

# Evaluation of Nursing Intervention Measures in Infection Control at Dialysis Units in Mosul City Hospitals

Ali Nafaa Salih, Rami Ramadhan Allo<sup>1</sup>

Nineveh Health Directorate, Ibn-Sina Hospital, Dialysis Unit, Mosul, Iraq, <sup>1</sup>Department of Clinical Sciences, College of Nursing, University of Mosul, Mosul, Iraq

## Abstract

**Background:** Nursing staff must take adequate precautions and implement appropriate practices to substantially reduce the risk of workplace transmission of blood-borne infections to patients and staff within dialysis units. This study aimed to evaluate the intervention measures for staff nurses in the dialysis unit. **Materials and Methods:** A descriptive cross-sectional design was used to conduct the study from December 1, 2021, to April 1, 2022, in three Mosul City hospitals. A convenience sample was selected. Sixty nurses participated in the study. **Results:** The study findings show that 41.7% of the study sample was within the 25–29 year age group, and the highest percentage was of males (51.7%). Regarding qualifications, 43.3% of nurses had a bachelor's degree, and 76.7% of them had less than 5 years of experience working in the dialysis unit. All the subjects received vaccination against the hepatitis virus. There are limitations in some nurses' practices, such as wearing a face shield, cleaning and disinfecting the beds and chairs, and external surfaces of the machines during pre- and post-dialysis. **Conclusion:** The study concludes that there are clear defects in the application of some nursing procedures and measures to control the transmission of infections inside hemodialysis units in Mosul city hospitals.

**Keywords:** Dialysis, evaluation, infection control, measures, nursing intervention

## INTRODUCTION

Hospital infections, also known as healthcare-associated infections (HAIs), are contracted while receiving medical care and can happen in an assortment of settings, such as hospitals, long-term care institutions, ambulatory settings, and even during discharge. The source or kind of infection-causing organism, which could be bacteria, viral, or fungal, determines the etiology of HAIs.<sup>[1]</sup> Strict measures, such as wearing protective gear such as gloves, gowns, masks, and goggles, are standard precautions to protect healthcare workers from infection due to blood or body fluids. Precautions to prevent droplet transmission include use of surgical masks and maintaining physical distance to prevent the spread of *Clostridium difficile* and multidrug-resistant organisms.<sup>[2]</sup> Patient and healthcare worker safety are seriously threatened by HAIs. Both patients and staff at hemodialysis centers (HDs) are at risk of acquiring HAIs because they are often and for long periods of time exposed to a number of possible pollutants.<sup>[3]</sup> Most infections in dialysis

patients are caused by a weakened immune system, frequent and long-term blood exposure through vascular access (mostly catheters) and extracorporeal circuits (with many ports and connections), close proximity to other dialysis patients during treatment, frequent contact with healthcare workers who move between patients and machines, frequent hospitalization and surgery, and other factors.<sup>[4]</sup> Infection control protocols in dialysis units continue to be the most crucial step in preserving a healthy environment and preventing the spread of infection among immunocompromised patients. Infection is the main reason why hemodialysis (HD) patients end up in the hospital and the second most common reason for their death.<sup>[5]</sup> Patients

**Address for correspondence:** Prof. Rami Ramadhan Allo,  
Department of Clinical Sciences, College of Nursing,  
University of Mosul, Mosul, Iraq.  
E-mail: rami.ramadhan@uomosul.edu.iq

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undergoing HD are vulnerable to a variety of diseases, including bloodstream infections, localized vascular access infections, blood-borne infections with hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV), as well as airborne infections. Contaminated equipment, environmental surfaces, and infected individuals are sources of diseases. One of the most frequent ways that healthcare-associated illnesses are transmitted is through the hands of contaminated healthcare workers.<sup>[6]</sup> HD patients with end-stage renal disease (ESRD) have a much higher risk of developing potentially fatal infections such as HBV, HVC, and HIV in the dialysis setting. Vascular access is a prominent factor in bloodstream infections, and central venous catheter (CVC) use is involved in 70% of these infections.<sup>[7]</sup> These infections cause significant morbidity, including cardiovascular disorders in ESRD patients. They are also more prone to viral and bacterial infections.<sup>[8]</sup>

This study aimed to evaluate the extent of nurses' intervention by applying the standards of the World Health Organization in implemented procedures that prevent infection and its transmission within the dialysis unit.

## MATERIALS AND METHODS

### Ethical approval

Ethical approval was obtained to conduct the study from the Committee for Medical Research Ethics at

the University of Mosul (No. 1889, November 10, 2021). The official permission of the Ethical Research Committee in the Nineveh Health Directorate was also obtained to implement the study (No. 21/163 on November 17, 2021).

### Study design and setting

In this descriptive design study, 60 nurses participated. All of the nurses working in the dialysis units were chosen. The study was conducted at three teaching hospitals in Mosul city from December 1, 2021 to April 1, 2022.

### Study sampling

A convenience sample was selected. The tool used in the study was composed of two sections: Section 1: Demographic characteristics of the sample, such as age, gender, educational qualification, years of work experience, and involvement in an educational course in respect to infection control.

Section 2: Checklist constructed using the World Health Organization guidelines related to Infection Prevention and Control Procedures composed of 25 items. Each item of the instrument used two options (0 for false practice and 1 for true practice), whereas, the total practicing values ranging from 0 to 25. The indirect observation method was used for collecting data from the subjects of the study while caring for each patient during the dialysis

**Table 1: Demographic characteristics of the study samples**

| Variables                                   |                   | Frequency | %           |
|---------------------------------------------|-------------------|-----------|-------------|
| Age                                         | 20–24             | 16        | 26.7        |
|                                             | <b>25–29</b>      | <b>25</b> | <b>41.7</b> |
|                                             | 30–34             | 5         | 8.3         |
|                                             | 35–39             | 7         | 11.7        |
|                                             | 40–44             | 7         | 11.7        |
| Gender                                      | <b>Male</b>       | <b>31</b> | <b>51.7</b> |
|                                             | Female            | 29        | 48.3        |
| Educational Qualification                   | Secondary school  | 14        | 23.3        |
|                                             | Diploma           | 20        | 33.3        |
|                                             | <b>Bachelor</b>   | <b>26</b> | <b>43.3</b> |
| Period of Nursing work                      | <b>1–5</b>        | <b>46</b> | <b>76.7</b> |
|                                             | 6–10              | 3         | 5.0         |
|                                             | 11–15             | 2         | 3.3         |
|                                             | 16–20             | 4         | 6.7         |
|                                             | 21–25             | 5         | 8.3         |
| Hepatitis B vaccination                     | Yes               | 60        | 100         |
| Source of Knowledge About Infection Control | Training          | 13        | 21.7        |
|                                             | <b>Guidelines</b> | <b>39</b> | <b>65</b>   |
|                                             | Seminar           | 8         | 13.3        |
| The Hospitals                               | Al-Salam          | 11        | 18.3        |
|                                             | <b>Ibn-Sina</b>   | <b>37</b> | <b>61.7</b> |
|                                             | Al-Mosul          | 12        | 20          |

procedure. Each nurse was monitored four times to ensure consistency and reliability of the same pattern. Each observation lasts 3–4 h.

## RESULTS

Based on age, the 25–29 age range had the highest percentage (41.7%) [Table 1], and based on gender, males made up the majority (51.7%). Most of the study sample's nurses (43.3%) had a bachelor's degree (certificate), and 76.7% of them had less than 5 years of experience working in a dialysis unit. All study participants had received a hepatitis B vaccination. The majority of nurses (65%) were knowledgeable of infection control procedures (from related guidelines).

Table 2 demonstrates the nursing practices of nurses for dialysis (52%) such as wearing face shields, cleaning and disinfecting patient beds and chairs as well as

external surfaces of machines before and after dialysis; checking patient weight prior to and following dialysis; cleaning and disinfecting medical equipment and dialysis machines, rechecking vital signs during and following dialysis; and completing nursing documentation after the end the dialysis process. The practices of excellent rank accounted for 28%, such as wearing sterile gloves before any procedure and dealing with dialysis machine, change the gloves between every patient, and every procedure, wearing sterile gloves before any nursing intervention for patients, maintaining patient safety, putting patient in semi-fowler position, sterilize and dressing the place of the needles after removing them from fistula and changing all connections between each patient and another. The remaining practices were distributed as follows: good practices (12%) such as hand washing, wearing a mask, and monitoring general health and observing any reactions or complications during dialysis; and practices

**Table 2: Overall nursing practices regarding dialysis procedure**

| No. | Checklist items                                                                                                       | No. | Mean  | St. deviation | Rank       |
|-----|-----------------------------------------------------------------------------------------------------------------------|-----|-------|---------------|------------|
| 1.  | Hand washing                                                                                                          | 60  | 0.962 | .659          | Good       |
| 2.  | Wear mask                                                                                                             | 60  | 0.925 | .908          | Good       |
| 3.  | Wear gown or uniform                                                                                                  | 60  | 0.675 | 1.499         | Acceptable |
| 4.  | Wear face shield                                                                                                      | 60  | .00   | .000          | V. Poor    |
| 5.  | Wear sterile gloves before any procedure and dealing with dialysis machine                                            | 60  | 1     | .000          | Excellent  |
| 6.  | Cleaning and disinfecting the beds and chairs of patients with a high-level disinfectant between each of the patients | 60  | .00   | .000          | V. poor    |
| 7.  | Cleaning and disinfecting the external surfaces of the machines                                                       | 60  | .05   | .220          | V. poor    |
| 8.  | Change the gloves between every patient and during every procedure                                                    | 60  | 1     | .000          | Excellent  |
| 9.  | Wear sterile gloves before performing any nursing intervention for patients                                           | 60  | 1     | .000          | Excellent  |
| 10. | Check patient weight prior to dialysis                                                                                | 60  | .00   | .000          | V. poor    |
| 11. | Check vital signs correctly (pre)                                                                                     | 60  | 0.525 | .573          | Acceptable |
| 12. | Maintain patient safety                                                                                               | 60  | 1     | .000          | Excellent  |
| 13. | Put patient in semi-fowler position                                                                                   | 60  | 1     | .000          | Excellent  |
| 14. | Clean connection site                                                                                                 | 60  | .00   | .000          | V. poor    |
| 15. | Use of a special syringe for each type of nursing intervention and not to be reused again                             | 60  | .00   | .000          | V. poor    |
| 16. | Do not re-cover the syringe by using hands and dispose of it in the special container.                                | 60  | .00   | .000          | V. poor    |
| 17. | Monitoring the general health and any reaction or complications during the dialysis                                   | 60  | 0.78  | 1.250         | Good       |
| 18. | Clean and disinfect the medical equipment                                                                             | 60  | 0.25  | .000          | Poor       |
| 19. | Recheck the vital signs during the dialysis                                                                           | 60  | 0.337 | .481          | Poor       |
| 20. | Sterilize and dressing the place of needle insertion after removing from the fistula                                  | 60  | 1     | .000          | Excellent  |
| 21. | Changing all connections between each patient and another                                                             | 60  | 1     | .000          | Excellent  |
| 22. | Sterilize machine after end of dialysis                                                                               | 60  | 0.27  | .279          | Poor       |
| 23. | Patient weight after the end of dialysis                                                                              | 60  | 0.25  | .000          | Poor       |
| 24. | Recheck the vital signs finally                                                                                       | 60  | 0.42  | .624          | Poor       |
| 25. | Nursing document                                                                                                      | 60  | 0.495 | .911          | Poor       |

of acceptable rank (8%) are wear gowns or uniforms and correctly checking vital signs (pre).

## DISCUSSION

ESRD, which necessitates long-term care and is exceedingly expensive, is a global health problem. In many different countries, chronic renal failure is becoming more prevalent. For hemodialysis (HD) patients, infection is the second leading cause of mortality and the primary reason for hospitalization. Healthcare professionals (HCP) are believed to play a significant role in preventing infections because they consistently and strictly adhere to the guidelines for standard precautions. Poor adherence to infection control techniques by HCP is the leading cause of infection incidence.<sup>[9]</sup> Preventive measure is an action taken to stop anything negative from happening in the healthcare system. Control measures refer to a set of precise actions and processes under strict rules aimed at minimizing pathogen contamination.<sup>[10]</sup> One might frequently anticipate potential exposure to blood and contaminated items during hemodialysis procedures. Personal protective equipment (PPE) refers to specialized equipment worn for protection against contamination of infectious materials. When choosing PPE, it is essential to consider the type of potential exposure from patient interaction, the suitability of the PPE for the task, and likely modes of pathogen transmission.<sup>[11]</sup> Hand hygiene practices, including hand washing and antiseptics, are vital when accomplishing tasks such as careful handling of surgical equipment and soiled linen.<sup>[12]</sup> The most important means of pathogen transmission in healthcare settings, including hemodialysis facilities, is thought to be the transmission of germs from patient-to-patient via the contaminated hands of healthcare personnel.<sup>[13]</sup> Many ways to stop infection spread are keeping hands clean, regular use of aseptic techniques, and cleaning and disinfecting, which are easy and cheap. Still, they also require staff accountability, behavior change, and better education, reporting, and monitoring systems.<sup>[14]</sup> Which are highly dependent on in the present study [Table 2].

The main personal protective equipment includes gloves, gowns, and face protection (masks, goggles, and face shields). Dialysis staff must replace them immediately if they become soiled with blood, body fluids, secretions, or excretions.<sup>[12]</sup> Wearing PPE is necessary to prevent infection transmission for nursing staff and patients; it is one of the essential methods of preventing hospital-acquired infections.<sup>[13]</sup> The use of personal protective equipment such as gloves, masks, and equipment, when handling blood samples and environmental management practices, such as pollution cleanup and waste recycling, is significant.<sup>[15]</sup>

Strict measures such as wearing protective clothing, gloves, gowns, masks, and goggles, as well as handling objects or

equipment that have surfaced in patient environments to prevent the transmission of infectious agents, are other precautions to protect healthcare workers. Additional protection to avoid droplet transmission includes use of surgical masks and maintaining physical distance.<sup>[15]</sup> This practice is not always dependent on patient care [Table 2]. Allo *et al.*<sup>[16]</sup> presented in their study that 78% of the nurses who work inside critical units of Mosul city hospitals do not wear face shields during contact with patients. Saud and Ali<sup>[17]</sup> found in their study that (82%) of the nurses working in dialysis units do not wear eye goggles or face shields while working in the team. These results are similar to those of our study. This result shows that nurses work in dialysis units without wearing a face shields when dealing with patients. The main reason is the lack of supply from the Ministry of Health and the inability of the medical and nursing staff to buy it from the market daily.

In our research, the majority of nurses (65%) do not participate in infection control training programs or seminars. This conclusion supports the findings of a study by Saleh *et al.*<sup>[18]</sup> who revealed that 61% of nurses attended conferences, training sessions, or educational lectures. This result either indicates a lack of involvement or unwillingness of the nursing staff or the absence of any activity related to avoiding the transmission of infection or controlling it by health institutions or hospitals on the one hand and the other hand, the work overload resulting from the shortage of nursing staff compared to the number of patients.<sup>[18]</sup> Osman *et al.*<sup>[19]</sup> indicated that training and educational nursing interventions dramatically improved nurses' knowledge, skills, and practice concerning infection prevention in hemodialysis units.

Patients receiving hemodialysis are at a much higher risk of developing life-threatening infections, and the majority of bloodstream infections are connected to vascular access, with the use of a CVC accounting for 70% of these infections. For all patients undergoing dialysis, blood tests can reveal the presence of viruses such as hepatitis B, hepatitis C, and/or HIV. So such viruses—in case of the present—may spread to other patients. During hemodialysis, a patient's blood passes through a dialysis machine. As a dialysis unit accommodates numerous patients, the possibility of transmission of those viruses can occur among patients.<sup>[20]</sup>

The skin around the catheter exit site should be cleaned with an antiseptic solution such as chlorhexidine and alcohol. The catheter hub should be cleaned frequently (also known as “scrubbing the hub”), and an antimicrobial ointment or dressing coated with chlorhexidine should be used to prevent infection.<sup>[21]</sup> CVCs should be washed with the appropriate disinfectant (e.g., alcohol-chlorhexidine, povidone-iodine, or 70% alcohol) after the caps have been removed. Widely used antimicrobial barrier caps may also aid in minimizing

bloodstream infections associated with catheters. Although antibiotic lock solutions have been shown to lower infection rates, they are not recommended for prevention due to concerns that resistant organisms may grow.<sup>[22]</sup>

Patients with ESRD are at risk of contracting the HBV due to their exposure to blood products and immunocompromised status.<sup>[23]</sup> According to Marty *et al.*<sup>[24]</sup>, administering alcohol and chlorhexidine gluconate before accessing central line hubs and vascular grafts reduces the risk of central line-associated bloodstream infection (CLABSI) events and maintains statistically significantly reduced (CLABSI) rates in the inpatient dialysis population. Timofte *et al.*<sup>[25]</sup> emphasized the great importance of prevention in disease transmission within HDs. They also confirmed the application of the measures recommended by international guidelines regarding preventing infection transmission within HDs. Hosney *et al.*<sup>[26]</sup> mentioned in their research that most nurses had poor knowledge of practices regarding infection control in the hemodialysis unit.

According to the results of this study [Table 2], the results showed apparent weaknesses in disinfecting and sterilizing the beds and chairs of patients, external surfaces of the machines, disinfecting the medical equipment, connection site, and sterilizing the machine after end dialysis. All these defects may lead to the acquisition and transmission of infections and communicable diseases between patients and medical staff. Nguyen *et al.*<sup>[27]</sup> indicated that by using separate dialysis equipment for patients who test positive for the Hepatitis C virus, in addition to strict adherence to general infection control policies, the incidence of the virus among Saudi patients receiving hemodialysis decreased from 2.4% to 0.2%. Due to the shortage of dialysis machines, the nurse must clean and disinfect the machine properly to prevent the transmission of infection. This was not practiced well in the present study [Table 2].

The needle must actually be disposed of when it comes to waste management in closed, strong, and not overfilled containers. Since the container's surface is probably polluted, it should be done using the "no touch" technique to drop the needle into it. Staff members should finish caring for patients before disposing of needles if doing so is challenging due to the container's design. Bloodlines and dialyzers that are no longer needed must be sealed as securely as possible in a fluid-tight waste bin or a leak-proof container before being removed from the dialysis unit. A special place away from the treatment and preparation facilities should be used to drain the circuit and remove any parts that need to be used elsewhere.<sup>[28,29]</sup>

Precautions to prevent the spread of disease include using and discarding sterile needles, syringes, and scalpels properly; keeping work environments tidy; and donning gloves and gowns. Using surgical masks and maintaining

physical distance are two more preventative measures to stop the spread of droplets.<sup>[30,31]</sup> The present study did not practice this well [Table 2]. It used infection-controlling practices such as avoiding contact with bodily fluids, blood, rashes, and mucus membranes. Also, do not let other patients use the hospital beds because it is more likely that the virus will spread to other patients. Infections are the most dangerous problems due to the high cost of examining and treating them in hospitals. They also have the highest morbidity and mortality rates.<sup>[32,33]</sup>

The environment of the dialysis center could be a cause of infection spread. Hemodialysis facilities have been associated to the spread of germs through dialysis stations, priming buckets, (HD) machines, effluent drain wall boxes, and other equipment that was not cleaned and disinfected properly.<sup>[34]</sup> Every apparatus, including the dialysis machine's front, should be considered contaminated post a dialysis session.<sup>[35]</sup> This practice was poor in the present study [Table 2].

The importance of standard measures was underlined, including disinfecting and sanitizing non-critical surfaces in patient care areas. It is essential for regularly handled surfaces, especially those closest to the patient, as they are more prone to getting affected (such as chairs, machines, carts, bedrails, bedside tables, commodes, doorknobs, sinks, surfaces, and equipment close to the patient). The external transducer protective filter needs to be removed immediately, and the transducer was examined if it gets wet with blood or fluid while the dialysis session is in progress. If there is blood or fluid on the side of the filter that is connected to a machine, the internals of the dialysis equipment must be examined before using it on additional patients.<sup>[36]</sup> This practice was inadequate in the present study [Table 2]. The patient's vital signs, weight, and safety serve as important gages of the general health of the human body, and any malfunction or flaw is taken as an indication that something is wrong internally.

The most noticeable of these is a high body temperature, which is a key sign of viral or bacterial infections. This finding reveals a flaw in the findings of the current study [Table 2]. Zhao and Su indicated that the risk of complications in the hemodialysis room is high. Infection, hypertension, and arrhythmia are common. Inside the hemodialysis unit, nursing precautions and monitoring of vital signs should be done to minimize these problems.<sup>[37]</sup> Early diagnosis and management are important to prevent unwanted effects, so nurses use various methods to assess and identify signs and symptoms of sepsis.<sup>[38]</sup>

## CONCLUSION

The study concluded that there is a clear defect in the application of some nursing procedures and measures to control the transmission of infection, with a shortage in

sterilization and disinfection processes for the patient unit, which may contribute to the transmission of infection to other patients inside the dialysis unit. Such defects included measuring the patient's weight, measuring vital signs, and accurate nursing documentation in the patient's sheet, with a lack in the number of nursing staff who are working in hemodialysis units.

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### Conflicts of interest

The authors declare no conflicts of interest.

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