorporeal circuit, removed gloves, donned clean gloves, and scrubbed the exterior of the CVC hub with antiseptic. Unfortunately, all of them ignored hand hygiene.

Likewise, in the termination process of the dialysis session for patients who had AV fistula and graft and post dialysis session care, all nurses reinfused extracorporeal circuit, removed gloves, and discarded unusual supplies. Furthermore, more than half of the study sample donned clean gloves while removing the needle. Two-thirds of the study sample replaced any blood-soiled bandages on the needle site (Figure 6).

Figure 5. (a) Infection control evaluator (ICE) checklist #2: Parenteral medication preparation and administration. (b) Infection control evaluator (ICE) checklist #3a: Access of central venous catheter (CVC) for termination of dialysis.
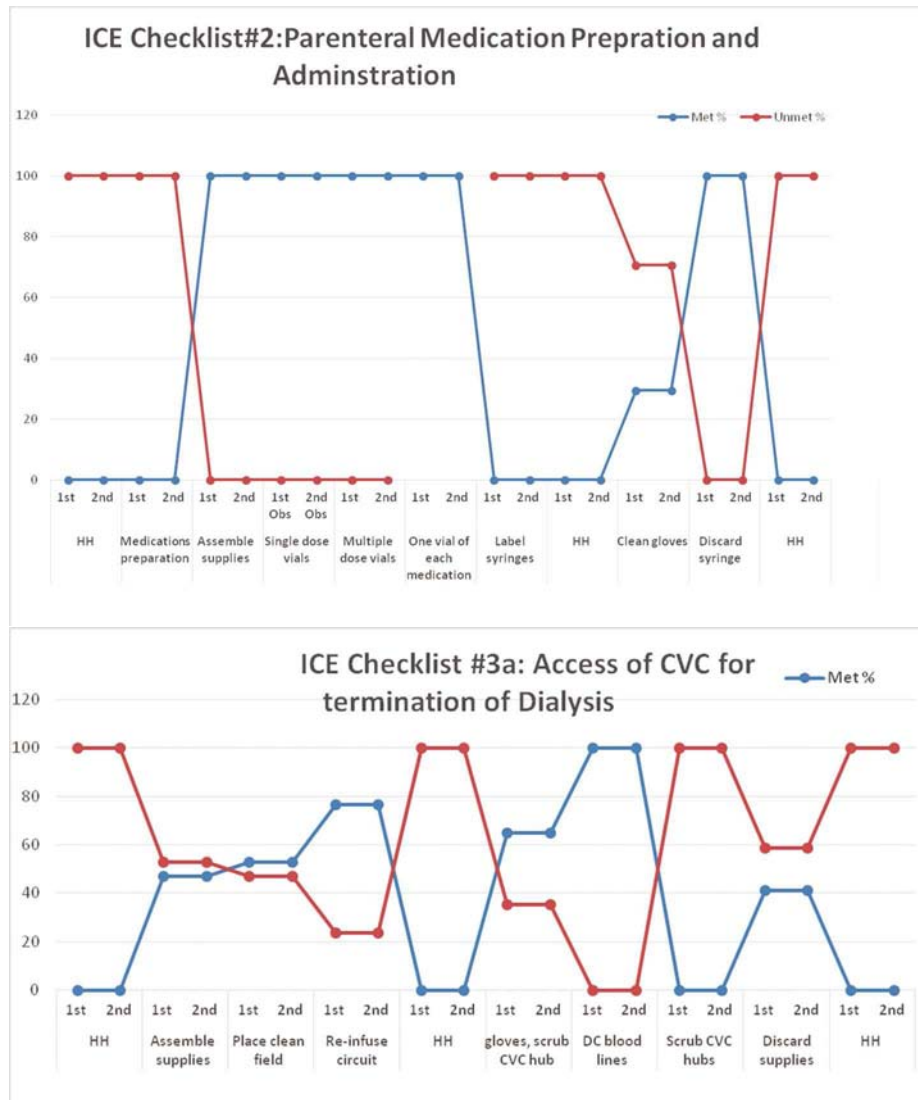

Figure 7 illustrates the cleaning and disinfection of the dialysis station and shows that all nurses disinfected the dialysis machine and emptied the prime waste receptacle, and discarded cloth/wipes, removed gloves; moreover, more than two-thirds disinfected the patients' chair and around chair; only 47% wiped all machine sides.

Figure 8 illustrates the nursing performance regarding dialysis supply management and contamination prevention. The findings showed that all nurses kept all supplies at the designated clean area and two-thirds of the study sample didn't bring the supplies of the next patient to the station. One-third of the nursing staff did not keep patients' supplies in their pocket.

Figure 9 shows the percentage of NOTICE checklists and the figure demonstrates that half of nurses had met most of steps described in checklist #1c: access of AV fistula or graft for
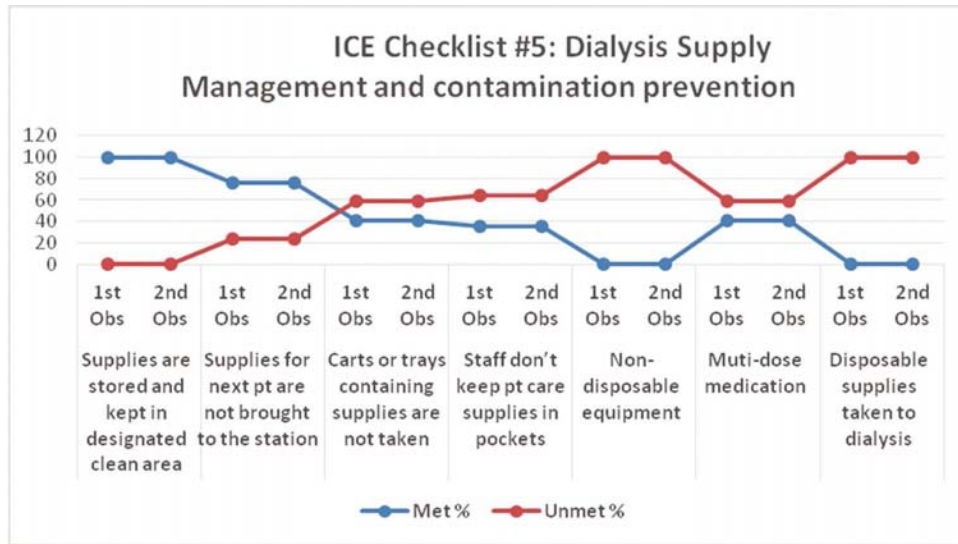
Figure 6. Infection control evaluator (ICE) checklist #3b: Access of AV fistula or graft for termination of dialysis and post dialysis access care.
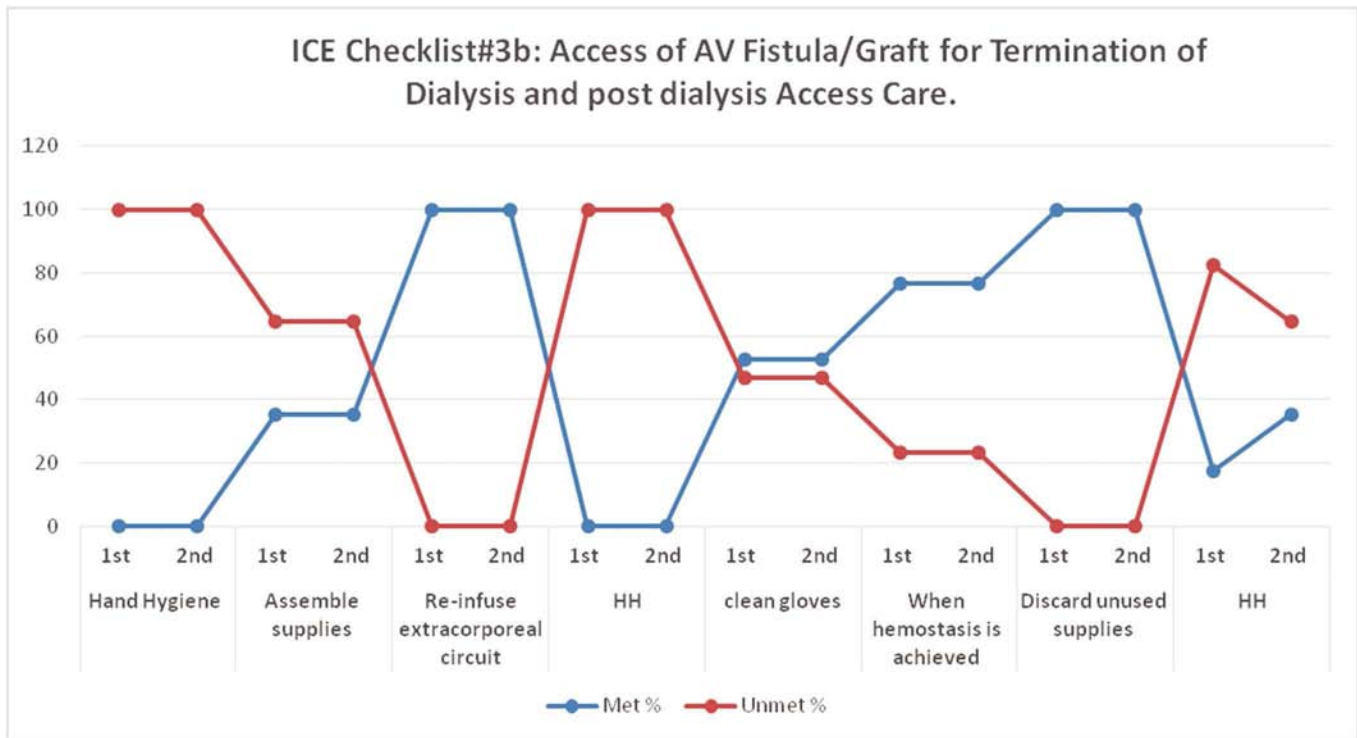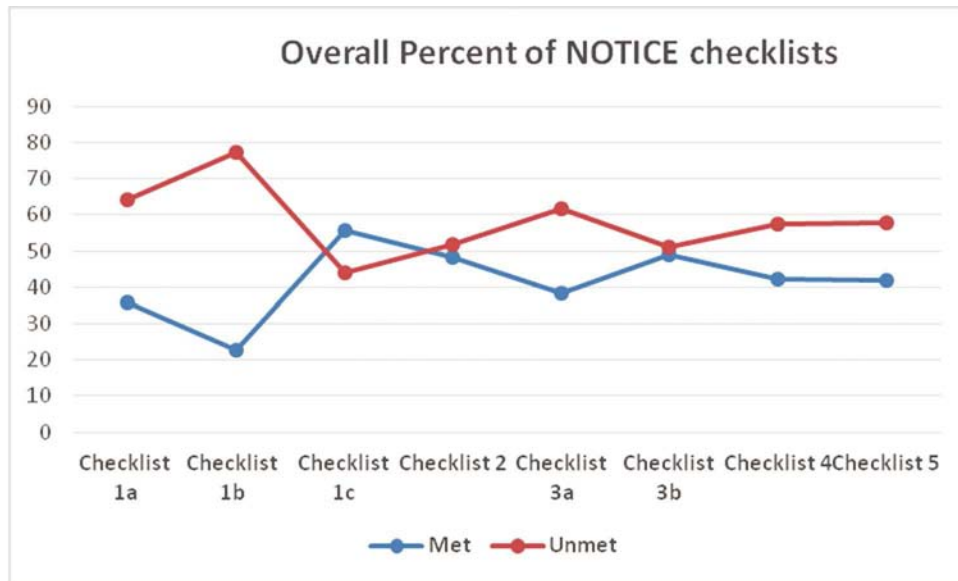

Figure 7. Infection control evaluator (ICE) checklist #4: Cleaning and disinfection of the dialysis station.
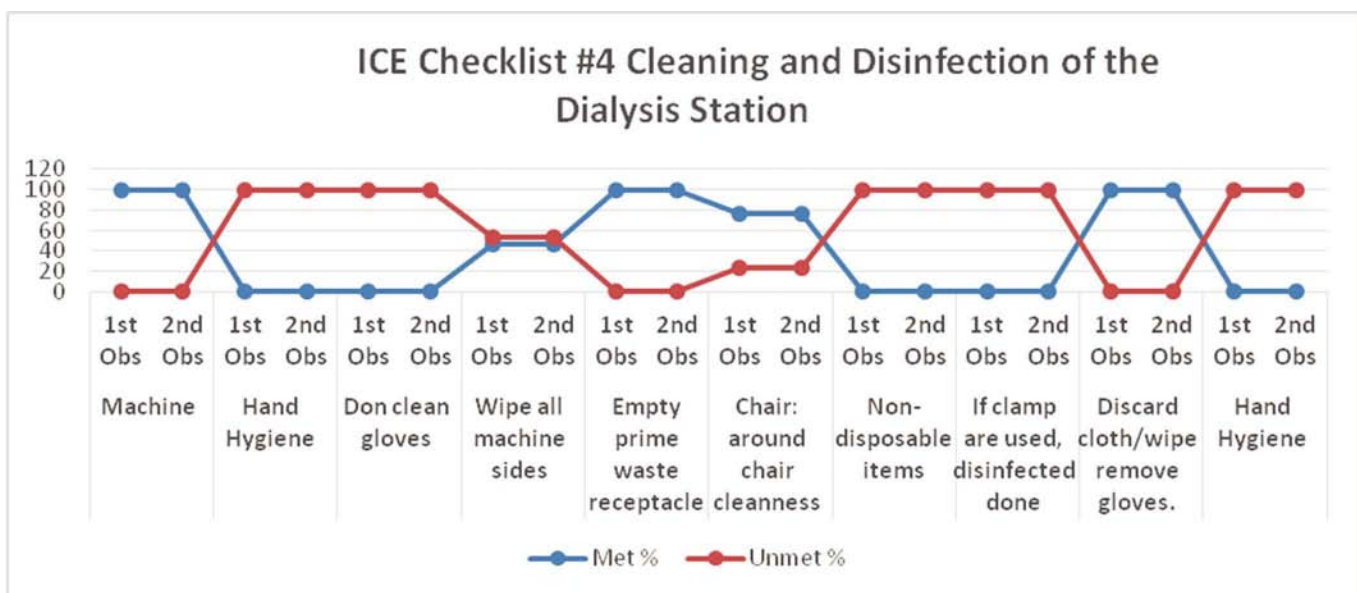
Figure 8. Infection control evaluator (ICE) checklist #5: Dialysis supply management and contamination prevention.

Figure 9. Overall percent of NOTICE checklists.

initiation of dialysis (55.87%), and ICE checklist #2: Parenteral medication preparation and administration (48.13%), ICE checklist #3b: Access of AV fistula or graft for termination of dialysis and post dialysis access care (48.1%). The lowest level of performance found was ICE checklist #1b: CVC exit site care (22.8%).

DISCUSSION

Practice guidelines were developed in Egypt by Ahmed et al. (2010) and emphasized the dialysis procedure as a whole and the measure of the infection control application via assessing nurses' performance throughout the treatment process once a patient was admitted to a

dialysis session for connection until termination of the dialysis session by using NOTICE checklists.

Infection is considered the second highest cause of mortality among patients on maintenance HD therapy (Karkar et al., 2014). However, nurses have noncompliance in applying infection control measures at the dialysis unit, which could cause harmful consequences for both nurses and patients who are maintaining HD therapy. The WHO established guidelines on hand hygiene in healthcare (WHO, 2009). Literature showed that the major route of transmission of HAIs is through transiently contaminated hands of the healthcare providers (Duckro, Blom, Lyle, Weinstein, & Hayden, 2005; Kamp & Kramer, 2004; Shimokura, Weber, Miller, Wurtzel, & Alter, 2006). In the present study, the compliance rate of hand hygiene throughout the dialysis procedure was very low, and nurses ignored hand hygiene in the initiation of treatment either via access of CVC or AV fistula/graft. These findings support the results of Duong and McLaws (2017), who reported the hand hygiene compliance rate was low throughout dialysis procedures. Moreover, Boyce, Pittet, Healthcare Infection Control Practices Advisory Committee, and HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force (2002) identified hand hygiene as the most important infection control measure and highlighted that the compliance rate of healthcare workers at dialysis units was very poor. Moreover, a most recent study done on 18 units in Egypt by Khamis, Yasina, Omaraa, and Salehb (2018) found that the medical team doesn't carry out proper and sufficient hand washing. On the other hand, a recent study done in Saudi Arabia which evaluated nurses' knowledge, attitude, and practice of nurses in renal dialysis units regarding infection control found that 15% to 18% of the total sample did not always comply with hand hygiene (Al Qahtani & Almetrek, 2017).

The barriers to compliance with hand hygiene may include too much time spent on demonstrating hand hygiene, shortage of staff, patient overcrowding, limited resources, and lack of awareness (Le, Lehman, Nguyen, & Craig, 2019).

Nurses in the current study were observed two consecutive times and around 40% of them wore clean gloves during initiation of the dialysis session either with a patient with AV fistula or CVC. This finding is similar to the study done by Girou et al. (2008) who found that 33% of nurses removed gloves after providing patient care. Based on clinical practice guidelines for vascular access, gloves should be changed at any time during the cannulation procedure (CDC, 2014).

Hospital-acquired infections are transmitted by contaminated environmental surfaces with different pathogens on surfaces (Vascular Access Work Group, 2006). The disinfection of dialysis machines between patient usage is recommended at the beginning and/or at the end of the day (CDC, 2011). Szewczyk, Grzeszczuk, Walski, Suder, and Komorowska (2013) recommended the disinfection of the dialysis machine should be done after each dialysis session or after every 72 hours' break in working. In the present study, all nurses cleaned and disinfected the dialysis station and the dialysis machine. Nonetheless, only 47% wiped all machine sides.

Regarding parenteral medication administration, all nurses assembled supplies, used a single dose only for one patient and discarded it, multiple dose vials were only entered with a new, empty sterile syringe and needle, and discarded within 48 days, and one vial of each medication was opened at a time, and the syringe was discarded into a sharps-container. Rebmann and Branes (2011) highlighted that parental medication should be prepared in a clean area, and not at the same patient area.

Overall, the total score of NOTICE checklists showed that the steps with the highest compliance rate were reported during initiation of treatment via AV fistula or graft, meanwhile, the lowest level was illustrated with CVC exit site care. Unlike to the current study, Chenoweth et al. (2015) reported good performance for all steps, but the highest level of performance was during the AV fistula access practices at treatment initiation.

Limitation of the Study
Limitations of the study included cross-sectional study design, small sample size, and limited resources.

CONCLUSION

Nurses are playing a crucial role at complex unique units such as dialysis units, and in providing holistic nursing care using advanced technology to care for patients with comorbid conditions. Because healthcare providers and patients are vulnerable to infection contamination, all healthcare providers, especially nurses, should follow meticulous infection control measures. Based on the finding of this study, using NOTICE assessment checklists could help nursing staff to follow strict infection control systems at dialysis units to prevent infection transmission among patients on maintenance HD therapy.

RECOMMENDATIONS

- Design evidence-based nursing practices training program for nurses to promote patient-centered care and improve quality of care.
- Hang posters with steps of hand rubbing and glove pyramid to reduce the risk of cross transmission among patients on maintenance HD therapy.
- Establish follow-up system at dialysis unit to ensure application of all infection control procedures.

References

Afifi, A., & Karim, M. A. (1999). Renal replacement therapy in Egypt: First annual report of the Egyptian Society of Nephrology. *Eastern Mediterranean Health Journal*, *5*, 1023–1029.

Ahmed, A. M. A., Mohd, F. A., Habil, E. S., Metwally, A. M., Ibrahiem, N. A., Radwan, M., . . . Gadallah, M. A. (2010). Development of practice guidelines for hemodialysis in Egypt. *Indian Journal of Nephrology*, *20*(4), 193–202. doi:10.4103/0971-4065.73450

Al Qahtani, S. A., & Almetrek, A. M. (2017). Knowledge, Attitudes and Practice of Nurses in Renal Dialysis Units Regarding Infection Control in Abha City – Saudi Arabia, 2015. *The Egyptian Journal of Hospital Medicine*, *66*, 103–114. doi:10.12816/0034640

Association for Professionals in Infection Control and Epidemiology. (2010). *Guide to the elimination of infections in hemodialysis*. Electronic version. Retrieved from http://apic.org/Resource_/EliminationGuideForm/7966 d850-0c5a-48ae-9090-a1da00bcf988/File/AP IC-Hemodialysis.pdf

Barsoum, R. S. (2002). End-stage renal disease in the developing world. *Artificial Organs*, *26*, 735–736. doi:10.1046/j.1525-1594.2002.00916.x

Boyce, J. M., Pittet, D., Healthcare Infection Control Practices Advisory Committee, & HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. (2002). Guideline for hand hygiene in health-care settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/ APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America. *MMWR Recommendations and Reports*, *51*, 1–45. doi:10.1086/503164

Centers for Disease Control and Prevention. (2011). *Guide to infection prevention for outpatient settings: Minimum expectations for safe care*. Retrieved from

https://www.cdc.gov/hai/settings/outpatient/outpatient-care-guidelines.html

Centers for Disease Control and Prevention. (2014). *Hepatitis C FAQs for the public*. Retrieved from http://www.cdc.gov/hepatitis/C/cFAQ.htm

Center for Disease Control and Prevention. (2016). *Dialysis safety. Guidelines and recommendations*. Electronic version. Retrieved from http://www.cdc.gov/dialysis/

Chenoweth, C. E., Hines, S. C., Hall, K. K., Saran, R., Kalbfleisch, J. D., Spencer, T., . . . Messana, J. M. (2015). Variation in infection prevention practices in dialysis facilities: Results from the national opportunity to improve infection control in ESRD (End-Stage Renal Disease) project. *Infection Control & Hospital Epidemiology*, *36*(7), 802–806. doi:10.1017/ice.2015.55

Duckro, A. N., Blom, D. W., Lyle, E. A., Weinstein, R. A., & Hayden, M. K. (2005). Transfer of vancomycin resistant enterococci via healthcare worker hands. *Archives of Internal Medicine*, *165*, 302–307. doi:10.1001/archinte.165.3.302

Duong, M. C., & McLaws, M. L. (2017). Dangerous practices in a hemodialysis unit in Vietnam identify from mixed methods. *BMC Infectious Diseases*, *17*(1), 181. doi:10.1186/s12879-017-2290-3

Girou, E., Chevaliez, S., Challine, D., Thiessart, M., Morice, Y., Lesprit, P., . . . Pawlotsky, J. M. (2008). Determinant roles of environmental contamination and noncompliance with standard precautions in the risk of hepatitis C virus transmission in a hemodialysis unit. *Clinical Infectious Diseases*, *47*(5), 627–633. doi:10.1086/590564

Health Research & Educational Trust, University of Michigan Kidney Epidemiology and Cost Center, Renal Network of the Upper Midwest, Inc. (Network 11). (2014). *National opportunity to improve infection control in ESRD*. Retrieved from https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patient-safety-resources/resources/esrd/finalreportphase1.pdf

Hussein, M. M., & Mooij, J. M. (2010). Methods used to reduce the prevalence of hepatitis C in a dialysis unit. *Saudi Journal of Kidney Disease and Transplantation*, *21*, 909–913.

Ibrahim, S. (2010). Quality of care assessment and adherence to the international guidelines considering dialysis, water treatment, and protection against transmission of infections in university hospital-based dialysis units in Cairo, Egypt. *Hemodialysis International*, *14*, 61–67. doi:10.1111/j.1542-4758.2009.00398.x

Kamp, G., & Kramer, A. (2004). Epidemiologic background of hand hygiene and evaluation of the most important agents for scrubs and rubs. *Clinical Microbiology Reviews*, *17*, 863–893. doi:10.1128/CMR.17.4.863-893.2004

Karkar, A. (2018). Infection control guidelines in hemodialysis facilities. *Kidney Research and Clinical Practice*, *37*(1), 1–3. doi:10.23876/j.krcp.2018.37.1.1

Karkar, A., Bouhaha, B. M., & Dammang, M. L. (2014). Infection control in hemodialysis units: A quick access to essential elements. *Saudi Journal of Kidney Disease and Transplantation*, *25*(3), 496–519. doi:10.4103/1319-2442.132150

Khamis, S. S. A., Yasina, Y. S., Omaraa, M. M., & Salehb, N. E. N. (2018). Safety measures in Dakhlia hemodialysis units. *Menoufia Medical Journal*, *31*(2), 429–437.

Le, C. D., Lehman, E. B., Nguyen, T. H., & Craig, T. J. (2019). Hand hygiene compliance study at a large central hospital in Vietnam. *International Journal of Environmental Research and Public Health*, *16*(4), 607. doi:10.3390/ijerph16040607

Mashragi, F., Bernstein, R. S., Al-Mazroa, M., Al-Tawfiq, J. A., Filemban, S., Assiri, A., . . . Memish, Z. A. (2014). HIV transmission at a Saudi Arabia hemodialysis unit. *Clinical Infectious Diseases*, *59*, 897–902. doi:10.1093/cid/ciu373

Rebmann, T., Barnes, S. A., & Association for Professionals in Infection Control and Epidemiology. (2011). Preventing infections in hemodialysis: An executive summary of the APIC elimination guide. *American Journal of Infection Control*, *39*, 72–75. doi:10.1016/j.ajic.2010.08.012

Sartor, C., Brunet, P., Simon, S., Tanalet, C., Berland, Y., & Drancourt, M. (2004). Transmission of hepatitis C virus between hemodialysis patients sharing the same machine. *Infection Control & Hospital Epidemiology*, *25*, 609–611. doi:10.1086/502448

Scheithauer, S., Eitner, F., Mankartz, J., Haefner, H., Nowicki, K., Floege, J., & Lemmen, S. W. (2012). Improving hand hygiene compliance rates in the haemodialysis setting: More than just more hand rubs. *Nephrology Dialysis Transplantation*, *27*(2), 766–770. doi:10.1093/ndt/gfr365

Shimokura, G., Weber, D. J., Miller, W. C., Wurtzel, H., & Alter, M. J. (2006). Factors associated with personal protection equipment use and hand hygiene among hemodialysis staff. *American Journal of Infection Control*, *34*, 100–107. doi:10.1016/j.ajic.2005.08.012

Szewczyk, M., Grzeszczuk, K., Walski, T., Suder, M., & Komorowska, M. (2013). Are disinfectant residues remained after cleaning hemodialysis machine procedure safe for patients? *Przegl Lek*, *70*(3), 97–101.

Vascular Access Work Group. (2006). Clinical practice guidelines for vascular access. *American Journal of Kidney Diseases*, *48*(Suppl. 1), S248–S273. doi:10.1053/j.ajkd.2006.04.040

World Health Organization. (2009). *Guidelines on hand hygiene in health care 2009*. Retrieved from http://whqlibdoc.who.int/publications/2009/9789241597906.eng.pdf

World Health Organization. (2012). *Hand hygiene in outpatient and home-based care and long-term care facilities*. Retrieved from https://www.who.int/gpsc/5may/EN_GPSC1_PSP_HH_Outpatient_care/en/