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Effect of Instructional Guidelines on Nurses' Compliance Toward Infection Control Standard Precautions in Dialysis Unit

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ABSTRACT

Background: Infection control in hemodialysis units remains a critical challenge due to patients' increased vulnerability and the complex care environment. Nurses, as the primary caregivers, play a vital role in preventing healthcare-associated infections through consistent adherence to standard precautions. **Objective:** This study aimed to assess the effect of instructional guidelines on nurses' compliance toward infection control standard precautions in the dialysis unit. **Subjects and Methods:** A pre-experimental one-group pretest-posttest design was used, involving a convenience sample of sixty female nurses working in the hemodialysis unit. Data were collected using an interview questionnaire and observational checklist to evaluate personal characteristics and nurses' compliance before and after implementing the instructional guidelines. The intervention included educational sessions and printed materials focused on standard precautions. Compliance scores were analyzed using descriptive and inferential statistics, including paired t-tests and chi-square tests. **Results:** Post-intervention, there were significant improvements in nurses' compliance scores regarding hand hygiene, personal protective equipment, clinical practices, specimen handling, waste management, and linen handling (all $p < 0.001$). The overall compliance rate increased by 32% after the program. Environmental assessment revealed that most areas met infection control standards, with some gaps in equipment storage and ventilation. Positive correlations were also found between compliance levels and both nurses' experience and prior training. **Conclusion:** Instructional guidelines proved effective in improving nurses' compliance with infection control standard precautions in the dialysis unit. Ongoing education and organizational support are recommended to sustain these improvements.

Keywords: Dialysis Unit, Instructional Guidelines, Nurses' Compliance.

INTRODUCTION

Chronic kidney disease is a silent health challenge that quietly worsens over time, affecting hundreds of millions worldwide. Its prevalence is steadily rising, and if current trends continue, it may become one of the world's top causes of death in the coming years. People who have suffered episodes of acute kidney injury are especially vulnerable, with a much greater likelihood of developing chronic kidney disease later on and progressing more quickly toward end-stage renal failure that needs intensive management like dialysis. Much research now focuses on preventing this worsening, particularly after acute incidents, so that patients can avoid more serious health issues down the line [(1)].

For those undergoing dialysis, the threat of infection is always present. The routine processes involved in dialysis care, such as frequent blood access and long exposure to the clinic environment, raise the chances of being exposed to infectious agents. Additional factors—like compromised immunity and repeated interactions with healthcare staff—further contribute to the risk. As a result, infection is a leading cause of complications, making strong infection control measures essential in these settings[(2)].

Standard precautions are a universal set of recommendations that serve as the cornerstone of infection prevention in clinical practice. These guidelines, promoted by organizations like the CDC and WHO, provide protection for both healthcare workers and patients by reducing the chances of spreading germs via blood, secretions, and even seemingly clean skin. Adhering to these standards is widely recognized as the first and most critical line of defense against healthcare-associated infections[(3)].

When it comes to dialysis units, the cleaning process is especially important. Even surfaces that look clean need to be disinfected between patients, and any area contaminated with blood or fluids should be treated with effective cleaning agents. These careful cleaning routines are a crucial part of keeping infection risks as low as possible for both patients and staff[(4)].

Nurses take on a central role in the dialysis environment. They not only carry out the dialysis treatments themselves, but also coordinate the broader care of each patient and are expected to maintain high standards of infection control at every stage. Their actions are key in making sure that strict protocols are followed, particularly to prevent blood-borne infections and keep vulnerable patients safe throughout the dialysis process[(5,6)].

SIGNIFICANCE OF THE STUDY

Infection is the leading cause of hospitalization and the second most common cause of death in dialysis patients, largely due to poor compliance with infection control practices. Strict adherence to standard precautions is vital to reduce infection rates. Globally, hepatitis C affects nearly one in four dialysis patients. At Aswan University Hospital in 2023, 25,920 dialysis admissions were recorded; about 5,184 (20%) were exposed to hepatitis C, and 11,664 (45%) developed

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other infections. These figures underscore the urgent need to strengthen infection control and ensure better compliance among dialysis nurses[7-9].

AIM OF THE STUDY

The aim of this research is to determine the effect of implementing instructional guidelines on nurses' compliance toward infection control standard precautions in a dialysis unit.

SUBJECTS AND METHODS

Study Design: This research was designed as a single-group pretest–posttest pre-experimental study.

Setting: The research was carried out at the dialysis unit of Aswan University Hospital. The unit provides ongoing hemodialysis care for a large population, making it an appropriate site for evaluating practical infection control measures among nursing staff.

Participants: A total of 60 nurses, all currently working within the hemodialysis unit, participated in the study. The sample was selected based on convenience and availability during the study period. Inclusion criteria required participants to be actively engaged in direct patient care in the dialysis unit for the duration of data collection and to voluntarily agree to take part in the study. No nurses were excluded due to gender or level of education, provided they met the above requirements.

Data Collection Tools:

To collect comprehensive information, two main tools were developed and refined following a detailed review of the literature.

Tool (I): A structured interview sheet: collecting background details such as age, gender, education, marital status, length and type of experience (both inside and outside dialysis settings), and participation in infection control training courses.

Tool (II): An observational checklist: adapted from established references, focusing specifically on nurses' practical compliance with infection control standard precautions, and on evaluating the environmental design of the dialysis unit. This checklist was divided into two main parts:

Part I: Included 83 items organized under nine categories: hand hygiene, use of personal protective equipment, clinical practice procedures, specimen handling, sharp disposal, management of body fluid spills, vaccine transport and storage, waste disposal, and safe linen handling. Each item was assessed using a 3-point scale, with scores of 3 for "completely done," 2 for "partially done," and 1 for "not done." Items not applicable to a given nurse were scored as 0. Based on total scores, compliance was classified as low (0–83), moderate (84–125), or high (126–168) [5].

Part II: Comprised 17 items evaluating the dialysis unit's physical environment and infection control infrastructure, covering areas such as layout, equipment storage, and the presence of written policies. Responses were rated as 2 ("available and adequate"), 1 ("available and inadequate"), or 0 ("not available"). Environmental design was categorized as low (0–16), moderate (17–24), or high (25–34) [6].

Validity and Pilot Testing:

Before starting the main study, both tools were reviewed for content validity by a panel of five experts three from the Faculty of Nursing and two from the Faculty of Medicine at Aswan University. A pilot test involving 10% of the final sample (n=6) was performed to assess the clarity and practicality of the tools and to estimate completion time. Data from the pilot were not included in the final analysis, and any required adjustments were made accordingly.

Ethical considerations:

Official approval to conduct the study was obtained from the Faculty of Nursing and the hospital administration. Additional permission was secured from the dialysis unit director. Once all permissions were in place and tools validated, data collection commenced. All participants gave informed consent, and confidentiality was assured throughout the study. The study adhered to the Helsinki Declaration throughout its execution.

Statistical Analysis

Data analysis was conducted using SPSS software (version 24). Descriptive statistics (mean, standard deviation, frequency, percentage) summarized the main findings. Categorical variables were compared with the chi-square test, and paired sample t-test was used to assess pre- and post-intervention differences for quantitative outcomes. The Spearman correlation coefficient was applied to explore associations between key variables. Bar and pie charts were generated to visualize results. A p-value ≤ 0.05 was considered statistically significant, and $p \leq 0.001$ was interpreted as highly significant

RESULTS

The majority of the nurses participating in this study were within the 30 to 39-year age range, accounting for almost half of the sample. All respondents were females, and the bulk of them—nearly three-quarters—were married. In terms of educational qualifications, most nurses (more than four out of five) held an associate degree from a technical health institute, while a smaller portion (around one in six) had completed a diploma in nursing. Only a single participant reported having a bachelor's degree in nursing. With respect to professional experience, a significant proportion (over 80%) had worked directly in the dialysis unit, and the remainder reported experience gained outside the dialysis setting. When it came to infection control training, just under half of the nurses indicated previous participation in relevant courses, and among those who did, the vast majority had attended only one training session **(Figure 1).**

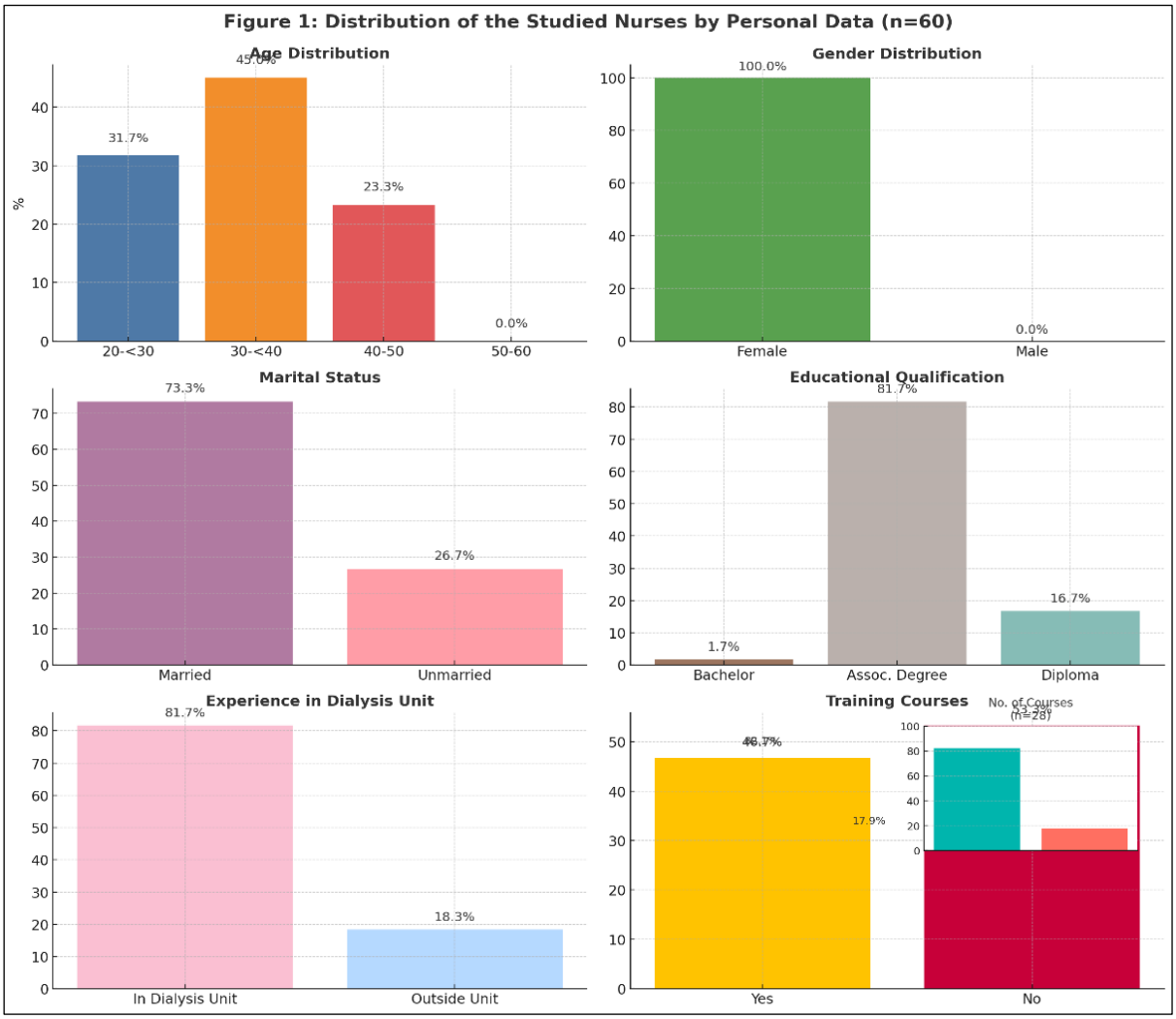

Figure (1): Distribution of the studied nurses by personal Data (n=60).

Table (1) indicates that there was a highly statistically significant improvement of the studied nurses' total compliance toward hand hygiene and personal protective equipment as infection control standard precautions in dialysis unit post program with a percentage of improvement 36% and 70% respectively.

Table (1): The mean scores of the studied nurses' compliance regarding hand hygiene and personal protective equipment pre and post intervention:

Items	Pre program	Post program	t	P -value
Hand hygiene				
Mean ±S. D	22.25 ± 3.82	30.53 ± 6.36	-8.383-	**<0.001****
Min-Max	16-35	12-36		
Percentage of change	36%			
Personal protective equipment				
Mean ±S. D	4.98 ± 2.90	8.48 ± 2.494	-10.841-	**<0.001****
Min-Max	2-14	5-14		
Percentage of change	70%			

(**) highly statistically significant. t= Paired sample t test.

Table (2) indicates that there was a highly statistically significant improvement of the studied nurses' total compliance toward clinical practice (Central venous catheters, I.V injection, I.M injection, and insertion of a line or canula) as infection control standard precautions in dialysis unit post program with a percentage of improvement 29%, 30%, 92% and 33.7% respectively.

Table (2): The mean scores of the studied nurses' compliance regarding clinical practice (Central venous catheters, I.V. injection, I.M injection, and insertion of a line or canula) pre and post intervention:

Items	Pre program	Post program	t	P -value
Clinical practice:				
Central venous catheters				
Mean ±S. D	**10.65 ± 1.63**	**13.68 ± 1.27**	**-13.380-**	**<0.001****
Min-Max	**8-15**	**11-15**		
Percentage of change	**29%**			
Intravenous injection				
Mean ±S. D	**26.67 ± 4.75**	**34.7 ± 3.89**	**-12.811-**	**<0.001****
Min-Max	**22-41**	**27-42**		
Percentage of change	**30%**			
Intramuscular injection				
Mean ±S. D	**6.43 ± 2.75**	**12.50 ± 1.65**	**-16.051-**	**<0.001****
Min-Max	**4-15**	**8-15**		
Percentage of change	**92%**			
Insertion of a line or(cannula)				
Mean ±S. D	**15.73 ± 2.641**	**21.05 ± 2.75**	**-10.645-**	**<0.001****
Min-Max	**12-24**	**15-24**		
Percentage of change	**33.7%**			

(**) highly statistically significant. t= Paired sample t test.

Table (3) shows that there was a highly statistically significant improvement of the studied nurses' total compliance toward specimen handling, safe handling and disposal of sharps, and management of spillage and contamination with body fluid as infection control standard precautions in dialysis unit post program with a percentage of improvement 25%, 6% and 36% respectively.

Table (3): The mean scores of the studied nurses' compliance regarding specimen handling, Safe handling and disposal of sharps and management of spillage and contamination with body fluid, pre and post intervention:

Items	Pre program	Post program	t	P -value
Specimen handling				
Mean ±S. D	12.76 ± 1.35	15.90 ± 1.51	-4.781-	**<0.001****
Min-Max	12-18	13-18		
Percentage of change	25%			
Safe handling and disposal of sharps				
Mean ±S. D	11.85 ± 1.55	12.50 ± 1.50	-3.396-	**0.001****
Min-Max	9-15	9-15		
Percentage of change	6%			
Management of spillage and contamination with body fluid				
Mean ±S. D	7.18 ± 2.029	9.78 ± 2.63	-5.511-	**<0.001****
Min-Max	4-14	4-14		
Percentage of change	36%			

(**) highly statistically significant. t= Paired sample t test.

Table (4) shows that there was a highly statistically significant improvement of the studied nurses' total compliance toward waste disposable and safe handling of linens as infection control standard precautions in dialysis unit post program with a percentage of improvement 9.5%, and 19% respectively.

Table (4): The mean scores of the studied nurses' compliance regarding Waste disposal and Safe handling of linen, pre and post intervention:

Items	Pre program	Post program	t	P -value
Waste disposal				
Mean ±S. D	21.18 ± 1.66	23.10 ± 2.42	-5.561-	**<0.001****
Min-Max	19-27	20-27		
Percentage of change	9.5%			
Safe handling of linen				
Mean ±S. D	12.61 ± 2.54	15.01 ± 2.88	-8.379-	**<0.001****
Min-Max	9-21	9-21		
Percentage of change	19%			

(**) highly statistically significant. t= Paired sample t test.

Table (5) indicates that there was a highly statistically significant improvement of the studied nurses' total compliance toward infection control standard precautions in dialysis unit post program with 32% a parentage of change.

Table (5): Comparison between total mean scores of the studied nurses' compliance toward infection control standard precautions in dialysis unit pre and post intervention (n=60)

	Pre program	Post program	T	P -value
Total compliance				
Mean ± S. D	148.95 23.36	196.05 13.01	-16.445-	**<0.001****
Min-Max	131-231	164-228		
Percentage of change	32%			

(**) highly statistically significant. t= Paired sample t test.

Figure (2) shows that only (8.3%) of the studied nurses had high level of total compliance and one half (50%) of them have low level pre intervention while, this percentages improved to (70%) had high level and only (11.7%) had low level of total compliance toward infection control standard precautions in dialysis unit post intervention.

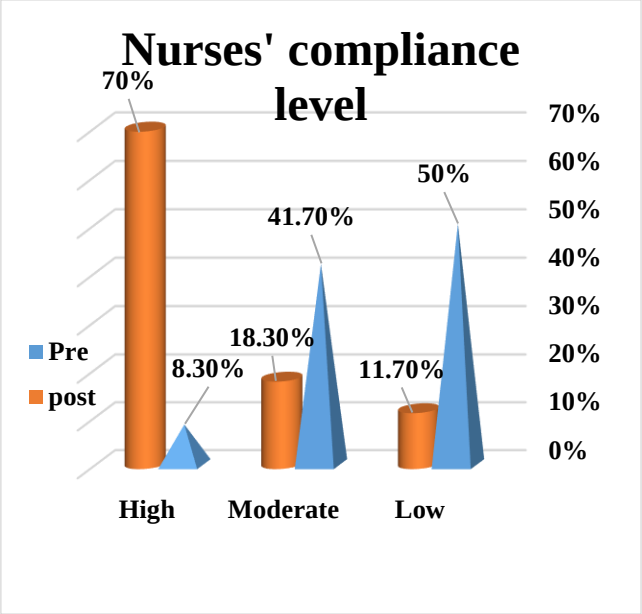

Figure (2): Total level of nurses' compliance toward infection control standard precautions in dialysis unit pre and post intervention (n=60).

Figure (3) shows that in dialysis units, all physical setup items were adequate except mechanical ventilation and waste bins with lids, which were available but inadequate. For storage, only oxygen cylinder closets and attire lockers were inadequate. Equipment, supply, and drug storage (inspected regularly) were adequate. All policies were adequate except records and reports, which were available but inadequate.

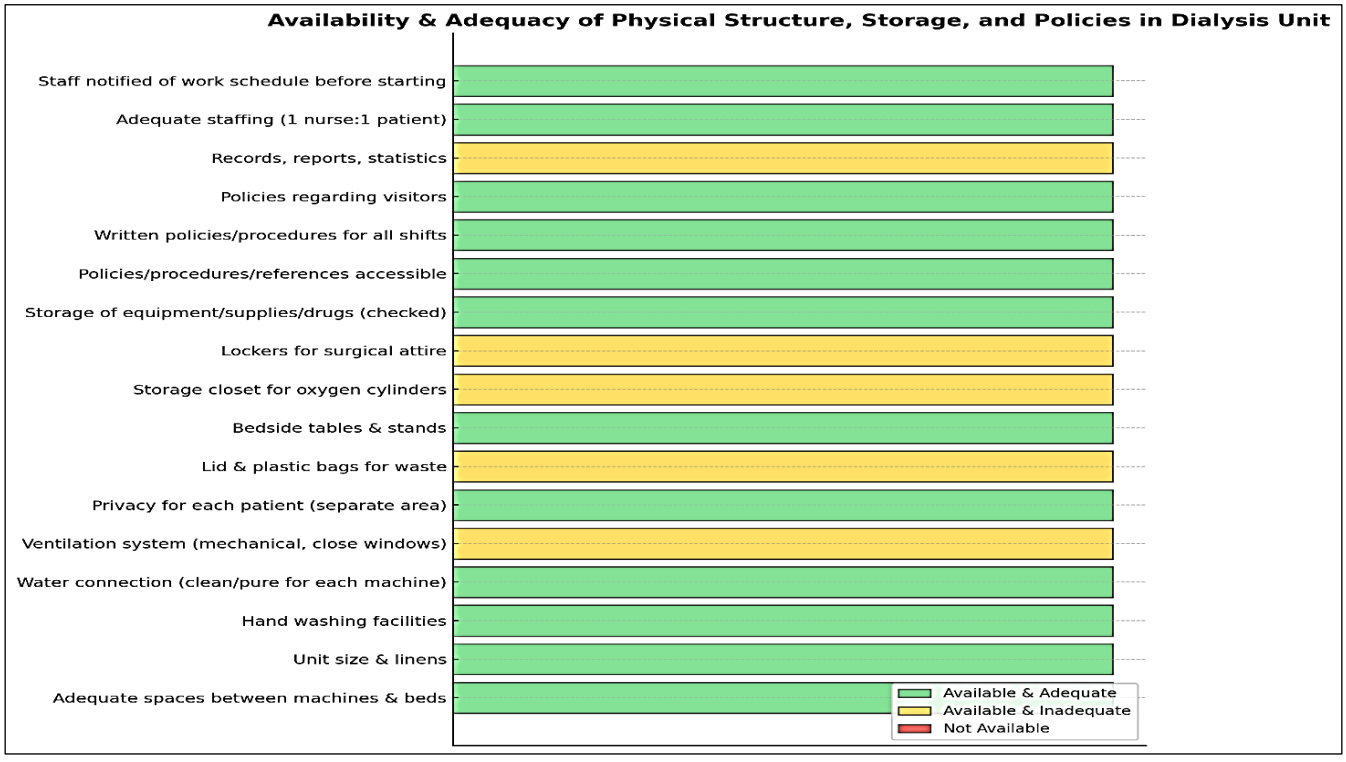

Figure (3): Dialysis unit's environmental design questionnaire.

Table (6) clarifies that, dialysis unit's environmental design had high level of meeting standards of infection control. Also, physical setup and presence of policies domains had high levels, while equipment and supply storage domain had moderate level of meeting standards of infection control.

Table (6): Level of meeting standards regarding Dialysis unit's environmental design:

Dialysis unit's environmental design domains	Maximum score	Score	Interpretation
Physical set up structure	16	14	High level
Equipment and supply storage	6	4	Moderate level
Presence of policies	12	11	High level
Total	34	29	High level

Figure (4) shows there was a statistically significant relation between the studied nurses' total knowledge level and their age, years of experiences and having a training course during preprogram phase. Also, there was a statistically significant relation between the studied nurses' total knowledge level and their educational qualification and years of experiences during post program phase.

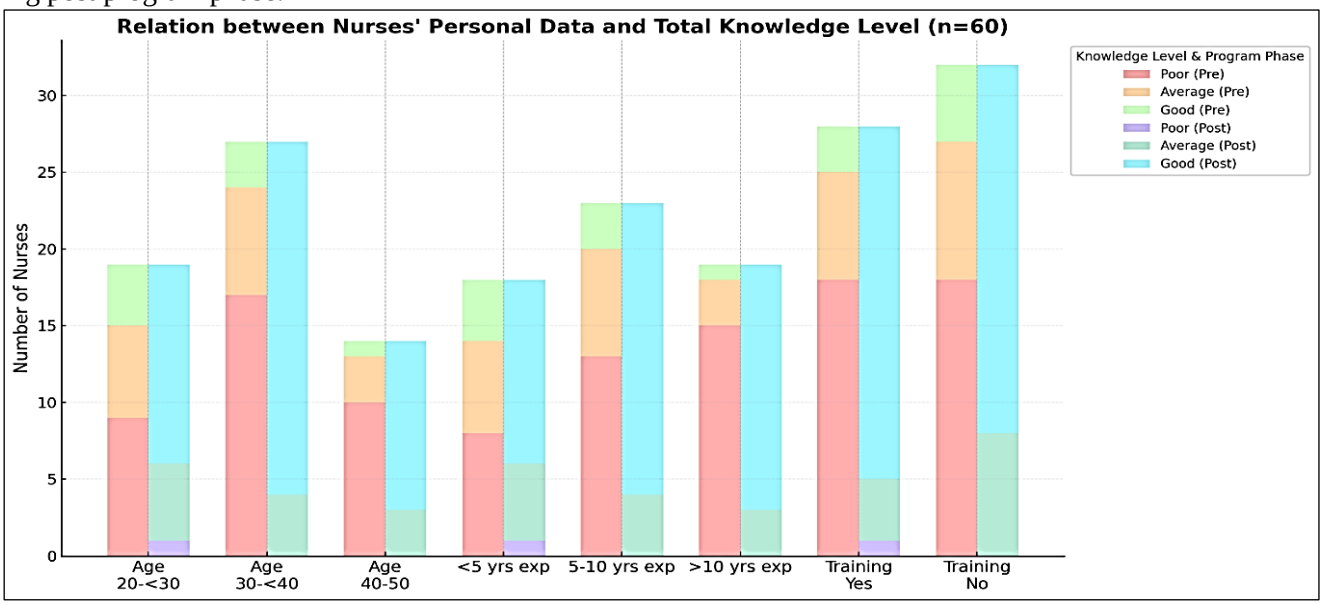

Figure (4): Relation between nurses' personal data and total knowledge level (n=60).

Figure (5) shows that there was a statistically significant relation between the studied nurses' total compliance level and their age, educational qualification and years of experiences during preprogram phase. Also, there was a statistically significant relation between the studied nurses' total compliance level and their age and having training course during post program phase.

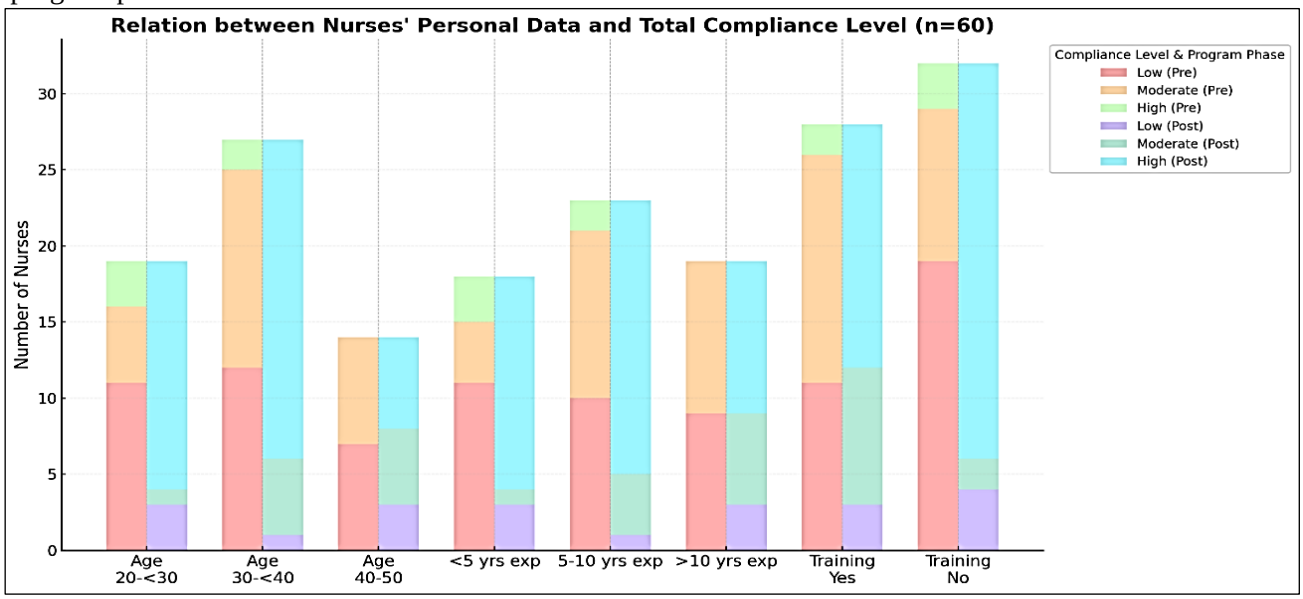

Figure (5): Relation between nurses' personal data and total compliance level (n=60).

Table (8) Shows that, there was a highly statistically significant positive correlation between total knowledge and total compliance score toward infection control standard precautions in dialysis unit at both pre and post intervention.

Table (8): Correlation between total knowledge and total compliance score among the studied nurses at pre and post intervention (n=60).

Study variables		Total compliance level	
		r	P
Pre program	**Total knowledge level**	0.595	**<0.001****
Post program	**Total knowledge level**	0.468	**0.001****

DISCUSSION

Patients undergoing hemodialysis, as well as the nurses who care for them, face a heightened risk of infections acquired within the healthcare setting. This increased vulnerability comes from being regularly exposed to various potential contaminants present in the dialysis environment. Because of this, it is widely recognized that infection control protocols are especially critical in hemodialysis units to help cut down the chances of healthcare-associated infections and to prevent cross-contamination within these settings. In light of these concerns, our study set out to explore how instructional guidelines might influence nurses' adherence to standard infection control precautions within the dialysis unit at Aswan University Hospital, aiming to strengthen overall patient safety and care quality[10].

When looking at the personal profiles of nurses in our study, we found that a bit less than half were aged between thirty and forty years, all were women, and most were married. The majority of participants held diplomas from technical health institutes, and less than half reported having attended a training course in infection control—most of these nurses had only participated in a single training. This might reflect the staffing pattern in our setting, where technical diploma nurses are more common than those with bachelor's degrees, and nursing continues to be a predominantly female profession in Egypt.

Our findings are in agreement with results from **Elasrag and colleagues**, who found that around half their sample of nurses were aged thirty to less than forty, with more than three-quarters being females, and over half holding technical health institute qualifications[11]. On the other hand, **Morkes *et al.*** [12] reported that most of their nurse participants were younger (aged 20–30) and the majority had not received any specific infection control training, which is at odds with our data.

When it comes to years of nursing experience, we saw that a bit more than one third of our nurses had worked between five and ten years. This makes sense given the local hiring practices, where nurses tend to start work in their twenties, meaning many in the thirty to forty age group have accumulated five to ten years of service. Our results are consistent with those of **Soliman *et al.*** [13]**,** who noted that a similar proportion of nurses working in a hemodialysis unit had five to ten years of experience. However, **Fahim and colleagues**[1] found different results, with half of their sample reporting less than or equal to five years of experience in the dialysis setting.

Analysis of nurses' compliance with infection control standard precautions—especially hand hygiene and the use of personal protective equipment—demonstrated a marked and statistically significant improvement after the intervention. This could be attributed to the presence of clear, detailed, and well-implemented infection control guidelines during the study period, which facilitated understanding and encouraged correct practices among staff.

Our findings are closely aligned with those of **Abdel Rahman and colleagues**[14] who found that targeted education resulted in significant gains in hand hygiene compliance among nurses in a hemodialysis unit. In contrast, a study from **Ogunrinde *et al.*** [15] noted generally high compliance with protective equipment even before training, suggesting differences in baseline culture and resources between settings.

For clinical practices—such as handling central venous catheters, performing intravenous or intramuscular injections, and inserting lines—nurses also showed significant progress in compliance after the instructional intervention. This likely reflects the positive influence of structured, focused training in building confidence and routine in core nursing procedures. Comparable improvements were noted by **Ahmed and colleagues**[16] who observed better compliance post-training for administration of both IM and IV medications. Similarly, **Ibrahim *et al.*** [17] documented improved adherence to disinfection protocols for catheter insertion after their own educational program.

When we explored compliance regarding specimen handling, disposal of sharps, and managing fluid spills, there was once again a significant upward shift post-intervention. This is likely due to a combination of accessible printed materials, comprehensive teaching, and improved access to supplies, which made best practices easier to adopt. Our data echo those of **Ahmed *et al.*** [18] who also found low pre-training compliance for sharps handling, but significant post-training improvement. **Adly *et al.*** [19] reached similar conclusions regarding sharp disposal after an education program. On the other hand, **Mohamed *et al.*** [5] reported relatively higher compliance at baseline for these practices, indicating context-specific differences.

With respect to waste disposal and linen handling, nurses demonstrated notable improvements in their practices following the intervention. This could be

explained by the enhanced awareness of infection risks and a clearer understanding of stepwise procedures for safe handling. Our results differ from **Ghorbanmovahhed *et al.*** [20] who reported no significant changes in waste management practices post-training, but they align with **Adly *et al.*** [19] who saw improvements in waste handling after an education program.

The overall mean compliance score for infection control precautions rose sharply after the educational intervention, mirroring gains in individual practice areas. Such findings suggest that targeted instruction positively influences attitudes and performance, translating into safer practice environments. **Xiong *et al.*** [21] similarly found significant increases in overall compliance scores among nursing students after a multimedia intervention. Again, **Ghorbanmovahhed *et al.*** [20] did not observe such improvements in their setting.

Before the intervention, only a small proportion of nurses were highly compliant, while the majority were at low or moderate levels. Afterward, nearly three-quarters reached a high compliance standard. This leap could be tied to the generally low educational level of many nurses and limited prior training, meaning the educational program addressed a clear gap.

Our pattern is comparable to that described by **Mahran *et al.*** [10] who found many nurses with low baseline performance on infection control in hemodialysis units. However, **Mohamed *et al.*** [5] reported a generally moderate baseline compliance, and **Ogunrinde *et al.*** [15] described predominantly good compliance levels among their staff

In terms of environmental design, our dialysis unit scored well on most aspects, though ventilation and some waste management details were found lacking. This is likely a reflection of hospital infrastructure and policy constraints rather than staff performance. **Saran *et al.*** [22] have emphasized the importance of robust ventilation systems for infection prevention. **Abdolsattari *et al.*** [23] also reported similar environmental limitations in their survey of hemodialysis units

Problems with storage space for supplies and equipment, and minor shortfalls in record-keeping, were also observed. Such challenges are not unique; **Tabash *et al.*** [24] **and El-Greeb *et al.*** [25] both highlighted physical and administrative obstacles as common barriers to compliance in similar clinical settings.

Our assessment further revealed that the overall design of the dialysis unit met a high standard for infection control, especially in physical layout and presence of formal policies, though supply storage remained a moderate concern. This supports **Metwally *et al.*'s** [26] view that the built environment plays a foundational role in infection prevention. **Mohamed *et al.*** [5] similarly found that environmental factors can influence compliance.

Examining the relationships between personal characteristics and compliance, our results showed that factors such as age, experience, and prior training correlated positively with compliance levels likely due to increased confidence and adaptability among more seasoned and better-prepared nurses. **Elkholy *et al.*** [27] **and Ghabayen *et al.*** [28] both reported similar patterns, while **Fahim *et al.*** [1] found no such relationships, underscoring the importance of contextual factors in influencing compliance.

Lastly, we observed a strong, positive correlation between total knowledge and compliance scores both before and after the intervention. This supports the widely accepted belief that knowledge is a vital driver of consistent adherence to infection control protocols. These observations were in harmony with those of **Ahmed *et al.*** [18] and **Elkholy *et al.*** [27].

CONCLUSION

The findings of this study demonstrate that implementing instructional guidelines can significantly enhance nurses' compliance with infection control standard precautions in dialysis units. Notable improvements were observed across most domains.

RECOMMENDATIONS

- Continued training and support are needed to address ongoing challenges and sustain high standards of infection control.
- Reapplying the research on more geographical areas to improve compliance with infection control standard precautions.

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No conflict of interest.

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