

Effect of Educational Program on Nurses' Performance regarding Arteriovenous Fistula among Hemodialysis Patients

(1) Hayah Abou Elazayiem Bayumi⁽¹⁾, Walaa Elshahat ElGammal⁽²⁾, Reda Dardier Hussein Awad⁽³⁾, Suzan Mohamed Elsayed⁽⁴⁾

(1)Assistant professor of adult Medical-Surgical Nursing, Faculty of Nursing, South Valley University, Upper Egypt

(2)Lecturer of Medical-Surgical Nursing Faculty of Nursing, Damanhour University

(3)Lecturer at Medical Surgical and Critical Care Nursing Department, Faculty of Nursing, Beni-Suef University/Egypt

(4)Lecturer of Medical-Surgical Nursing, Faculty of Nursing, Zagazig University Egypt

Abstract

Background: Arteriovenous fistula (AVF) has been known as the gold standard for hemodialysis. It provides good blood flow for dialysis lasts longer than other types of access and is less likely to get infected or cause blood clots than other types of access. Educational program are important for nurses working in hemodialysis units to improve patient outcomes and reduce healthcare costs. **The aim was to** evaluate the effect of educational program on nurses' performance regarding arteriovenous fistula among hemodialysis patients. **Design:** a quasi-experimental design was used. **Setting:** The study was conducted at the hemodialysis unit at Zagazig University Hospital. **Subjects:** A convenient sample of all available nurses (40 nurses) who are working in the previously mentioned setting. **Tools of data collection:** Two tools were used: Tool I Structured interviewing questionnaire and II: Observational checklists. **Results:** The study result revealed that most of the studied nurses had a satisfactory level of knowledge and most of them had competent levels of practice after the educational program implementation. There were highly significant improvements in the studied nurses' knowledge and practice post-educational program ($P < 0.001$). There was a positive significant correlation ($P = < 0.005$) between nurses' knowledge and practice post-educational program at ($p < 0.001$). **Conclusion:** The educational program had a positive effect on improving nurses' knowledge and practices level regarding arteriovenous fistula among hemodialysis patients. **Recommendations:** Provide continuous in-service training and regular educational programs regarding arteriovenous fistula care for the nurses in hemodialysis units.

Keywords: Arteriovenous fistula, Educational program, Hemodialysis, Nurses' performance, and hemodialysis.

Introduction:

Hemodialysis is used to remove toxins and waste products from the bloodstream by connecting the vascular access site to a dialyzer machine that works as a pump that circulates and filters the blood and returns it to the child. Hemodialysis is achieved through vascular access, either via arteriovenous fistula, graft, or central venous catheter. An arteriovenous fistula is a connection of an artery to a vein made in the forearm or upper arm. An arteriovenous fistula causes extra pressure and extra blood to flow into the vein making it grow large and strong. The larger vein provides easy, reliable access to blood vessels (National Kidney and Urologic Diseases Information Clearinghouse, 2018).

Hemodialysis (HD) requires well-functioning vascular access (VA) that allows sufficient blood flow to achieve adequate clearance and blood dialysis. The VA offers an excellent way for bacteria to invade the bloodstream of

patients undergoing HD. One of the major problems and causes of failure in HD was represented by the lack of good VA (Canaud et al., 2019).

The arteriovenous fistula is preferred over the other types of access because it provides good blood flow for dialysis, lasts longer than other types of access, and is less likely to get infected or cause blood clots than other types of access. Multiple factors may influence the survival of AVF such as age, frailty, sex, race, body mass index, smoking, the timing of referral to the surgeons, surgical techniques and skills, vessel size, and use of adjuvant therapies such as antiplatelet agents and infrared, timing and technique of cannulation and other diseases such as diabetes, hypotension, thrombosis, infection and aneurysm formation (Woo & Lok, 2016).

The AVF is a subcutaneous anastomosis of an artery with an adjacent vein, usually in the non-dominant limb of the patient, to limit the consequences of any functional disability. The

recommended location, initially, is the more distal, saving you the most proximal vessels, because if there is a failure of AVF, will be able to rebuild it in a more proximal location (Yen et al., 2018).

VA dysfunction is one of the most important causes of morbidity and mortality in HD patients, contributing to up to one-third of hospitalizations and accounting for a significant amount of the healthcare costs of these patients (Gameiro & Ibeas, 2020; Yap et al., 2021). Primary AVF dysfunction in HD patients is associated with gender, aging, PLT counting number, hemoglobin level, and retention time of temporary catheter (Wen et al., 2019).

Nurses play an important role in AVF care include important role to prolong the life span of AVF and reduce complications. good cannulation technique, examination of the fistula and implementing proven infection control practices, using aseptic technique, appropriate cannulation methods, the timing of fistula cannulation and early evaluation of immature fistula are all factors that may prevent morbidity and prolong its survival (Vale et al., 2015).

Significance of the study

Over the past few years, there has been a noticeable increase in the prevalence of chronic renal disorders all over the world. The treatment and avoidance of complications in dialysis units is thought to be made possible by nurses. Since their experience has been shown to be the most commonly cited source of vascular access troubles, the capacity of the nurse to avoid access problems requires sufficient education. To successfully prevent vascular access issues, it's crucial to set standards of care and have knowledgeable staff.

Hemodialysis is the therapy used most often among patients with ESRD. In Egypt, according to statistical records at Assuit University Hospital, the total number of patients admitted to this hospital in the year 2017/2018 was 40812 of which 3436 patients underwent HD, representing (8.4%). The AVF is the method of choice for the establishment of HD vascular access in patients with ESRD. A good function VA is a prerequisite for successful HD treatment. Therefore, VA sites need special care to increase their maintenance. AVF complications are the leading cause of

hospitalization and morbidity among HD patients. The survival of AVF is based on multi-factors, including surgical technique, patient's condition, and nurses' practices. Therefore, there is a need to establish a satisfactory level of performance for nurses working in hemodialysis units which helps in providing qualified competent nurses who provide care for patients (Khalifa et al., 2017).

Aim of the study:

The study aimed to evaluate the effect of educational program on nurses' performance regarding arteriovenous fistula among hemodialysis patients. This aim achieved through

- Assess nurses' knowledge regarding the care of arteriovenous fistula among patients undergoing hemodialysis.
- Assess nurses' practices regarding the care of arteriovenous fistula among patients undergoing hemodialysis.
- Implement and design an educational program based on nurses' needs.
- Determine the effect of educational program on nurses' knowledge and practices regarding arteriovenous fistula among hemodialysis patients

Research Hypothesis:

Implementation of an educational program was expected to increase nurses' knowledge and practices regarding arteriovenous fistula among hemodialysis patients.

Materials and Method

Research Design:

The quasi-experimental research design was used to achieve the aim of the current study.

Setting:

This study was carried out at the Hemodialysis Unit at Zagazig University Hospital

Sample:

A convenient sample of all available nurses (40 nurses) who are working in the previously mentioned setting

Tools of data collection:

Data collection was gathered by using the following two tools:-

Tool (I): Nurses structured interviewing questionnaire:It was developed by the researcher based on a review of the current relevant research based on (Canaud et al., 2019; Wen et al., 2019, Bayoumi, & Khonji, 2020 & Yap et al., 2021) to assess nurses' knowledge related to care of AVF puncture. It consists of two parts:

Part (I): Nurses' data such as Age, gender, qualification, experience years, and attending training courses regarding AVF.

Part (II): Nurses' knowledge: Assess nurses' knowledge regarding arteriovenous fistula among hemodialysis patients. It was used twice before and immediately after the implementation of the educational program. It consists of 30 multiple-choice questions. It included a definition of AVF, its indication, and contraindication, and its advantages and disadvantages of AVF. Complications of AVF, signs and symptoms of AVF infection, frequency measurement of blood pressure, caring for fistula bleeding and instruction before starting a session, and health education about AVF. It included instruction before, during, and after a session of HD-related AVF.

Nurses' knowledge scored as follows: The total level of nurses' knowledge was categorized as the following:

- 75% to 100% was considered satisfactory knowledge
- less than 75% was considered unsatisfactory knowledge

Tool (II): Observational Checklists: It was adopted from Maria & Jitka, (2014); Wilkinson & Van Leuven, (2017); National Institute for Health and Care Excellence, (2018) to assess the nurses' practice regarding arteriovenous fistula puncture. It was used twice before and immediately after the implementation of the educational program. It consists of 66 items categorized under the following:

Before cannulation: It includes 12 items regarding the preparation of the environment (4 items), preparation of the equipment and materials (1 item), preparation of the patients (3 items), and assessment of AVF (4 items).

During cannulation: It contains 44 items divided into two subgroups. Subgroup 1: infection control practice (31 items) includes hand washing (14 items), hand scrubbing by using alcohol (3 items) and sterile gloving (10 items), and disinfection of AVF site (4 items). Subgroup 2: cannulation technique (13 items).

After cannulation: It consists of 10 items regarding needle removal and hemostasis.

The scoring system for Nurses' practice was as the following:

Done correctly and completely was scored (1), and done incorrectly or not done was scored (0). The total level of nurses' practices was categorized as the following: 75% to 100% was considered competent and <75% was non

Content validity:

Tools of data collection were investigated for their content validity by three experts in Medical-Surgical Nursing from the Faculty of Nursing, who were selected to test the content validity of the instruments and to judge their clarity, comprehensiveness, relevance, simplicity, and accuracy. The tools were regarded as valid from the experts' point of view.

Reliability of tools

Reliability for tools was applied by the researcher for testing the internal consistency of the tools by administering the tool to the same subjects under similar conditions. Answer from repeated testing was compared (test-re-test Reliability). This turned out to be (0.94) for the knowledge structured interview schedule questionnaire and (0.96) for the nurses' practices observational checklist, this indicates a high degree of reliability for the study tools.

Ethical considerations:

The research approval of the current study was obtained from the scientific research Ethical Committee in the Faculty of Nursing at Zagazig University before starting the study. The researcher clarified the aim of the study to the nurses included in the study. Written approval was obtained from each nurse to participate in the study. Nurses were assured that all gathered data was used for research

purposes only and the study was harmless. Additionally, nurses were allowed to withdraw from the study at any time without giving a reason. Confidentiality of the gathered data and results was secured.

Pilot Study:

The pilot study was carried out on 4 nurses; those represented 10% of the subjects included in this study in the HD unit at **Zagazig** University Hospital to test the applicability and the clarity of the constructed tools. Also, the pilot served to estimate the time needed for each subject to fulfilling data collection tools. According to the results of the pilot, no modifications or omissions of items were performed, so the nurses included in the pilot study were involved in the study sample.

Field of work:

The following phases were adopted to achieve the aim of the current study:-

1- Assessment phase:

The nurses were questioned during this phase in order to get baseline data. On two out of seven days, the researcher was available. The researcher introduced herself to each nurse at the start of the interview, went over the goals, timeline, and activities of the study, and got their signed consent. In order to gauge the nurses' knowledge, the researcher provided them a questionnaire to complete. To evaluate each nurse's practises, an observational checklist was used to watch each one of them while they carried out actual procedures. This pre-testing process lasted for 4 weeks (from the beginning of March 2019 to the beginning of April 2019).

Planning phase

The educational program was prepared by the researcher in accordance with nurses' level of comprehension in simple Arabic language, which was indicated by baseline data from pre-test assessment and appropriate examination of literature. Modified lectures, brainstorming, demonstrations, re-demonstrations, and group discussions were among the several instructional techniques used. To ensure that nurses fully understood the material, appropriate teaching tools such as handouts, audio-visual aids, dolls, and real equipment were used.

2- Implementation phase:

Program implementation took place in sessions. Each group of the eight investigated nurses was divided into four sessions for the theoretical portion of the program, which lasted between 30 and 45 minutes, and four sessions for the practical portion, which lasted between 45 and 60 minutes. The program took 4 to 8 hours for each group. Ten minutes were allotted for discussion and comments after each session. Each session typically began with an overview of the lessons from the previous one as well as the goals of the new topics. Every group of nurses received these sessions again.

Evaluation phase:

After the implementation of the educational program content, the post-test was administered to assess nurses' knowledge and practices using the same formats as a pretest. This help to evaluate the effect of the implemented educational program. This was done immediately after the implementation of the educational program.

Statistical analysis:

The collected data were organized, tabulated, and statistically analyzed using Statistical Package for Social Science (SPSS) version. Descriptive statistics were applied (e.g. frequency, percentages, means, and standard deviation). Test of significance, Chi-square test (X^2), Fisher exact test, F test, Independent T-test, and correlation coefficient (r). These tests were applied to test the study hypothesis. The reliability of the study tools was done using Cronbach's Alpha. A significant level value was considered when $p < 0.05$ and a highly significant level value was considered when $p < 0.001$. No statistically significant difference was considered when $p > 0.5$.

Results:

Table (1): Showed that 52.5% of nurses were in the age group of 25-<30 years ($\bar{x} \pm SD$ 24.94 \pm 4.03 years), 77.5 of them were females and 55% of them had nursing technical institutes. Concerning, years of experience 45% of them had 4<6 years of experience. Also, the same table revealed that 45% of the studied nurses revealed that they had previous training courses regarding nursing care of AVF for HD patients.

Table (2): Demonstrates that there was an improvement post the educational program implementation with a highly statistically significant difference between nurses' knowledge regarding AVF pre/post educational program implementation ($P < 0.001$).

Figure (1): This showed that 53% of nurses had a satisfactory level of knowledge of pre-educational program implementation. In contrast, 92% of them had a satisfactory level of knowledge post-educational program implementation.

Table (3): Demonstrates that there was an improvement post the educational program implementation with a highly statistically significant difference between nurses' practices regarding AVF pre/post educational program implementation ($P < 0.001$).

Figure (2): Showed that 54% of the nurses had incompetent practices before educational program implementation. On the other hand, 93% had competent practices after educational program implementation.

Table (4): Illustrates that there was a highly statistically significant relationship between the total knowledge of studied nurses and their educational level and years of experience pre and post-educational program implementation (p -value < 0.000).

Table (5): Reveals that there was a highly statistically significant relationship between the total practices of studied nurses and their educational level and years of experience before and after educational program implementation (p -value < 0.000).

Table (6): Illustrated that there was a highly statistically significant positive relation between total knowledge scores and total practice scores of the studied nurses before and after educational program implementation $r = 0.85$, $r = 0.43$, p -value < 0.000 respectively.

Table (1): Frequency and percentage distribution of the studied nurses regarding their demographic data (n=40).

Nurses' data	No	%
Age in years		
20-<25	13	32.5
25-<30	21	52.5
30-<35	4	10.0
≥ 35	2	5.0
$\bar{x} \pm SD$ 24.94 \pm 4.03		
Gender		
Male	9	22.5
Female	31	77.5
Qualification		
Nursing technical school	8	20.0
Nursing technical institute	22	55.0
Bachelor of Nursing	10	25.0
Years of experience		
<2	8	20.0
2-<4	10	25.1
4-<6	18	45.0
≥ 6	4	10.0
Attending Training courses		
No	18	45.0
Yes	22	55.0

Table (2): Distribution of the studied nurses' knowledge regarding AVF pre and post-educational program implementation (n=40)

Nurses ' knowledge	No =(40)		X ²	P-value
	Pre educational program implementation	Post educational program implementation		
knowledge regarding AVF	25(62.5%)	38(95%)	63.39	<0.001*
Complications of AVF	20(50%)	31 (77.5)	16.44	<0.001*
Care of AVF	22 (55%)	32 (80%)	15.16	<0.001*
Health education about AVF	20(50%)	33 (82.5)	19.45	<0.001*

*highly significance at < 0.001 levels

-Chi-square test

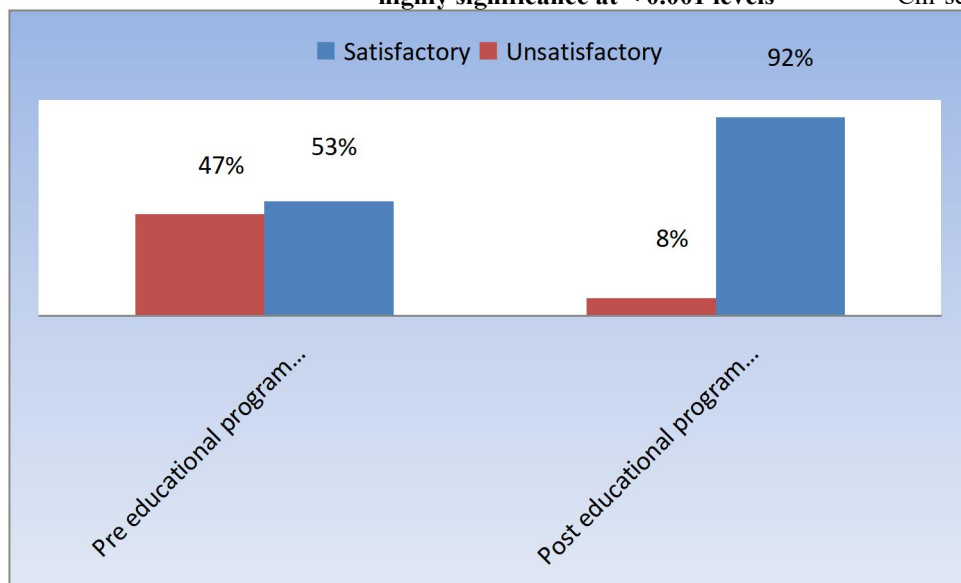


Figure (1): Distribution of the studied nurses regarding their total level of knowledge regarding AVF pre and post-educational program implementation (n=40).

Table (3): Distribution of the studied nurses ' practices regarding AVF pre and post-educational program implementation (n=40)

Nurses ' practices	No =(40)		X ²	P-value
	Pre educational program implementation	Post educational program implementation		
Pre-cannulation of AVF	22 (55%)	40(100%)	68.392	<0.001*
Cannulation of AVF	25(62.5%)	32 (80%)	136.44	<0.001*
Post-cannulation of AVF	20 (50%)	34 (85%)	156.163	<0.001*

*highly significance at < 0.001 levels

-Chi-square test

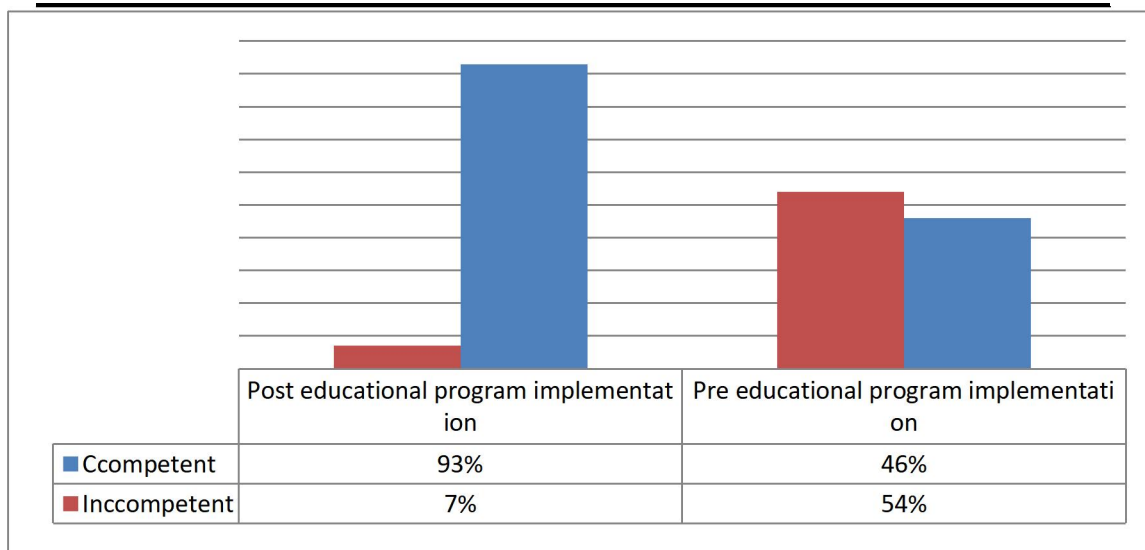


Figure (2): Distribution of the studied nurses regarding their total practices level pre and post-educational program implementation.

Table (4): Relation between nurses' knowledge and their data pre and post-educational program implementation (n=40)

Nurses' data	Pre educational program implementation	Post educational program implementation	F test Independent T-test	P-value
	Mean±SD	Mean±SD		
Age				
20-<25years	27.82±7.32	50.11±6.10	14.94	0.276
25-< 30 years	29.22±8.44	50.36±5.13	16.63	0.354
30-<35years	25.60±7.16	50.23±5.76	11.88	0.136
≥35years	33.05±8.48	46.52±10.64	1.96	0.295
Gender				
Male	25.12±7.88	50.67±7.78	1.35	0.184
Female	29.18±7.69	50.13±5.19	0.04	0.962
Qualification				
Nursing technical school	29.33±10.054	49.75±6.36	24.38	0.000
Nursing technical institute	28.43±7.59	49.73±5.97	111.87	0.000
Bachelor of Nursing	28.26±7.35	50.82±4.93	97.70	0.000
Years of experience				
<2years	27.88±8.95	49.55±7.55	30.80	0.000
2-< 4 years	28.72±6.97	50.68±4.47	154.36	0.000
4-< 6 years	20.34±5.23	35.67±3. 26	26.57	0.000
≥6years	28.46±8.78	49.53±6.15	58.32	0.000

** Highly Statistical significance (p-value < 0.000)

Table (5): Relation between nurses' knowledge and their data pre and post-educational program implementation (n=40)

Nurses' data	Before educational guidelines implementation	After educational guidelines Implementation	F test Independent tT-test	p-value
	Mean±SD	Mean±SD		

Age				
20<25years	16.23±5.55	43.85±.63	44.43	0.674
25<30years	18.45±5.24	43.64±.81	49.41	0.513
30<35years	19.56±6.8	44.22±.00	66.49	0.372
≥35years	22.52±2.12	43.50±.70	176.40	0.126
Gender				
Male	15.37±5.31	43.62±.72	1.45	.161
Female	18.35±5.47	43.72±.71	0.44	.624
Education				
Nursing technicalschool	17.34±5.52	43.75±.46	187.69	.000
Nursing technicalinstitute	16.78±5.41	43.78±.54	564.78	.000
Bachelor of Nursing	20.78±5.38	43.67±.97	280.50	.000
Years of experience				
<2years 2-	15.23±5.87		213.94	0.000
<4years4-	18.77±5.09	43.88±.74	509.17	0.000
<6years	20.34±6.23	43.65±.84	426.57	0.000
≥6years	18.26±5.74	45.63±.26	303.35	0.000
		43.80±.44		

** Highly Statistical significance (p-value < 0.000)

Table (6): Correlation between total knowledge and total practices pre and post-educational program implementation (n=40)

Items	Total Knowledge scores			
	Pre-educational program implementation		Post educational program implementation	
	R	p-value	r	p-value
Total Practices scores	0.85	0.000**	0.43	0.003**

** Correlation is significant at the < 0.01 level (2- tailed).

Discussion:

To enhance patient outcomes and lower healthcare costs, educational program are crucial for nurses working in hemodialysis units. Everyone involved in providing care for patients with AVF needs to be knowledgeable about that care. Arteriovenous fistula care requires competence and assurance from nurses. An effective educational program helps nurses to deliver, monitor, and evaluate care as well as continuously advance their knowledge and practice (National Institute for Health and Care Excellence, 2018).

The current study's findings regarding demographic characteristics showed that the mean age of the studied nurses was a 24.94±4.03 year, with more than half of them falling within the age range of 25–30 years. Young age nurses in the studied sample may be explained by the fact that they provide direct nursing care to HD patients

while elderly nurses are preoccupied with administrative tasks. This may illustrate how demanding the dialysis service is.

This result is consistent with a study by Al-Mawsheki et al. (2016) titled "Nurses' knowledge and practise about the care for the patients during HD," which found that more than half of the nurses in the study were between the ages of twenty and less than thirty.

Moreover, this finding disagreed with Yousif et al., (2017) in a study entitled "The effect of an educational program for vascular access care on nurses' knowledge in Khartoum state" who showed that $\bar{x} \pm SD$ was 34.31±6.59 years.

More than three-quarters of the nurses in the study were female, according to the results of the current study. Given that women continue to dominate the nursing profession and men still make

up a small minority of nurses, this may explain the current situation. This mirrors the overall nursing scenario in Egypt, where women do the majority of nursing duties. It may also be related to the fact that until recently, nursing study in Egyptian universities was only open to female students. In a study titled "Factors related with fistula secondary failure in patients on hemodialysis," **Ibrahim et al., (2018)** discovered that half of the nurses were female.

More than half of the nurses studied at a nursing technical institute, according to research on their educational background. These findings may be the result of the fact that the majority of bedside nurses employed by public hospitals hold diplomas in technical nursing. This result was consistent with that of **Al-Mawshaki (2016)**, who found that more than half of the nurses in the study had a technical institute degree. The study was titled "Nurses' knowledge and practice about care for the patients undergoing hemodialysis." The results of this study may be attributable to the nursing technical institute, as opposed to other organizations like nursing faculties, which gave the community a greater number of nursing graduates.

Moreover, this study differs from a quasi-experimental study by **Ahmed and Sallam (2018)**, entitled "The effect of nursing instructions on nurses' knowledge, practice, and suggestions regarding adverse events in HD," on 26 nurses working at an HD unit in Hail City (Kingdom of Saudi Arabia), which found that, in light of the economic situation as family preferred nursing schools as it required sho Related to this is also taking the social and academic divide between the two populations into account.

Less than half of the nurses in the study had 4 to 6 years of experience working in an HD unit, according to the study's findings about their years of experience. The x-SD was 6.53 ± 2.98 in a study by **Yousef et al., (2019)**, titled "The Effect of Educational Program on Knowledge and Practices of Nurses Regarding Infection Control Measures for Children under Hemodialysis." This conclusion is consistent with their findings. This could be as a result of the fact that nurses in pediatric hemodialysis units need to have more years of experience in order to be knowledgeable and skilled in the treatment of arteriovenous fistulas.

Additionally, these results are consistent with a quasi-experimental one-group pretest posttest study by **Pássaro and D'vila (2018)** that

looked at a "Nursing Educational Intervention for the Identification of Adverse Events in HD" that was conducted on 16 nurses in Brazil and found that all 16 nursing technicians who participated had the same amount of experience on average in the HD sector.

Similar to the previous study, **Saleh et al., (2018)**, quasi-experimental study, "Nurses compliance to standards of nursing care for HD patients: educational and training intervention," was conducted on 41 nurses working in the HD unit at El-Menia University Hospital in Egypt, and found that two-fifths of them had years of experience ranging from 5 to 10 years.

Less than half of the nurses in the study had previously completed training in the care of HD patients with AVF, according to the current study's findings about their prior training. This outcome may have come about as a result of the nurses' disinterest in training sessions on AVF treatment. **Al-Mawshaki et al., (2016)** found that two-fifths of studied nurses attended the training course, which was in line with this conclusion.

According to the current study, there was an improvement in nurses' overall level of knowledge following the implementation of the educational program, and there was a highly statistically significant difference between nurses' knowledge regarding AVF before and after the educational program's implementation. According to the researchers, it illustrates the advantages of implementing educational program.

In a study titled "Nurses conformity to standards of nursing care for hemodialysis patients," **Saleh et al., (2018)** found that more than two-fifths of the nurses had insufficient knowledge at the preprogram phase. This study's findings are consistent with their findings. This might be due to the fact that no training sessions on how to treat arteriovenous fistulas (AVF) in patients receiving hemodialysis were attended by all nurses, a lack of incentives for nurses to learn more or at least refresh their knowledge, whether they were newly graduated or not, and an abundance of work. The findings of **Abdel-Latif et al., (2019)** study, "Assessment of nurses' knowledge and practises about complications of hemodialysis patients in critical care Unit," are in conflict with this one which showed that the majority of the studied nurses had unsatisfactory knowledge.

As a result of the training program's implementation, the majority of the nurses in the

study had a satisfactory level of knowledge, according to the study's findings. In a study titled "The effect of an educational program for vascular access care on nurses' knowledge in Khartoum state," **Yousef et al., (2017)** found that there were highly statistically significant differences between the pretest and posttest, and that three-quarters of nurses had a good level of knowledge after the program had been implemented. This improvement demonstrated that implementing the educational program was an effective way to expand the knowledge of nurses.

The current study's findings regarding the overall level of nurses' practice showed an improvement following the implementation of the educational program and a highly statistically significant difference between nurses' practises regarding AVF before and after the implementation of the educational program. The findings of **Abdel-Latif et al. (2019)**, who demonstrated that more than two-thirds of the studied nurses have an insufficient level of experience prior to intervention, are consistent with this finding.

The current research also aligns with a study by **Alsaqri et al., (2019)** titled "The impact of educational module on self-care habits of arteriovenous fistula among hemodialysis patients in Hail region, Saudi Arabia." In the pre-test, which indicated an increase in the mean score on general advice on AVF care and the mean score of knowledge about looking for infection, it was noted. Additionally, there was a statistically significant improvement in the mean score of knowledge linked to the evaluation of AVF function in the pre-test. Interestingly, other similar results were reported by **Gaffer and Ibrahim (2021)**, who studied "Effect of Teaching Guidelines on Uremic Patients Regarding Arteriovenous Fistula Occlusion." And revealed that less than half of the studied patients had satisfactory self-care practices pre-teaching guideline implementation.

According to the current study, the majority of the nurses were competent in their practises throughout the post-program implementation phase, as evidenced by the significant statistical differences between the pretest and posttest. This result is consistent with that of **Saleh et al., (2018)**, who discovered that the majority of them (80.9%) had excellent practises in the post-implementation phase with a highly statistically significant difference between the pre-test and post-test.

The current study revealed that there was a highly statistically significant relationship between nurses' overall knowledge and their educational attainment and years of experience both before and after the implementation of educational program. This relationship concerned the relationship between nurses' characteristics and the total level of their knowledge. This finding contrasts with those of **Ahmed & Mohamed (2019)**, who found no statistically significant relationship between nurses' overall level of knowledge and their education and years of experience in the pre and post-implementation phases. Their study was titled "Effect of an educational program about infection control precautions for nurses in pediatric hemodialysis units." This might be the result of nurses with more experience demonstrating superior knowledge to those with less experience.

The current finding showed a highly statistically significant association between the total number of practises of the examined nurses and their degree of education and years of experience both before and after the implementation of educational program. This finding supports the assertion made by **Nwaomah et al., (2020)** that there is a substantial correlation between nurses' knowledge and practises of AVF treatment. This finding is consistent with that of **Diab and Mostafa (2020)**, who found a highly significant difference between the study sample's knowledge and its self-care habits.

This finding is consistent with a study by **Bayoumi and Mahmoud (2017)** titled "Effect of an education program on nurses' knowledge and practice regarding care of central venous line in pediatric hemodialysis: evidence-based practice guidelines," which found a highly statistically significant correlation between nurses' practice and their educational attainment and years of experience both prior to and immediately following implementation. This might be because nurses with more years of experience have more experience caring for AVF receiving hemodialysis than nurses with less experience. Daily tasks also improve nurses' practises and enrich their experiences.

Regarding examining the relationship between the total knowledge and total practises of the studied nurses with regard to the care of AVF for hemodialysis patients, the current study found that there was a highly statistically significant positive relationship between the total knowledge and total practises of the studied nurses before and after the implementation of educational program. The

findings of Saleh et al., (2018), who discovered a high positive link between nurses' overall knowledge and their overall practice ($p < 0.001$), were in line with this outcome. This finding contrasted with that of Ibrahim et al. (2019), who showed that there was no statistically significant relationship between nurses' knowledge and practice in their study ($p > 0.05$). This could be because knowledge serves as the foundation for practices.

Conclusions

The result of this study concluded that:

Arteriovenous fistula among hemodialysis patients was a topic that the educational program had a favorable impact on nurses' knowledge and practice of. Additionally, there was a highly statistically significant positive link between nurses' overall knowledge and practice level with regard to the treatment of arteriovenous fistula in hemodialysis patients before and after the introduction of training guidelines.

Recommendations:

Based on the results of the present study the following recommendations are suggested:

- Providing nurses in hemodialysis units with ongoing in-service training and regular educational sessions regarding AVF care.
- Creating a brochure with information on AVF care for nurses working in the HD unit so that they have it in their possession and may use it as a standard operating procedure in their daily practises.
- Regular assessments of all HD nurses' knowledge and skills in relation to AVF care to determine their requirements and create instructional strategies that address those needs.
- In order to generalize the study's findings, the study should be repeated on a sizable sample and in a different hospital context.

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