



## Nursing Competency with Vascular Access Care among Hemodialysis Patients in Arab World: A Narrative Review

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### Abstract

**Objective:** To review studies published of Arab World concerning vascular access care by nursing staff among hemodialysis patients.

**Methods:** Electronic databases SCIENCE DIRECT, PUBMED, CINHAI, EBSCO, SCOPUS, and UPTODATE have been searched to identify relevant studies. Initially 20 studies were identified potentially relevant and out of which 6 studies which met the selection criteria were included in the review.

**Results:** Nursing staff need more training, and the available training programs are not of the needed quality.

**Keywords:** Arab patients; Hemodialysis; Vascular access; Nursing staff

### Introduction

CKD is a major health problem worldwide, end stage renal disease need renal replacement therapy, this can be most commonly and at diagnosis by hemodialysis, less frequently by peritoneal dialysis and finally by renal transplantation [1].

In modern clinical medical practice Central Venous Access (CVCs) settle a very crucial roles, those could be to deliver medications, parenteral nutrition, and to be the access of Hemodialysis (HD) session [2]. In the past CVCs were practiced in intensive care units usually but nowadays it became more common [3].

The nursing role in caring of CVCs become a mandatory skills among nursing staff specialized with HD patient [4]. Complications associated with CVC insertion are hematoma, cardiac arrhythmias, venous perforation and pneumothorax with mortality rates as high as 47% [5]. Experience and skills are required to insert CVCs, to determine the best site, size, material, settings and duration [6]. Ultra sound guidance is better to minimize the complications [7].

For patients who are eligible to kidney transplantation as a renal replacement therapy, hemodialysis considered to be a bridge treatment that could help them until they get the permanent treatment (transplantation) [8]. The efficient blood flow of hemodialysis should be at least of 350 ML/min; this needs a suitable vascular access which is most likely the arteriovenous fistula [9].

Unless the suitable vascular access is established, there is no excepted quality of hemodialysis, and this absolutely would affect the patient health and put him in a higher associated morbidity as well as increased mortality rate [10].

In those patients, most of the problems arises from vascular issues, and this absolutely would affect the outcome [11,12].

When we revise the common indications of hospitalization for the hemodialysis patients, we find that the vascular access site problems cause most of it, approximately twice per year, problems like arteriovenous fistula rupture and clotting are the most common [13]. Treatment of these cases consumes a huge amount of money and efforts yearly; this affects the overall outcome and exhausting the resources of the health systems [14].

In a report regarding hospital admissions in Tabuk area KSA, about a quarter of admissions of hemodialysis patients found to be due to vascular access site problems, and this found to spend half of the costs related to those patients [15-20].

So it's obvious that although AVF is still the best way to handle end stage kidney disease

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**Table 1:** Six studies reviewed, showed lack of knowledge about infection control among HD nursing staff.

S. no	Name of the Author	Research design	No: Sample	Institute	Objectives and intervention	Results/outcome
1	Kalthoum I, [45]	Quasi experimental study	57HD nurses	College of Nursing sciences, Ribat national university, Khartoum	Evaluate the effect of an educational program using the protocols and recommend actions of the K/DOQI guide-lines for vascular access care on dialysis nurses' knowledge at nine dialysis centers in Khartoum State, Sudan.	(89.5%) attained a score of knowledge less than "good" before the educational intervention. After the educational program 75% of them scored levels of "very good" to "Excellent".
2	Abdelsatir S, [46]	Survey	50 HD nurses	College of nursing sciences, Ribat national university, Khartoum	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.	Nurses with a bachelor degree were 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. There was no significant difference between nurses with less than two years of experience compared to nurses with two or more years of experience in adherence to hand hygiene (56.3% versus 73.1%, P=0.2) and the use of gloves during connection/disconnection (100% versus 93.8%, P=0.4).
3	Hamed OAMA, [47]	Survey, observation	100 HD nurses.	Faculty of Graduate Studies & Scientific Research, Ribat National university, Khartoum	Assessment of Nurses' Knowledge and Practice towards care of hemodialysis patients.	Mean of knowledge about care of hemodialysis patients was found moderate (67.2%), mean of practice about care of hemodialysis patients was found moderate (66.4%). They showed high knowledge and practice regarding routine investigations (80%) and measuring vital signs (97%), but poor knowledge and practice regarding mechanism of hemodialysis and infection control methods properly (37%) (3%) respectively.
4	Moursy AME, [48]	Survey, observation	48 HD nurses	Nursing department- Faculty of Nursing, Alexandria University-Egypt	to assess hemodialysis nurses compliance to infection prevention and control practices during vascular access care.	The overall percent score of nurses' knowledge about infection prevention and control practices was (61.57%). The overall nurses' compliance to infection control guidelines was poor.
5	Bakey SJ, [49]	Survey	30 HD nurses	ty of Baghdad (Iraq)- College of Nursing	Nursing staff practices throughout hemodialysis treatment for patients in hemodialysis units and to determine the relationship between nurses' practices and their demographical characteristics.	The nurses' practice that should be applied to the patient throughout hemodialysis treatment. No significant relationship was found between nurses' practice and their gender, level of education, years of experience in hemodialysis units, while significant relationship was found between nurses' practice and their marital status.
6	Kadium MJ, [50]	Quasi-experimental design	56 HD nurses	Jordanian University (Oman), Walden university	To evaluate the effectiveness of educating registered dialysis nurses regarding CVC maintenance care to reduce catheter-related bloodstream infection (CRBSI) in a hemodialysis unit.	The results suggested a statistically significant improvement in the registered dialysis nurses' knowledge following the educational intervention. This study contributes to social change by identifying an educational intervention that helped improving nurses' knowledge in hemodialysis unit, thus helping hemodialysis patients stay safer and possibly reducing.

patients for hemodialysis because of its benefits over other routes, it is not that safe, it has its costs [21]. Arteriovenous fistula problems could outweigh jugular vein catheters, the first has complications like clotting, carpal tunnel syndrome, ischemia, and aneurysm with bleeding, while the second's complications are those of clotting, stenosis, and the most common is infection (line sepsis) [21,22].

Advanced practice nursing roles responsibilities and roles of medical officers and nursing staff are always undergo discussion because of different circumstances in different centers, also the coactions both of them sharing during daily activities [4].

The international council of nursing has defined the job of the advanced specialized nurse in terms of requirements of experience, skills, and competency to be able to make the right decisions [23]. Nurses should be trained and qualified especially when they are dealing with CVCs, "patient safety remains one of the most critical issues facing health care today and that nurses are the health care professionals most likely to intercept errors and prevent harm to patients" [24].

One of the most important obstacles is lack of awareness about safety and errors that commonly occur [25]. Human error can be defined as a failure of a planned action or a sequence of mental or

physical actions to be completed as intended, or the use of a wrong plan to achieve an outcome [26]. Hemodialysis units have special safety requirements that should be considered, among those CVCs care are a very crucial because of fear of infections, obstructions and incompetency [27].

Patients physical parameters may be including: weight, stabilized vital signs and lab investigation, machines and dialysate, vascular access state, and avoidance of medications errors all those are very important roles that nurses should be competent with [28]. Psychological aspects also are very important and HD centers should train their nursing and medical staff to be care about it [28].

The importance of nurses' role in preservation of vascular access site can be emphasized [29]. There are high costs and miserable outcomes of vascular access complications and their related mortality [30], frequent hospitalizations of patients to treat these complications [13] (thus, 25% of end-stage renal patients' care burden is associated with vascular access) [31], and shortage of new research in this field.

There are guidelines produced by international authorities regarding infection control, and it is of utmost importance to prevent infectious diseases from being transmitted by medical staff from one patient to another or to others!

It is important to educate nursing student's principles of standard service and precautions, this should ensure the competency and safety of their practice, any education system regarding nursing should put this first [32]. The efficient nurse has to do all what is needed to ensure safety as well as competency whenever it came about patient's care [33].

What are the standard precautions? It is the guidelines prepared make the risk minimum and those are relying on the healthcare staff compliance as well as continuous training and monitoring [34]. There is other non-compliance factors reported, it ranges in between lack of knowledge and understanding to lack of resources [35].

The good nurse should know the common infection types, expected causes of hospital acquired infections, who is suspected to be infected, who is at higher risk (like TB patients), and how to prevent hospital acquired infections [36].

There is a good spread of training regarding hand hygiene and compliance to guidelines among nurses. But unfortunately there is not enough researchers working on efficacy of these educational activities. And there is no specific courses regarding this in many of nursing schools. Almost all these schools introduce only a one hour lecture accompanying the clinical program, this is could not be accepted as a satisfying dose!

In developing countries there is not enough resources, this is complicating the situation of hospital acquired infections, but this should also increase the awareness towards importance of preventing those. This should illuminate the importance and the need to prevent hospital acquired infections greatly [37]. And because of all these circumstances, nurses should be in a continuous infection control practical educational program throughout their courses regarding patient's care [38].

Ethical and professional duties should be accomplished by nurses to ensure they are on daily basis utilizing the knowledge and skills regarding safety and competency, to introduce the best possible care to their vulnerable patients [36].

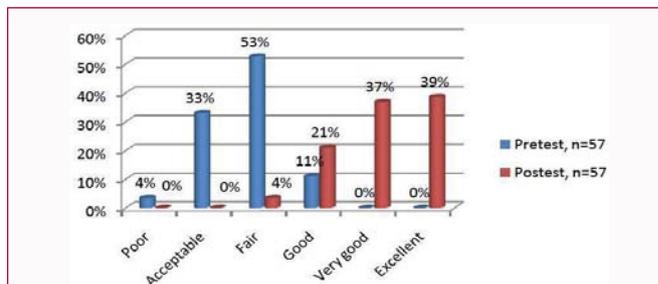
As nurses usually are the largest group of health care providers at most health care facilities, their education about infection control should be the most important task of those facilities [39,40]. Several studies suggested that infection control guidelines should be done and followed while the care supplied at hemodialysis units [41-44].

## Search Strategy

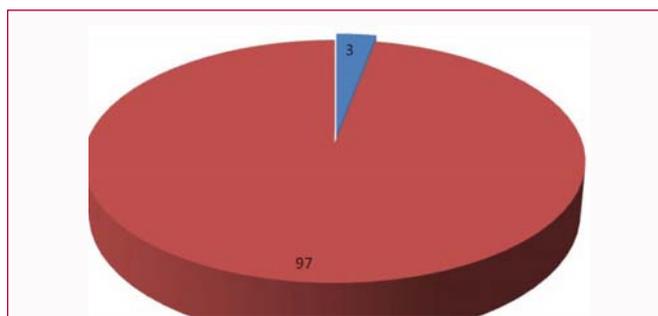
A review of all published literature related to nursing care of vascular access among hemodialysis patients in middle east including Sudan were conducted. The online databases SCIENCE DIRECT, PUBMED, CINHAI, EBSCO, SCOPUS, and UPTODATE were used for identifying relevant studies. Medical terms and free text terms such as central venous catheters, vascular access care, and hemodialysis care were used for the search.

## Selection Criteria

Studies were identified from international peer-reviewed journals that used descriptive, longitudinal, cross sectional, experimental, prospective and prevalence approaches in research. All published studies, master's thesis, conference abstracts and presentations between the years 2010 to 2017, assessing the care and training of nursing staff about vascular access among Arab patients were included in the review. Twenty studies have been identified as



**Figure 1:** Comparison between the levels of knowledge among nurses participating in the study before and after the educational intervention. Kalthoum, et al. 2017, Saudi Journal of Kidney Diseases and Transplantation.



**Figure 2:** Proper use of infection control methods, (n=100) (Ohood Ahmed, 2016).

possible potential suggestions to be included within this review.

Studies which met the selection criteria were included in the review data from 6 studies were identified as potentially relevant and were abstracted into a standardized form, some of the studies were excluded due to statistically representative sample issues, some of the studies included were insufficient regarding nursing staff but sufficient regarding patients, only studies included HD nurses are included in this review.

## Data Collection and Analysis

The 6 studies were reviewed for the research approach; sample and population, setting, tools with its cut off scores, objectives, interventions with the outcome of the study.

## Results of the Search Strategy

A total of 6 studies were from Sudan 3, Egypt 1, Iraq 1 and Jordan 1 respectively. The summary of the studies has been shown in the Table 1. A total of 341 hemodialysis nurses were included in the reviewed studies. All the 6 studies reviewed (Table 1) showed that the nursing staff need more training about vascular access care and their knowledge were more satisfying after training programs underwent for their HD nursing care providers. Only 6 studies were selected from a total of 20 studies found, Sudan 3, Egypt 1, Iraq 1 and Jordan 1.

The summary of the studies has been shown in the Table 1. A total of 341 nurses were included in the reviewed studies. All of 6 studies reviewed Table 1 showed lack of knowledge about infection control among HD nursing staff.

## Discussion

The 1<sup>st</sup> study from Sudan were conducted in Khartoum State, by Kalthoum Ibrahim Yousuf et al. [45], the study title "The Effect of an Educational Program for Vascular Access Care on Nurses"

Knowledge at Dialysis Centers in Khartoum State, Sudan”, the aim of the study was to evaluate the effect of an educational program for vascular access care on nurses’ knowledge at nine dialysis centers in Khartoum State was published in Saudi Journal of Kidney Disease 2017.

This study has utilized quasi experimental study design, this has been done through a structured real survey, and it was all about the (K/DOQI) guidelines application. Reliability and validity of the instrument was tested by experts through a pilot study for just 15 nurses. By a pilot study to test the knowledge scores for 15 nurses. The correlation coefficient of Pearson calculated was  $r=0.82$ . The process of data collection done pre and post the experimental procedures. Three months after that, the follow up process done successfully.

Regarding the knowledge levels, about 22 variables that assess due to the K/DOQI guidelines, all of it proved the progress in nurses information ( $P<0.001$ ). It is a very interesting paper with good design and conduction during a period in between January 2013 and July 2013 including 17 HD centers serving 3000 patients in Khartoum State, all the methodology were of quality and results showed clearly the importance of such training programs to the safety of vascular care among Hemodialysis patient in Khartoum State Sudan. 4 participants failed to complete the study, so 75 nurses data were at the end available, three quarters of the participants were of university grades, and about ninety percent had experience not less than one year not more than ten years.

University of Khartoum research board granted the protocol examination and the ethical approval collected individually from the involved hospitals. To ensure that the participants wouldn’t be under any pressure, no incentives given, they had the right to cancel the participation at any time of the experiment. The second study is also from Sudan, published in May 2013 at the Arab Journal of Nephrology and Transplantation and was done by Suhair Abdulsatar [46], the study title “Evaluation of Nurses Awareness and Practice of Hemodialysis Access Care in Khartoum State, Sudan”.

The study population was 50 nurses randomly selected. To collect the study data a questionnaire prepared and distributed to the participants, those data according to the determined variables organized and analyzed. More than seventy percent of the participants are females while more than eighty percent are university graduates, and about the half got more than a decade of hemodialysis experience.

All participants agreed that the correct HD access helps in keeping away from infections; half of them agreed that this will preserve the function. Almost all of the nurses agreed that hand hygiene at the centers is very important to avoid infections, but only seventy percent were stick to that. Almost all nurses check the access function but only half of them check signs of infections. The bachelor degree holders were more after the rules generally in comparison to those who had diplomas.

The study conclusion state that the knowledge is not sufficient as well as the adherence to what is already known. We can see that the above two studies were not conducted simultaneously, the first study conducted in 2013 and published in 2017, while the second study conducted in 2010 and published 2013.

It was very disappointing that such studies take all that time to be published, and it looks obvious that the first (fresher) study design is more complex that the second (earlier) study, another interesting

issue that the first study detected the problem and tried to solve it while the second one only detected the problem. The 3<sup>rd</sup> study title “Knowledge and Practice of Nurses towards Care of Hemodialysis Patients at Governmental Hospitals in Khartoum State, (2015-2016)” [47]. The aim of the study was to assess of Nurses’ Knowledge and Practice towards care of hemodialysis patients.

The descriptive cross-sectional hospital-based study conducted among 100 nurses working at dialysis centers in 5 governmental hospitals. The data was collected by using predesigned questionnaire managed by the researcher fulfilled by interview and observation, then processed by using the statistical package for social science and presented as Table 1, Figure 1 and 2. Results showed that among 100 nurses, the commonest age group was 30 to 39 years (54%), female to male ratio was 2.3:1. In-service training was received by 67%, mostly for less than 1 week (55.2% out of 67); it was local for 92.5% of nurses who received training versus 7.5% who received abroad training. Mean of knowledge about care of hemodialysis patients was found moderate (67.2%), mean of practice about care of hemodialysis patients was found moderate (66.4%). They showed high knowledge and practice regarding routine investigations (80%) and measuring vital signs (97%), but poor knowledge and practice regarding mechanism of hemodialysis and infection control methods properly 37%, 3% respectively.

The study concluded that Nurses in dialysis units in the current study showed moderate level of knowledge and practice towards care of hemodialysis patients, but there is a need for more efforts regarding training and patients counseling and obviously not good at infection control (only 3%). We can notice that the 3<sup>rd</sup> study included diploma of nursing holders, the study conducted in the in 2015-2016 and published in 2016. Important point that all of the participants received training, quality of the training programs at those centers should be questioned.

The fourth study titled “Vascular Access Care at Hemodialysis Unit; nurses’ compliance to Infection prevention and Control Practices” [48]. This study objective is to assess the hemodialysis staff preparations to fight and prevent contamination during the vascular access manipulation.

This study utilized a dual manner, there is a questionnaire as well as observation, and the results approved the poor knowledge of the study population about how to deal properly to the vascular access in order to prevent contamination. The study published in 2017 and it was done in Egypt.

The fifth study titled “Evaluation of Nurses’ Practices throughout Hemodialysis Treatment for Patients in hemodialysis unit at Baghdad teaching hospitals” [49]. In the hemodialysis centers’ in the city of Baghdad, this descriptive study done successfully. Non-probability (purposive sample) of thirty nurses selected.

A constructed questionnaire used, 25 items plus the demographic data are the collected data items. That questionnaire was tested by nine experts. Different statistical measure obtained. The results showed deficient knowledge of participants. A lot of factors found to be not related to the knowledge, such as: Gender, marital status, etc.

The last (sixth) study from Jordan, the title of the study “Improving Nurses’ Knowledge to Reduce Catheter- Related Bloodstream Infection in Hemodialysis Unit” [50]. The purpose of the project was to evaluate the effectiveness of educating registered

dialysis nurses regarding CVC maintenance care to reduce Catheter-Related Bloodstream Infection (CRBSI) in a hemodialysis unit. The project question focused on the educational program derived from the evidence-based guidelines recommended by the Centers for Disease Control and Prevention (CDC) to improve registered dialysis nurses' knowledge regarding CVC maintenance care. The theoretical foundation of the study was based on Donabedian's structure-process outcomes model. In this project, nurses considered a structural element and used a self study module to improve the process of providing CVC maintenance care. A paired samples t-test was conducted to compare knowledge scores of the participants in the posttest (n=56) and knowledge scores of participants in the pretest (n=57). The t-test was significantly higher for the posttest than scores for the pretest. The results suggested a statistically significant improvement in the registered dialysis nurses' knowledge following the educational intervention. This study contributed to social change by identifying an educational intervention that helped improving nurses' knowledge in hemodialysis unit, thus helping hemodialysis patients stay safer and possibly reducing infectious complications.

## Conclusion

That vascular care provided by nurses to Hemodialysis patients in Arab world should be improved through continuous training programs, and that the available training programs are not sufficient. All this would affect quality of care and reduce infection rates among Arab HD patients.

## Recommendations

- To introduce national regular training programs for hemodialysis nursing staff in all the countries included in the study.
- To make another review for articles measuring hemodialysis patient's opinion about the service they get.
- To revise the available training programs that the hemodialysis nursing staff are receiving.

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## References

1. Clark K. Clinical Medicine; 2014.
2. A TR&P. Critical Care Medicine; 2007.
3. Hamilton HC. A nurse led central venous access service in the United Kingdom. *J Association for Vascular Access*. 2005;10(2):77-80.
4. Dowling S, Barrett S, West R. With nurse practitioners, who needs house officers? *BMJ*. 1995;311(7000):309-13.
5. Brown C. Central venous catheters: Considerations regarding placement and clinical use. *Contemporary Critical Care*. 2007.
6. Hamilton H. Central venous catheters: Choosing the most appropriate access route. *Br J Nurs*. 2004;13(14):862-70.
7. Bishop, Dougherty L, Bodenham A, Mansi J, Crowe P, Kibbler C, et al. Guidelines on the insertion and management of central venous access devices in adults. *Int J Lab Hematol*. 2007;29(4):261-78.
8. Gilpin V, Nechols WK. Vascular access for hemodialysis: Thrills and thrombosis. *J Vasc Nurs*. 2010;28(2):78-83.
9. Chhetri PK, Manandhar DN, Lamichhane S. Vascular access for hemodialysis in Nepal medical college and Teaching hospital. *Nepal Med Coll J*. 2009;11(2):111-4.
10. Vanholder R. Vascular access: Care and monitoring of function. *Nephrol Dial Transplant*. 2001;16(8):1542-5.
11. Vazquez MA. Vascular access for dialysis: Recent lessons and new insights. *Curr Opin Nephrol Hypertens*. 2009;18(2):116-21.
12. El-Minshawy O, Abd El Aziz T, Abd El Ghani H. Evaluation of Vascular access complications in acute and chronic hemodialysis. *J Vasc Access*. 2004;5(2):76-82.
13. Lafrance JP, Rahme E, Leloir J, Iqbal S. Vascular access-related infections: Definitions, incidence rates, and risk factors. *Am J Kidney Dis*. 2008;52(5):982-93.
14. Kanani M, Hasanzade F, Reyhani T. Assessment duration of function and complications of arteriovenous fistula in hemodialysis patients. *Modern Care J*. 2011;8:13-8.
15. Chiulli LC, Vasilas P, Dardik A. Surgery superior patency of upper arm arteriovenous fistulae in high risk patients. *J Surg Res*. 2011;170(1):157-64.
16. Dix FP, Khan Y, Al-Khaffaf H. The brachial artery-basilic vein arteriovenous fistula in vascular access for hemodialysis: A review paper. *Eur J Vasc Endovasc Surg*. 2006;31(1):70-9.
17. Safaei M, Moeini E, Goharian V. Efficacy of sapheno-femoral AV fistula in chronic renal failure patients undergoing hemodialysis. *J Shahid Sadoughi University of Medical Sciences*. 2005;13(1):16-20.
18. Bachleda P, Utikal P, Kalinova L, Köcher M, Cerna M, Kolar M, et al. Infectious complications of arteriovenous ePTFE grafts for hemodialysis. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub*. 2010;154(1):13-9.
19. Polkinghorne KR, Seneviratne M, Kerr PG. Effect of a vascular access nurse coordinator to reduce central venous catheter use in incident hemodialysis patients: A quality improvement report. *Am J Kidney Dis*. 2009;53(1):99-106.
20. Wasse H, Kutner N, Zhang R, Huang Y. Association of initial hemodialysis vascular access with patient-reported health status and quality of life. *Clin J Am Soc Nephrol*. 2007;2(4):708-14.
21. Wilson B, Harwood L, Oudshoorn A, Thompson B. The culture of vascular access cannulation among nurses in a chronic hemodialysis unit. *CANNT J*. 2010;20(3):35-42.
22. Kumar V. Arteriovenous access for hemodialysis. In Daugirdas JT, editor. *Handbook of dialysis*. 4<sup>th</sup> ed. lippincot; 2007.
23. Schober A. 2006.
24. Kligler AS, Diamond LH. Patient safety in end stage renal disease: How do we create a safe environment? *Adv Ren Replace Ther*. 2001;8(2):131-7.
25. WHO. World health alliance for patient safety organization. 2004.
26. Science: ECToebnai. A Canadian perspective. *World views Evidence Based*. In; 2011.
27. Burns T, Smyth A. Reducing aggression in the hemodialysis unit by improving the dialysis experience for patients. *Renal Society of Australasia J*. 2011;7(2):79-89.
28. Bahadori M, Raadabadi M, Jamebozorgi MH, Salesi M, Ravangard R. Measuring the quality of provided services for patients with chronic kidney disease. *Nephrourol Mon*. 2014;6(5):e21810.
29. Hooland S, Donck J, Aমেy F, Aerden D. Duplex ultrasonography and hemodialysis vascular access: A practical review. *Int J Nephrol Urol*. 2010;2(2):283-93.
30. Allon M. Venous catheter access for hemodialysis. In Daugirdas JT, BPIT, editor. *Handbook of Dialysis*; 2007.
31. Zadeh KM, Omrani Z, Shirali A, Najmi N, Zade MM, Fereshtehnejad

- S. Determination of prevalence and survival of various types of vascular accesses in patients with end stage renal disease under chronic hemodialysis, in Tehran during 2004. *RJMS*. 2009;15:71-7.
32. Dehkordi LM, Tavakol K. Experiences of nursing students in caring of patients in source isolation. *Iran J Nurs Midwifery Res*. 2011;16(1):13-9.
33. Yousef SAA. Effect of Nursing Guidelines Regarding Infection Control Measures on Performance of Internship Students in Applied Medical Science College at Hafr Al-Batin. *J Nursing Health Sci*. 2014;3(4):37-46.
34. Long BC, Phipps WJ, Cassmeyer VL. *Medical-surgical nursing a nursing process approach*. 3<sup>rd</sup> ed. Mosby Publication; 2011.
35. Moyo GM. Factors influencing compliance with infection prevention standard precautions among nurses working at Mbagathi district hospital, Nairobi, Kenya. 2013.
36. Royal College of Nursing. *Essential practice for infection prevention and control, Guidance for nursing staff. A selected Egyptian Cancer Hospital. Journal of Education and Practice*. 2013.
37. Rasslan OS. Infection prevention and control education in Egypt: Professional Diploma in Infection Control (PDIC). *Int J Infect Control*. 2011;7(2):1-4.
38. Eskander HG, Youssef W, Morsy M, Elfeky HA. Intensive care nurses' knowledge & practices regarding infection control standard precautions at a selected Egyptian Cancer Hospital. *J Education Practice*. 2013.
39. Hepatitis B. WHO. 2008.
40. Ahmed NI, Eshra DM, Nassar BM, El-Shikh AA. Study of nosocomial respiratory infections and nurses' performance related to infection control measures in artificially ventilated patients. *J Egypt Public Health Assoc*. 2000;75(1-2):199-217.
41. Centers for Disease Control and Prevention. CDC: Recommendations for preventing transmission of infections among chronic hemodialysis patients. *IDSA*. 2001;50(5):1-43.
42. Higgins M, Evans DS. Nurses' knowledge and practice of vascular access infection control in haemodialysis patients in the Republic of Ireland. *J Ren Care*. 2008;34(2):48-53.
43. Karkar A, Bouhaha BM, Dammang ML. Infection Control in Hemodialysis Units: A Quick Access to Essential Elements. *Saudi J Kidney Dis Transpl*. 2014;25(3):496-519.
44. Yanai M, Uehara Y, Takahashi S. Surveillance of infection control procedures in dialysis units in Japan. a preliminary study. *Ther Apher Dial*. 2006;10(1):78-86.
45. Yousif KI, Abu-Aisha H, Abboud OI. The effect of an educational program for vascular access care on nurses' knowledge at Dialysis Centers in Khartoum State, Sudan. *Saudi J Kidney Dis Transpl*. 2017;28(5):1027-35.
46. Abdelsatir S. Evaluation of Nurses Awareness and Practice of Hemodialysis Access Care in Khartoum State, Sudan. *Arab J Nephrol Transplant*. 2013;6(2):119-21.
47. Hamed OAMA. Knowledge and practice of nurses towards care of hemodialysis patients at Governmental Hospitals in Khartoum State. The National Ribat University. 2016.
48. Moursy AME, Sharaf AY. Vascular access care at hemodialysis unit; nurses' compliance to Infection prevention and control practices. *IOSR J Nursing and Health Science*. 2017;6(2):61-9.
49. Bakey SJ. Evaluation of nurses' practices throughout hemodialysis treatment for patients in hemodialysis unit at Baghdad teaching hospitals. University of Baghdad. 2012.
50. Kadium MJ. Improving Nurses' Knowledge to Reduce Catheter- Related Bloodstream Infection in Hemodialysis Unit. Walden University Scholarwork. 2015.