Assessment of health care service provided to patients of chronic renal failure under hemodialysis

Morsi Ahmed Abdel-Aziz Ammar[1], Mohamed Abdel-Hakim Rizk[1], Mostafa Abdel Fattah Elballat [2], Mohamed Sobhy Mohamed Abd-Rabou [1]

[1]Department of Community Medicine and Industrial Medicine, Faculty of Medicine, Al-Azhar University, Egypt
[2]Department of internal medicine, Faculty of Medicine, Al-Azhar University, Egypt
Msobhy55888@yahoo.com

Abstract: Background: Chronic Kidney Disease is currently recognized as an important global population health problem. In developed countries, the progressive increase in numbers of CKD patients and those requiring renal dialysis is reaching epidemic levels, growing by 5–8% annually. **Objectives:** To demonstrate the socio-demographic characteristics among the studied samples, to assess health care provided to patients of chronic renal failure under hemodialysis and to compare between some centers of hemodialysis as regard health care provided. **Subjects and methods:** A cross-sectional hospital-based study was conducted where all patients of chronic renal failure under hemodialysis in Bab El Shaareya University Hospital (84 patients), Theodor Bilharz Research Institute (114 patients) and National Institute of Urology & Nephrology (158 patients) are included in this study (totally 356 patients) **Results:** The results from this study declared that some essential procedures were not done at different levels of hemodialysis however they are essential guideline approved by WHO and other international agencies. Also, many indicators were not matched with the standards in this regard. **Conclusion:** Several procedures at all hemodialysis centers are not matched with guidelines and there is no abide by the rules and guidelines governing the process of hemodialysis in all its components. **Recommendations:** Developing strict laws to limit non-compliance with rules and standards relating to hemodialysis, developing specialized training courses for the health care providers acting in field of hemodialysis, periodic further assessment of the health care services provided for patients of chronic renal failure under hemodialysis, the need to further studies in field of hemodialysis and all what related to it.

Keywords: chronic renal failure – hemodialysis–hemodialysis assessment.

1. Introduction

Chronic kidney disease (CKD) is defined as structural and/or functional damage to the kidney or a glomerular filtration rate (GFR) of < 60 mL/min/1.73 m^2, for three months or more, irrespective of cause **(Am J Kidney Dis, 2002).**

Population-based epidemiological studies in several countries have found high CKD prevalence in its different stages, estimated at 10.0% –16.0% of the adult population **(CDC, 2014).**

CKD is currently recognized as an important global population health problem. In developed countries, the progressive increase in numbers of CKD patients and those requiring renal dialysis is reaching epidemic levels, growing by 5–8% annually **(El Nahas et al., 2005).**

End-stage renal disease (ESRD) is a major public health problem. In the United States, more than 350000 patients with ESRD are being treated by dialysis with about 92% receiving hemodialysis (HD) and about 8% on continuous ambulatory peritoneal dialysis (CAPD) **(Am J Kidney Dis, 2006).**

The principal reported causes of CKD worldwide are diabetes mellitus (DM) (30–40%) and hypertension (HT) (25–30%), associated primarily with behavioral risk factors and aging **(Takahashi et al., 2010)**.

Kidneys are probably the only vital organs which can be realistically replaced by artificial means. Maintenance dialysis is a well-recognized modality of treating patients having end stage renal disease. Several thousands of patients all over the world are surviving and achieving reasonable quality of life on maintenance dialysis **(Mathew et al., 2010).**

Hemodialysis treatment replaces the cleaning function of normal healthy kidneys. Blood is taken out of the body and travel round a dialysis machine and through a special filter called a dialyser. This dialyser clean human blood from waste products, remove any extra fluid and the cleaner blood is then returned to body. **(NHS, 2017).**

As this process to take place, a surgeon will make an access, or entrance, into blood vessels. This is done with minor surgery, usually to patient arm. Two main types of access can be made—a fistula or a graft.

A fistula is the first choice for an access. It is made by joining an artery to a nearby vein under skin to make a bigger blood vessel. This type of access is preferred because it has fewer problems and lasts longer. If blood vessels of the body are not suitable for a fistula, a graft may be used. This involves joining an artery and nearby vein with a small, soft tube made of synthetic material, placed under your skin. **(Foley, et al, 2013)**

MONITORING OF DIALYSIS PATIENT **(MOH, 2012)**

1. Monitoring of patients during dialysis:

The dialysis treatment should be monitored closely, with particular attention to:

- Any intra-dialytic complications.
- Vital signs during dialysis: Blood Pressure, pulse & temperature.
- Vascular Access

2. Records of dialysis treatment:

- Each dialysis treatment should be recorded

3. Long-term monitoring of dialysis patients:

- Blood Investigations
- ✓ Blood investigations should be done regularly at three (3) monthly intervals or more often as necessary.
- Dialysis Adequacy
- ✓ Dialysis adequacy be monitored at least every three (3) monthly.
- ✓ This can be calculated using Kt/V or Urea Reduction Ratio (URR).
- ✓ The delivered Kt/V should be more than 1.2 or
- ✓ The URR should be more than 65%.

Rational

Based on the previously mentioned facts;

Assessment of health care service provided to patients of chronic renal failure under hemodialysis is considered an essential part of the managerial process for national health development and has to be applied on a continuing basis throughout the planning and implementation of programs**.**

2. Patients and Methods

Study Design:

A cross-sectional hospital-based study was conducted to assess health care provided to patients of chronic renal failure under hemodialysis and to compare between some centers of hemodialysis as regard health care provided.

Phases of the study:

I- Preparatory phase:

During this phase the following steps were done:

1. Survey of literature:

A review of literature was conducted from first of March 2015 to the end of April 2015, in order to help in the proper understanding, identify tools and to design and prepare the research questionnaire.

A review of the literature covered the following subjects:

- Definition and epidemiology of chronic renal failure.
- Causes and risk factors of chronic renal failure.
- The principle of hemodialysis process.
- Side effects and complications of hemodialysis.
- National standard practice conditions and regulations of health care provided to patients under hemodialysis especially nursing care.

2. Research settings:

The present study was conducted in three hemodialysis centers:

- ✓ BEUH hemodialysis center.
- ✓ TBRI hemodialysis center.
- ✓ NIUN hemodialysis center.

An attempt to capture a wide spectrum of clinical and socioeconomic factors was made by enrolling study participants from the three centers.

Exclusion criteria included patients with acute renal failure, mental disability and the presence of communication barriers.

3. Study population:

All patients of chronic renal failure under hemodialysis in Bab El Shaareya University Hospital (**84** patients), Theodor Bilharz Research Institute (**114** patients) and National Institute of Urology & Nephrology (**158** patients) are included in this study **(totally 356 patients)**

4. Research tools and Data Collection Technique:

A pre-tested data collection sheet (Annex I) was designed according to the Egyptian Standards and Guidelines for Hemodialysis Project which was funded by a grant from EMRO/WHO to collect and record data from the three centers as regard:

A. Pre-dialysis assessment.
B. Initiation of dialysis.
C. Intra-dialysis assessment.
D. Termination of dialysis.
E. Post-dialysis assessment.
F. In-between dialysis.
G. Personnel and staff assessment.
H. Infection Prevention and Control assessment.
I. Reprocessing, sterilization, and disinfection assessment.
J. Housekeeping and Waste Management assessment.
K. Administration standards of the facility assessment.

5. Administrative Approvals:

The implementation of this research took the approval of .

- Dean of Faculty of Medicine, Al-Azhar University.
  - Faculty Research Ethical Committee.
  - General Managers of the three Hospitals.
  - Chairmen of hemodialysis departments in the three Hospitals.

6. Ethical consideration:

The study was conducted after explaining the steps of the study and its objectives to the participants. Only those who agreed were included and those who refused were excluded and this did not affect the quality of services delivered and avoiding physical or emotional harm. Written informed consents were obtained from all the participants in the study. The following patient's rights were considered:

• Autonomy: participation was made voluntarily rather than imposition, thus, individuals had the right to or not to participate in the study. Only consenting individuals were chosen to be interviewed and the questionnaire was filled.

• Beneficence: findings were communicated to individual respondents on field during the time of evaluation and necessary advice was rendered based on individual status.

• Non maleficence: no harmful procedures in the study and no harm for the patients refusing participation.

• Justice: all participants were equally treated.

• Confidentiality: all information provided to the researcher by participants was strictly confidential. Records were securely stored and were not included any names that might be used to identify the individuals as well as families or groups.

II- Implementation phase:

During this phase the following steps were done:

1.   Preparatory visits:

Were conducted to these hemodialysis centers to take the formal approval, inspect the place, availability of suitable sites for data collection from attendants and harmonization with authorities as regards suitable day, time and arrangements to ensure proper co-operation of center staff without interruption of their work.

2. Pilot study:

Before starting the practical phase a pilot study was conducted for about two month (May and June 2015). It includes 10 patients from each hemodialysis center.

The pilot study aimed to;

- Testing the form design and content of the interview questionnaire and language at the study sites.
- Determining coding process of the research forms.
- Determining time needed for each interview.

No changes or modifications were needed following pilot study, hence these 30 patients were included in the study later on.

3. Field work and Data collection:

This phase lasts about 12 months (from first of July 2015 to the end of June 2016). Data were collected using the previously constructed interview questionnaire. Each interview session lasted about 3 hours in average.

It necessitates the researcher to visit the research settings two visits per week to ensure meeting all the patients.

III- Data management and reporting phase:

1. Data entry and Analysis:

This phase took 2 months (between first of July 2016 to the end of August 2016).

All completed questionnaires were revised for completeness and logical consistency. Data were entered on the **Statistical Program for Social Sciences** (SPSS) version 20. Data analysis was done by simple frequencies for qualitative variables and measures of central tendency and dispersion for quantitative variables. Quantitative data were displayed as mean ± standard deviation, while qualitative data were displayed as percentages & frequencies.

To test the significant difference, Chi-square: The hypothesis that the row and column variables are independent, without indicating strength or direction of the relationship. Pearson chi-square and likelihood-ratio chi-square are computed.

Chi-square test was used for qualitative data. All statistical tests were considered significant at P-value of ≤ 0.05.

2. Interpretation of Data:

This phase took 3 months (between first of September 2016 to the end of October 2016). The results were represented in tabular and diagrammatic forms then interpreted.

IV- Final phase:

This phase took 2 months (between first of November 2016 to the end of February 2017). Writing and printing the thesis was completed during this phase.

3. Results

General characteristics of the study samples:

Regarding age groups, the majority of the studied samples were in the age groups from 41 to 60 years with a percentage of **46.1%.** While the lowest percentage was in the age group < 20 with a percentage of **13.2%.** There was no significant difference between the three dialysis centers regarding to age.

As regarding sex, the percentage of males in the study samples was **55.1%** compared with **44.9%** of

females. There was no significant difference between the three dialysis centers regarding to sex.

As regarding the residence, the percentage of patients who were living in urban areas was **56.7%**, while the percentage of patients who were living in rural areas was **43.3%**. There was no significant difference between the three dialysis centers regarding to residence.

As regarding the occupation, the percentage of non-working and housewife patients were **21.9%** compared with **30.1%** of skilled worker patients, while the percentage of non-skilled worker patients were **48%**. There was no significant difference between the three dialysis centers regarding to occupation.

As regarding the educational level, the percentage of illiterate patients was **13.2%**. On the other hand the percentages of patients who are capable of read and write and patients with primary education were **30.1%**. While the largest percentage was in the patients with secondary or technical education **48%** and the lowest percentage were in the patients with university or post-graduate education **8.7%**. There was no significant difference between the three dialysis centers regarding to education**.**

As regarding marital status, the percentage of unmarried patients in the study samples was **46.9%** compared with **53.1%** of married patients. There was no significant difference between the three dialysis centers regarding to marital status.

The Pre-dialysis assessment

Concerning temperature measurement; this procedure was not done for the majority of the studied samples **(80.9%)**. The largest percentage of not doing that was 86.1% at NIUN compared with 81.6% at TBRI and 70.2% at BEUH. There was statistically significant difference between the three dialysis centers under the study regarding to this procedure. (P value = 0.01).

With reference to pulse measurement, it was not done for **83.4%** of studied samples. The largest percentage for not doing this procedure was at NIUN. There was no significant difference between the three dialysis centers.

Concerning blood pressure measurement, it was done for the most of the studied samples **(94.4%)**. The percentage was nearly similar between centers. There was no significant difference between the three dialysis centers under study regarding to blood pressure measurement.

With reference to weight measurement, this procedure was done for **98.6%** of samples. It was done completely for all samples at BEUH & TRBI. On the other hand, it was done with a percentage of **96.8%** at NIUN. There was statistically significant

difference between the three dialysis centers under study. **(P value = 0.04).**

Regarding determining vascular access, this procedure was done for the majority of the studied samples **(96.3%)**. There was no significant difference between the three dialysis centers under study regarding to this procedure.

About asking for recent medical history in, this procedure was not done for the majority of the studied samples **(70.5%)**. The largest percentage was at NIUN. There was no significant difference between the three dialysis centers under study regarding to asking for recent medical history.

Referring to doing general physical examination, this procedure was not done for the most of the studied samples **(77.2%)**. The percentage was 85% at TBRI compared to 72.6% at BEUH. There was statistically significant difference between the three dialysis centers under study regarding to doing general physical examination**. (P value = 0.05)**.

Regarding review previous lab results; this procedure was not done for about **(59.3%)**. The largest percentage between centers was 74.6% at TBRI. There was statistically significant difference between the three dialysis centers under study regarding to review previous lab results. **(P value = 0.0)**.

The Initiation of dialysis assessment

Regarding gathering all supplies before initiation of dialysis, this procedure was done for the majority of the studied samples (97.5%). The largest percentage was 98.8% at BEUH compared with 96.8% at NIUN. There was no significant difference between the three dialysis centers under study regarding to gathering all supplies before initiation of dialysis.

With reference to washing hands, this procedure was not done for the majority of the studied samples (79.8%). There was no significant difference between the three dialysis centers under study regarding to washing hands.

Concerning wearing sterilized gloves, this procedure was not done for all the studied samples (100%).

As Regard sterilizing access site with antiseptic, this procedure was done for the majority of the studied samples (97.8%). The largest percentage was 98.8% at BEUH. There was no significant difference between the three dialysis centers under study regarding to sterilizing access site with antiseptic.

On the other hand, about vessel should not be palpated after sterilization, this procedure was done for the majority of the studied samples (98.0%). There was no significant difference between the three dialysis centers under study regarding to vessel should not be palpated after sterilization.

Referring to inserting the arterial needle first before the venous needle, this procedure was done for all the studied samples (100%).

As regarding use the button-hole approach in canulation, this procedure was not done for all the studied samples (100%).

Related to if canulation is unsuccessful three times, repeated attempts should be avoided and vascular consultation is warranted, this procedure was done for the majority of the studied samples (80.6%). The largest percentage was 95.2% at BEUH compared with 55.6% at NIUN and 66.7% at TBRI. There was significant difference between the three dialysis centers under study regarding to if canulation is unsuccessful three times, repeated attempts should be avoided and vascular consultation is warranted **(P value = 0.03)**.

Concerning if the site becomes swollen the area should be avoided until the swelling/ bruising has gone, this procedure was not done for the majority of the studied samples (60.4%). The percentage was about 60% at TBRI & NIUN compared with 59% at BEUH. There was no significant difference between the three dialysis centers under study regarding to if the site becomes swollen the area should be avoided until the swelling/ bruising has gone.

The Intra-dialysis assessment

with reference to hourly monitoring of pulse, this procedure was not done for the majority of the studied samples (73.6%). The largest percentage was 76.2% at BEUH compared with 71% at TBRI. There was no significant difference between the three dialysis centers under study regarding to hourly monitoring of pulse.

Concerning hourly monitoring of arterial and venous blood pressure, this procedure was done for the majority of the studied samples (83.4%). The most percentage was 88% at NIUN. There was statistically significant difference between the three dialysis centers under study regarding to hourly monitoring of arterial and venous blood pressure. (P value = 0.02).

Regarding hourly monitoring of subjective symptoms and signs, this procedure was done for the majority of the studied samples (87.4%). The largest procedure was 98.2% at TBRI compared with 81% at NIUN. There was statistically significant difference between the three dialysis centers under study regarding to hourly monitoring of subjective symptoms and signs. (P value = 0.0).

Concerning hourly monitoring of heparin pump, mL delivered, this procedure was not done for the majority of the studied samples (93.8%). There was no significant difference between the three dialysis centers under study regarding to hourly monitoring of heparin pump, mL delivered.

About hourly monitoring of blood pump speed, mL/min, this procedure was not done for the majority of the studied samples (93.3%). The most percentage was 93.95 at TBRI compared with 90.5% at BEUH. There was no significant difference between the three dialysis centers under study regarding to hourly monitoring of blood pump speed, mL/min.

With reference to hourly monitoring of arterial and venous pressure limits, this procedure was not done for the majority of the studied samples (92.4%). The largest percentage was 93.9% at TBRI. There was no significant difference between the three dialysis centers under study regarding to hourly monitoring of arterial and venous pressure limits.

Referring to hourly monitoring of color of blood and dialyser, this procedure was not done for the majority of the studied samples (93.0%). The largest percentage was 94.7% at TBRI. There was no significant difference between the three dialysis centers under study regarding to Hourly monitoring of color of blood and dialyser.

On the other hand, hourly monitoring of blood lines and circuit integrity, this procedure was not done for the majority of the studied samples (94.9%). There was no significant difference between the three dialysis centers under study regarding to hourly monitoring of blood lines and circuit integrity.

The Termination of dialysis assessment

As regarding gather all supplies, this procedure was done for the majority of the studied samples (99.4%). It was completely done at BEUH. There was no significant difference between the three dialysis centers under study.

Concerning wash hands, this procedure was not done for the majority of the studied samples (82.6%). The largest percentage was 86% at TBRI. There was no significant difference between the three dialysis centers under study regarding to wash hands.

As regarding wear gloves, this procedure was done for the majority of the studied samples (96.3%). The percentage was similar at different centers. There was no significant difference between the three dialysis centers under study regarding to wear gloves.

Referring to reset the arterial and venous monitor gauges to wider limits, this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to reset the arterial and venous monitor gauges to wider limits.

Concerning stop the blood pump in termination of dialysis, this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to stop the blood pump.

With reference to clamp the arterial needle line, this procedure was done for all the studied samples

(100%). There was no significant difference between the three dialysis centers under study regarding to clamp the arterial needle line.

About clamp the arterial machine lines, this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to clamp the arterial machine lines.

Regarding turn off the negative pressure (ultrafiltration control), this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to turn off the negative pressure (ultrafiltration control).

Referring to observe the venous line to the patient, ensuring there are no air bubbles, this procedure was done for the majority of the studied samples (94.4%). The largest percentage was 97.6% at BEUH. There was no significant difference between the three dialysis centers under study regarding to observe the venous line to the patient, ensuring there are no air bubbles.

About disconnect the arterial line from the arterial needle and hold the arterial line above the level of dialyser, this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to disconnect the arterial line from the arterial needle and hold the arterial line above the level of dialyser.

Concerning turn the blood pump to 100 mL/min and unclamp the arterial line, to return the blood with the saline infusion line in termination of dialysis, this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to turn the blood pump to 100 mL/min and unclamp the arterial line, to return the blood with the saline infusion line.

With reference to clamp the arterial line and unclamp the saline line in termination of dialysis, this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to clamp the arterial line and unclamp the saline line.

The Post-dialysis assessment

Regarding assessment and charting of vital signs, including standing BP, this procedure was done for the majority of the studied samples (90.2%). The percentage was similar at NIUN & TBRI by 90% compared with 89.35 at BEUH. There was no significant difference between the three dialysis centers under study regarding to assessment and charting of vital signs, including standing BP.

On the other hand, assessment and charting of, this procedure was done for all the studied samples

(100%). There was no significant difference between the three dialysis centers under study regarding to assessment and charting of weight.

About assessment and charting of weight loss, this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to assessment and charting of weight loss.

Concerning assessment and charting of total fluid received, this procedure was done for the majority of the studied samples (98.0%). It was completely done at BEUH. There was no significant difference between the three dialysis centers under study regarding to assessment and charting of total fluid received.

In relation to assessment and charting of total anticoagulant received, this procedure was done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study.

Regarding assessment and charting of saline or other colloid or crystalloid required to support BP, this procedure was done for the majorly of the studied samples (97.8%). The largest percentage was 98.8% at BEUH compared with 97.5 at the other centers. There was no significant difference between the three dialysis centers under study regarding to assessment and charting of saline or other colloid or crystalloid required supporting BP.

Concerning assessment and charting of complications of dialysis, this procedure was done for the majorly of the studied samples (83.1%). The largest percentage was 84.5 at BEUH COMPRED WITH 81.6% at TBRI and 83.5% at NIUN. There was no significant difference between the three dialysis centers under study regarding to this procedure.

Referring to assessment and charting of cleaning the machine and disinfection according to a standard protocol in post-dialysis assessment, this procedure was done for the majorly of the studied samples (97.5%). The largest percentage was 98.8% at BEUH compared with 96.2% at NIUN. There was no significant difference between the three dialysis centers under study regarding to assessment and charting of cleaning the machine and disinfection according to a standard protocol.

In-between dialysis assessment

Concerning (CBC every 1 month, BUN pre- and post-dialysis every 3 months, Creatinine every 3 months, Electrolytes (Na, K, and Cl) every 3 months, Calcium and phosphorus every 3 months), these procedures were done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to all these procedures.

About Glucose (fasting and post prandial) every 3 months, this procedure was done for the majority of

the studied samples (60.7%). It was completely done at NIUN compared with 31% at BEUH and 28.1% at TBRI. There was statistically significant difference between the three dialysis centers under study regarding to this procedure. (P value = 0.0).

With reference to bilirubin every 3 months, this procedure was not done for the majority of the studied samples (59.3%). The largest percentage of not doing this procedure was 65.55 at BEUH compared with 53.2% at NIUN and 63.2% at TBRI. There was no significant difference between the three dialysis centers under study regarding to this procedure.

As regarding SGOT and SGPT every 3 months, this procedure was not done for the majority of the studied samples (66.0%). The percentage was 75% at BEUH compared with 60.8% at NIUN and 66.7% at TBRI. There was no significant difference between the three dialysis centers under study regarding to this procedure.

On the other hand, alkaline phosphatase every 3 months, this procedure was not done for the majority of the studied samples (80.6%). The largest percentage was 90.5% at BEUH. There was statistically significant difference between the three dialysis centers under study regarding to this procedure. (P value = 0.03).

Referring to albumin every 3 months, this procedure was not done for the majority of the studied samples (59.3%) but the percentage of not doing this procedure was 2.4% at BEUH compared with 77.8% at NIUN and 75.4% at TBRI. There was statistically significant difference between the three dialysis centers under study regarding to this procedure. (P value = 0.0).

About (HBs Ag every 3 months, HCV antibody every 3 months, HIV antibody every 3 months), these procedures were done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to all these procedures.

With reference to C-reactive protein every 3 months, this procedure was not done for the majority of the studied samples (79.2%). There was no significant difference between the three dialysis centers under study regarding to this procedure.

As regard Iron and Iron-binding capacity every 6 months, this procedure was done for the majority of the studied samples (51.7%). It was completely done at BEUH compared with 38% at NIUN and 35.1% at TBRI. There was statistically significant difference between the three dialysis centers under study regarding to this procedure. (P value = 0.0).

Concerning ferritin every 6 months, this procedure was not done for the majority of the studied samples (53.1%), however this procedure was completely done at BEUH. There was statistically

significant difference between the three dialysis centers under study regarding to this procedure. (P value = 0.0).

Referring to parathyroid hormone every 6 months, this procedure was done for the majority of the studied samples (82.9%). This procedure was completely done at BEUH and NIUN compared with 46.5% at TBRI. There was statistically significant difference between the three dialysis centers under study regarding to this procedure. (P value = 0.0).

About Chest X-ray every 12 months, this procedure was not done for the majority of the studied samples (68.3%). The largest percentage was 71.1% at TBRI. There was no significant difference between the three dialysis centers under study regarding to this procedure.

Concerning Electrocardiogram every 12 months, this procedure was not done for the majority of the studied samples (63.5%). There was no significant difference between the three dialysis centers under study regarding to this procedure.

Regarding Nutrition education, this procedure was not done for the majority of the studied samples (60.4%). There was no significant difference between the three dialysis centers under study regarding to this procedure.

With reference to social Service (Through the social worker of the hemodialysis unit or the Primary Health Care Unit), this procedure was not done for the majority of the studied samples (84.3%). It was completely not done at NIUN and TBRI. There was statistically significant difference between the three dialysis centers under study regarding to this procedure. (P value = 0.0).

As regard (The facility should record the number of persons with urea reduction ratio < 65% or Kt/V < 1.2 over the total number of patients dialyzed to assess the adequacy of hemodialysis), these procedure was not done for all the studied samples (100%). There was no significant difference between the three dialysis centers under study regarding to all these procedure.

Infection Prevention and Control assessment

With reference to assessment of all patients that are vaccinated against Hepatitis B according to the guidelines for vaccinating of a patient with end stage renal disease; it was achieved at BEUH but not achieved at NIUN or TBRI.

Regarding assessment of Hepatitis B vaccine for all staff personnel at risk of potentially harmful contact with blood and body fluids, it was achieved in all centers under study.

About assessment of (Tetanus toxoid at 10-year intervals, the proper use of personal protective devices such as gowns, gloves, visors and masks), these were not achieved in all centers under study.

Concerning assessment of the proper use and disposal of sharp devices, it was achieved in all centers under study.

About assessment of (An approved method for the disposal of blood and body fluid spills, Appropriate hand washing practices, Appropriate disinfection of hemodialysis equipment including internal and external surfaces, Adequate hand washing sinks are appropriately located throughout the facility, Sufficient supply of cloth or disposable towels is available so that a fresh towel is used after each hand washing. Common towels are prohibited, Hands are washed between patients, after removal of gloves and after contact with any contaminated objects), these were not achieved in all centers under study.

With reference to assessment of (The use of multi-dose vials is prohibited, IV system attached to the patient from a common syringe or IV bag are never delivered to more than one patient), these were achieved in all centers under study.

As regarding assessment of (Smoking is not permitted in any area of the facility, Personnel and patient do not eat or drink in any area where direct care is provided), these were achieved at BEUH but not achieved at NIUN or TBRI.

On the other hand, assessment of Linen, bed and pillow covers are changed between patients, it was achieved in all centers under study.

Referring to assessment of (Patient care items such as K-basins, thermometers, etc., are not used between patients unless reprocessed, No animals allowed in the facility), these were not achieved in all centers under study.

As regard assessment of The facility is effectively protected against the entrance of insects and animals or the elements by self-closing doors, closed windows, screens, controlled air currents, or other effective means, it was achieved in all centers under study.

Concerning assessment of (A designated person responsible for the maintenance and enforcement of infection control and occupational health standards in the facility, written policy for managing patients with blood borne infections (HIV—HCV—HBV), these were not achieved in all centers under study.

Reprocessing, sterilization, and disinfection assessment

Regarding assessment of (Adequate sterilization equipment are available and in working order, The guidelines for sterilization are followed as in the National Guidelines for Infection Control, Clean and soiled supplies are properly segregated and physically separated at all times, A designated area for soiled supplies which is physically separated from patient care areas and from areas of housing, clean and sterile

supplies), these were achieved in all centers under study.

About assessment of (The soiled area have an adequate counter space to receive soiled supplies, The soiled area have a double utility sink to rinse and clean soiled items, The soiled area have a flushing device for the disposal of body fluid wastes, an adequate facility to hand wash, Personnel working in the soiled area have proper protective apparel for their personal protection and are properly trained), these were not achieved in all centers under study.

Concerning assessment of The clean area have adequate counter space for receiving washed equipment for storage or wrapping, it was achieved in all centers under study.

With reference to assessment of (Written policies and procedures for the operation and maintenance of the sterilizers, documented routine preventive maintenance is performed on the sterilizer, A method to check the sterilization parameters of the equipment), these were achieved in NIUN but not achieved BEUH or TBRI.

Regarding assessment of (An appropriate monitoring of the sterilizers with biological monitors and a recall method for sterilized equipment, Personnel operating the sterilizers are properly trained), these were not achieved in all centers under study.

Referring to assessment of An approved method of sterilization is used, it was achieved in all centers under study.

About assessment of Outside shipping cartons are not kept in the clean supply area, it was not achieved in all centers under study.

4. Discussion
The pre-dialysis assessment:

As shown in results, table (1) revealed that regarding procedures should be done in pre-dialysis assessment in the three hemodialysis centers under study; it is found that most of these procedures are not done satisfactory in the pre-dialysis assessment, five of them are not done compared to three are done.

The five procedures which are not done satisfactory were temperature measurement, pulse measurement, asking for recent medical history, doing general physical examination and reviewing previous lab results. According to study conducted by **(Ahmed, et al. 2010),** the previous procedures are considered essential guidelines before stating of hemodialysis.

The three procedures which are done satisfactory were Blood pressure measurement, weight measurement and determining vascular access. There was statistically significant difference between the three dialysis centers under study related to weight measurement. **(Feldman, et al, 1996)** declared that

Obtaining and maintaining adequate access to the circulation remains a major impediment to the long-term success of hemodialysis treatment, and it is considered one of the greatest challenges in the provision of reliable dependable of repeatedly accessing a patient's blood.

According to a study conducted by (**Rizqallah, 2006**), 68.2% of the patients were with established AVF which known for its good dialysis adequacy.

Most of clinical studies have used pre-HD BP for determining optimal BP levels or analyzing the effects of BP-lowering therapies. (**Shafi and Waheed, 2014**).

The initiation of dialysis assessment:

Concerning assessment of procedures that should be done at initiation of dialysis, it is found that washing hands not be done at majority of studied centers by percentage of 79.8 %. According to (**The World Health Organization guidelines, 2009**), hand washing is essential procedure before any dealing with a patient especially health activities related to blood as hemodialysis. According to (**WHOM, 2006**), One of the most important routes of patient-to-patient transmission of microorganism in health-care settings is through the contaminated hands of health workers.

Referring to wearing sterilized gloves, no anyone did that at any center under study by a percentage of 100%. This is in contrast to a study conducted in Ain Shams university, Egypt (**El Rafay, et al, 2002**), which showed that, although nurses' attitude about the importance of gloves was generally good, their corresponding performance was unsatisfactory. According to a study conducted by (**El-Enein, et al, 2011**), about 70% of studied samples of health care providers were using sterilized gloves during hemodialysis.

Standard precautions are recommended by the Centers for Disease Control and Prevention when caring for all patients and include hand hygiene before and after patient contact and wearing gloves for procedures that are likely to involve contact with blood or contaminated body fluids. Studies have generally documented poor compliance with these practices, particularly with hand hygiene (**HICPAC, 2002**).

In one recent study of hospital-based health care workers, two-thirds reported routinely wearing gloves when performing an invasive procedure, but less than half reported washing their hands after patient care (**Doebbeling, et al, 2003**); a similar study among European hemodialysis staff also reported this tendency for staff to use gloves but not to wash hands (**Arenas, et al, 2005**).

Regarding using the button hole approach in canulation at initiation of dialysis, no any health care provider in the studied centers were using this approach. According to a study conducted by (**Grudzinski, et al. 2013**), Buttonhole cannulation may be associated with an increased risk of infection, and more definitive studies are needed to determine whether this technique is safe for broader use. There are some hemodialysis programs have adopted the method as a means by which to facilitate self-cannulation, and some programs have adopted the technique for in-center units as well (**Labriola, et al, 2011**).

Related to if the site becomes swollen, the area should be avoided until the swelling/ bruising has gone, majority of studied samples did not make that by a percentage of 60.4%. According to study conducted by (**Ahmed, et al. 2010**), the previous procedure is considered one of the practice guidelines for hemodialysis.

Other than the previous essential procedure at initiation of dialysis, all the remaining essential procedure are mostly done at the studied samples as gathering all supplies before initiation of dialysis by a percentage of 97.5%, sterilizing access site with antiseptic by a percentage of 97.8%, being vessel should not be palpated after sterilization by a percentage of 98%. All of these are matching with guidelines provided by (**WHO, 2009**).

The Intra-dialysis assessment:

Concerning assessment of procedures that should be done at Intra-dialysis, it is found that hourly monitoring of pulse as an essential procedure was not done at the majority of study samples by a percentage of 73.6%. According to study conducted by (**Amar, et al. 2000**), it was demonstrated that nocturnal BP and 24-hour pulse pressure are independent predictors of CV mortality in treated hypertensive hemodialysis patients.

As like pulse monitoring, procedure of hourly monitoring of heparin pump, mL delivered, was not done at the majority by a percentage of 93.8%. According to study conducted by (**Wei, et al. 1994**) it was concluded that the use of an appropriate dose of heparin during hemodialysis will improve polysulfone dialyzer clearance, increase the delivered KT/V.r.e, and reduce TAC_{urea}. Heparin dosing should be given close attention because it does affect the dialysis dose delivered.

In addition to the previous procedures, the hourly monitoring of blood pump speed, arterial and venous pressure limits, color of blood and dialyser and finally blood lines and circuit integrity, all of these procedure were not done at the majority of centers by a percentage of 93% in the average. These are not matching with guidelines for hemodialysis provided by (**WHO, 2009**).

Other than the previous essential procedure at intra-dialysis assessment, all the remaining essential procedure are mostly done at the studied samples as

hourly monitoring of arterial and venous blood pressure and hourly monitoring of subjective symptoms and signs, however about 17% for blood pressure monitoring and 13% symptoms and signs monitoring, were not doing them.

The assessment of procedures at termination of dialysis:

Concerning procedure should be done at termination of dialysis. It is found that, washing hands as essential procedure was not don't at the majority of studied health care providers by a percentage of 82.6%. According to study conducted by **(Shimokura, et al. 2006)**, about 95% of staff participants reported staff always wearing gloves when putting patients on and taking patients off of dialysis.

Other than hand washing, all essential procedure that should be done at termination of dialysis, were done at the majority of the studied centers by a percentage ranges from 94% to 100% as wearing gloves, stop the blood pump, clamping the arterial needle line and clamping the arterial line and unclamp the saline line. All those are matched with guidelines provided by **(Jindal, et al. 2006).**

The post dialysis assessment:

As regard as procedures should be done in post-dialysis assessment, they include assessment of vital signs, weight, total fluid received, total anticoagulant received, saline required to support blood pressure, complication of dialysis and finally assessment of cleaning and disinfection.

It is found that all the previous procedures were done at high percentages in the studied centers that ranged from 83% in assessment of complication of dialysis to 100% in most of the assessed procedure.

According to **(Tattersall, et al. 2007)**, all the previous procedures are within the essential guidelines for post- hemodialysis.

In the clinical practice of hemodialysis, estimation of "dry weight" is a major problem. "Dry weight" is defined as that weight at the end of a dialysis treatment below which the patient, more often than not, will develop symptoms of hypotension. Overestimation of dry weight will expose the patient to the potential hazards of overhydration, such as hypertension and pulmonary edema. On the other hand, underestimation of dry weight will make the patient more prone to suffer from hypotensive episodes during dialysis **(Kouw, et al. 1992)**.

In-between dialysis assessment

Concerning procedures should be done In-between dialysis; these include assessment of some laboratory investigation as every one month CBC, and every 3 months creatinine, electrolytes, some minerals, glucose, liver function test and others.

According to **(MOH Malaysia, 2012)**, Minimum laboratory investigations for chronic haemodialysis patients include Full blood count, Iron Study, Blood Urea, Renal Function Test, liver Function Test, Calcium & phosphate, parathyroid, Fasting Serum Lipid, Blood sugar and virology (HBs Ag, Anti HB s Abtitre, Anti HCV and Anti HIV)

It is found in this study that most of these investigations are done at high percentage reaching to 100% as CBC, Creatinine, electrolytes and calcium with exception of glucose measurement by 60%, iron assessment by 52% and parathyroid assessment by 83%.

But in contrast, some procedure were not done at the majority of studied samples as bilirubin every 3 months (59.3% not done), SGOT and SGPT every 3 months (66% not done), Alkaline phosphatase every 3 months (80,65% not done), Albumin every 3 months (59.3% not done), CRP every 3 months (79.2% not done), Ferritin every 6 months (53.1% not done), Chest X-ray every 12 months (100% not done), ECG every 12 months (63.5% not done) and nutrition education (60.4% not done).

Personnel and staff assessment:

Concerning staff members and all health care providers related to process of hemodialysis, it is found that all of them have the necessary certificates and experience for dealing with hemodialysis with exception of certificate in basic Cardiac Life Support in spite of its importance in this field. This basic Cardiac Life Support training was not achieved in our study in about 82.6% of consultants, 61.5% of medical directors, 80% of nursing supervisors and 89% of dialysis nurses.

According to study conducted by **(Karnik, et al. 2001)**, Cardiac arrest is a relatively infrequent but devastating complication of hemodialysis. The cardiac arrest rate was 400 out of 5,744,708, corresponding to a rate of 7 per 100,000 hemodialysis sessions. To reduce the risk of adverse cardiac events on hemodialysis, the dialysate prescription should be evaluated and modified on an ongoing basis, especially following hospitalization in high-risk patients.

So, and according to study conducted by **(Ahmed, et al. 2010),** basic Cardiac Life Support training is considered one of the essential standards for all the health care providers in relation to hemodialysis.

Infection Prevention and Control assessment

Referring to vaccination of all patients with ESRD against Hepatitis B, it is found that most of patients were not vaccinated. Also tetanus toxoid at 10-year intervals is not achieved at any one.

There is no a proper use of personal protective devices such as gowns, gloves, visors and masks at centers under study. According to **(Raad, et al. 1994),**

Sterile gloves should be worn for the insertion of arterial, central, and midline catheters.

There is no an approved method for the disposal of blood and body fluid spills, or appropriate hand washing practices at centers under study. Also there is no appropriate disinfection of hemodialysis equipment including internal and external surfaces at all centers under study. According to study conducted by **(Ahmed, et al. 2010)**, appropriate disinfection of hemodialysis equipment is considered an essential guideline.

There is no adequate hand washing sinks are appropriately located throughout the facility at all centers under study. There is no sufficient supply of cloth or disposable towels is available so that a fresh towel is used after each hand washing. Common towels are prohibited at all centers under study. There is no hand washing between patients, after removal of gloves and after contact with any contaminated objects at all centers under study.

Smoking, eating and drinking is permitted in most of centers under study. According to **(Wang, et al. 2002)**, Smoking is associated with alterations of blood thiol-group related antioxidants in patients on hemodialysis. Cigarette smoking has a negative impact on plasma-circulating products of lipid peroxidation in HD patients. The lower blood levels of the tGSH and non-GSH fSH in HD patients who smoked suggests that these patients may be more susceptible to oxidative damage caused by smoking.

There is no a designated person responsible for the maintenance and enforcement of infection control and occupational health standards in the facility at centers under study. This element is essential standard for long-term care infection control **(Pritchard, 1999).**

There is no written policy for managing patients with blood borne infections (HIV—HCV—HBV) at centers under study.

According to **(O'grady, et al. 2011)**, all the previous elements are essential guidelines for the Prevention of Intravascular Catheter-related Infections. These guidelines have been developed for healthcare personnel who insert intravascular catheters and for persons responsible for surveillance and control of infections in hospital, outpatient, and home healthcare settings.

Reprocessing, sterilization, and disinfection assessment

Regard Reprocessing, sterilization, and disinfection assessment at the hemodialysis process in the center under study, it is found that the soiled area have no an adequate counter space to receive soiled supplies, have no a double utility sink to rinse and clean soiled items, have no a flushing device for the disposal of body fluid wastes. According to **(Ahmed,** **et al. 2010)**, presence of the previous items is essential standards for proper hemodialysis process.

There is no an adequate facility to hand wash, in addition to that, personnel working in the soiled area have no proper protective apparel for their personal protection. According to study conducted by **(Siegel, et al. 2006)**, personal protective equipment (PPE) refers to a variety of barriers and respirators used alone or in combination to protect mucous membranes, airways, skin and clothing from contact with infectious agents.

There are no written policies and procedures for the operation and maintenance of the sterilizers or documented routine preventive maintenance is performed on the sterilizer at most of studied centers. According to study conducted by **(Hess, et al., 2013)**, presence of that is an essential components of an infection prevention program.

There is no proper training for personnel operating the sterilizers at all centers under study. Advisory and regulatory bodies including the CDC and The Joint Commission recommend that at least one individual with training in infection prevention be available **(CDC, 2011)**

Housekeeping and Waste Management assessment

Concerning housekeeping and Waste Management assessment, handling of waste material does not comply with the National Guidelines for Infection Control.

There is no training of Housekeeping personnel for the specific requirements of a health care facility and maintain an established housekeeping schedule, also personnel does not adhere to a written protocol for cleaning each patient care area. According to study conducted by **(Ahmed, et al. 2010)**, the absence of the previous elements are not matches with the guidelines in this regard.

Administration standards of the facility assessment

As regard administration standards of the facility assessment, there is no an organizational chart is updated and be available to all personnel.

Sterile and non-sterile areas are not clearly demarcated; also the dialysis treatment area is free of extraneous materials such as boxes and supplies, patients and equipment are not assessed and documented before, during and after dialysis. However all of these are essential guidelines in process of dialysis according to guidelines provided by European committee **(Watson, et al. 2001)**

Conclusion

According to the findings of the study and the interpretation of these results, the researcher comes to the following conclusions:

1.   The pre-dialysis assessment:

Some essential procedures were not done before starting of hemodialysis in spite of they are essential guidelines, they are represented in:
- Temperature measurement.
- Pulse measurement.
- Asking for recent medical history.
- Doing general physical examination.
- Reviewing previous lab results.

2.   The initiation of dialysis assessment:
Some essential procedures were not done at initiation of hemodialysis however they are essential guidelines, they are represented in:
- Washing hands.
- Wearing sterilized gloves.
- Avoiding of the swollen area until the swelling/ bruising has gone.

3.   The Intra-dialysis assessment:
Some essential procedures were not done during the hemodialysis in spite of they are essential guidelines, they are represented in:
- Hourly monitoring of pulse
- Hourly monitoring of heparin pump, mL delivered.
- Hourly monitoring of blood pump speed,
- Hourly monitoring of arterial and venous pressure limits,
- Hourly monitoring of color of blood and dialyzer
- Hourly monitoring of blood lines and circuit integrity.

4.   The assessment of procedures at termination of dialysis:
One essential procedure was not done at termination of hemodialysis in spite of it is essential guideline; it is represented in washing hands.

5.   The post dialysis assessment:
All procedures at post dialysis are matched with guidelines and no essential procedures are not done.

6.   In-between dialysis assessment:
Some essential investigations were not done in-between hemodialysis in spite of they are essential guidelines, they are represented in:
- bilirubin every 3 months.
- SGOT and SGPT every 3 months.
- Alkaline phosphatase every 3 months.
- Albumin every 3 months.
- CRP every 3 months.
- Ferritin every 6 months.
- Chest X-ray every 12 months.
- ECG every 12 months.
- nutrition education.

7.   Personnel and staff assessment:
This basic Cardiac Life Support training and certificates were not achieved in spite of its importance in this field.

8.   Infection Prevention and Control assessment:
Many procedures and activities were not matched with the guidelines of infection and control and that represented in:
- Most of patients with ESRD are not vaccinated against Hepatitis B.
- There is no proper use of personal protective devices such as gowns, gloves, visors and masks.
- There is no an approved method for the disposal of blood and body fluid spills.
- There is no appropriate hand washing practices.
- There is no appropriate disinfection of hemodialysis equipment including internal and external surfaces.
- There is no adequate hand washing sinks are appropriately located throughout the facility.
- There is no sufficient supply of cloth or disposable towels is available.
- There is no hand washing after removal of gloves and after contact with any contaminated objects.
- Smoking, eating and drinking is permitted in most of centers.
- There is no a designated person responsible for the maintenance and enforcement of infection control and occupational health standards.
- There is no written policy for managing patients with blood borne infections.

9.   Reprocessing, sterilization, and disinfection assessment:
Many procedures and activities were not matched with the guidelines and that represented in:
- The soiled area have no an adequate counter space to receive soiled supplies, have no a double utility sink to rinse and clean soiled items, have no a flushing device for the disposal of body fluid wastes.
- There is no an adequate facility to hand wash.
- Personnel working in the soiled area have no proper protective apparel for their personal protection.
- There are no written policies and procedures for the operation and maintenance of the sterilizers.
- There is no proper training for personnel operating the sterilizers.

10.   Housekeeping and Waste Management assessment:
Many procedures and activities were not matched with the guidelines and that represented in:
- Handling of waste material does not comply with the National Guidelines for Infection Control.
- There is no training of Housekeeping personnel for the specific requirements of a health care facility.
- Personnel do not adhere to a written protocol for cleaning each patient care area.

11.   Administration standards of the facility assessment:

Some indicators are not matched with standards, and that represented in:

▪ There is no an organizational chart is updated and be available to all personnel.

▪ The facility does not provide separate water treatment.

▪ Sterile and non-sterile areas are not clearly demarcated.

▪ The dialysis treatment area is free of extraneous materials such as boxes and supplies.

▪ Patients and equipment are not assessed and documented before, during and after dialysis.

Recommendations

Based on the results of this study and the conclusions, we can recommend the following:

1. The need to abide by the rules and guidelines governing theprocess of hemodialysis in all its components.

2. Developing strict laws to limit non-compliance with rules and standards relating to hemodialysis.

3. Raising the efficiency of renal dialysis units to the extent that is appropriate for the patients and improve the health in general.

4. Developing specialized training courses for the health care providers acting in field of hemodialysis.

5. Periodic further assessment of the health care services provided for patients of chronic renal failure under hemodialysis.

6. The need to further studies in field of hemodialysis and all what related to it.

References

1. Ahmed, A. M. A., et al. (2010) "Development of practice guidelines for hemodialysis in Egypt." Indian journal of nephrology 20.4: 193.

2. Am J Kidney Dis 2006: United States renal data system 2005 annual data report. Am J Kidney Dis 2006;47: S1-S286.

3. Am J Kidney Dis. 2002: National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. Am J Kidney Dis. 2002 Feb;39(2 Suppl1): S1–266.

4. Amar, Jacques, et al. (2000) "Nocturnal blood pressure and 24-hour pulse pressure are potent indicators of mortality in hemodialysis patients." Kidney international 57.6: 2485-2491..

5. Arenas, M.D., Sánchez-Payá, J., Barril, G., Garcia-Valdecasas, J., Gorriz, J.L., Soriano, A. et al. 2005, Amulticentric survey of the practice of hand hygiene in haemodialysis units: Factors affecting compliance. Nephrol Dial Transplant. ; 20: 1164–1171.

6. CDC 2011: Guide to Infection Prevention for Outpatient Settings: Minimum Expectations for Safe   Care. http://www.cdc.gov/HAI/pdfs/guidelines/standatds-of-ambulatory-care-7-2011.pdf. 2011.

7. Centers of Disease Control and Prevention (CDC) 2014: Prevalence of Chronic Kidney Disease and Associated risk Factors of Unites States. 1999-2014. Morb Mortal Wkly Rep. 2014 March 2;56(8);161–5.

8. Doebbeling, B.N., Vaughn, T.E., McCoy, K.D., Beekmann, S.E., Woolson, R.F., Ferguson, K.J. et al 2003.Percutaneous injury, blood exposure, and adherence to standard precautions: are hospital-based health care providers still at risk? Clin Infect Dis. ; 37: 1006–1013.

9. El Nahas A Meguid, Bello AK 2005: Chronic kidney disease: the global change. Lancet. 2005 Jan 22-28;365(9456):331–40.

10. El Rafay S, Said H, Al Sharkawy S, Hamido S. 2002, Infection control programmed instruction for nurse working at different health setting. Egypt Med J 2002; 1:1–9.

11. El-Enein, Nagwa Younis Abou, and Hala M. El Mahdy. (2011) "Standard precautions: a KAP study among nurses in the dialysis unit in a University Hospital in Alexandria, Egypt." The Journal of the Egyptian Public Health Association 86.1 and 2 (2011): 3-10.

12. Grudzinski, Alexa, et al. (2013) "A systematic review of buttonhole cannulation practices and outcomes." Seminars in dialysis. Vol. 26. No. 4. 2013.

13. Hess, Sally, and Virginia Bren. (2013) "Essential components of an infection prevention program for outpatient hemodialysis centers." Seminars in dialysis. Vol. 26. No. 4. 2013.

14. Jindal, Kailash, et al. (2006) "Hemodialysis clinical practice guidelines for the Canadian Society of Nephrology." Journal of the American Society of Nephrology: JASN17.3 Suppl 1 (2006): S1-27.

15. Karnik, Jwala A., et al. (2001) "Cardiac arrest and sudden death in dialysis units." Kidney international 60.1: 350-357.

16. Kouw, Peter M., et al. "Assessment of post-dialysis dry weight (1992): An application of the conductivity measurement method." Kidney international 41.2: 440-444..

17. Labriola L, Crott R, Desmet C, Andre G, Jadoul M (2011): Infectious complications following conversion to buttonhole cannulation of native arteriovenous fistulas: a quality improvement report. Am J Kidney Dis 57:442–448, 2011.

18. Mathew TH, Corso O, Ludlow M, Boyle A, Cass A, Chadban SJ, et al, 2010: Screening for chronic kidney disease in Australia: a pilot study in the community and workplace. Kidney Int Suppl. 2010 Mar; (116): S9–16.

19. Ministry of health, Malaysia, 2012, Medical Services Unit, Medical Development Division, Haemodialysis Quality And Standards, MOH/P/235.12(GU), ISBN 978-967-0399-14-0.

20. National health services, university hospital Birmingham, introduction to hemodialysis, 2017, cited in https://www.uhb.nhs.uk/Downloads/pdf/PiIntroductionToHaemodialysis.pdf.

21. O'grady, Naomi P., et al. (2011) "Guidelines for the prevention of intravascular catheter-related infections." Clinical infectious diseases 52.9: e162-e193.

22. Pittet, Didier, Benedetta Allegranzi, and John Boyce. (2009) "The World Health Organization guidelines on hand hygiene in health care and their consensus recommendations." Infection Control & Hospital Epidemiology 30.07: 611-622.

23. Pritchard, Vicki. (1999) "Joint Commission standards for long-term care infection control: putting together the process elements." American journal of infection control 27.1: 27-34.

24. Raad II, Hohn DC, Gilbreath BJ, et al. 1994. Prevention of central venous catheter-related infections by using maximal sterile barrier precautions during insertion, Infect Control Hosp Epidemiol, vol. 15 (pg. 231-8).

25. Rizqallah, Allam Muhammad Abdel-Hafiz. 2006. Adequacy of Hemodialysis among End Stage Renal Disease Patients at Al-Watani Hospital. Diss. An-Najah National University.

26. Shimokura, Gayle, et al. (2006) "Factors associated with personal protection equipment use and hand hygiene among hemodialysis staff."

American journal of infection control 34.3: 100-107.

27. Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007. Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. Available from: http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf [Last accessed on 16 April 2014]

28. Takahashi S, Okada K, Yanai M, 2010: The Kidney Early Evaluation Program (KEEP) of Japan: results from the initial screening period. Kidney Int Suppl. 2010 Mar; (116): S17–23.

29. Tattersall, James, et al. "EBPG guideline on dialysis strategies." Nephrology Dialysis Transplantation 22. suppl 2 (2007): ii5-ii21.

30. The Healthcare Infection Control Practices Advisory Committee 2002, HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Guideline for hand hygiene in health-care settings: Recommendations of the Healthcare Infection Control Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. MMWR. ; 51: 1–48.

31. Wang, Ming-Cheng, et al. 2005, "Stepwise increase in arterial stiffness corresponding with the stages of chronic kidney disease." American Journal of Kidney Diseases 45.3 (2005): 494-501.

32. Wei, S. S., et al. (1994) "Effect of heparin modeling on delivered hemodialysis therapy." American journal of kidney diseases 23.3 (1994): 389-393.

33. World Health Organization (WHO), 2006. World alliance for patient safety, WHO guidelines on hand hygiene in health care, Global patient safety challenge 2005–2006: 'Clean care is safer care'. Geneva, Switzerland: World Health Organization (WHO); 2006.

9/8/2017