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Effect of Instructional Guidelines on Nurses' Performance Regarding Care of Arteriovenous Fistula Puncture for Hemodialysis Children

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ABSTRACT

Background: The arteriovenous fistula is recognized as the ideal and most commonly utilized technique of vascular access for hemodialysis, typically regarded as the optimum standard in clinical practice. Instructional programs are imperative for equipping nurses with the required skills to enhance patient outcomes and decrease overall health care expenses. **Objectives:** The aim of the study was to evaluate the effect of instructional guidelines on nurses' performance regarding care of arteriovenous fistula puncture for hemodialysis children. **Methods:** The study design was quasi-experimental. At Beni-Suef University Hospital's pediatric hemodialysis unit, the study was carried out. A purposive sample composed of 50 nurses. Data were gathered utilizing two tools: The 1st tool is the interviewing questionnaire sheet. The 2nd tool is observational checklists. **Results:** More than three-quarters of nurses had an unsatisfactory total level of knowledge, and the majority of them had an incompetent total level of practice regarding arteriovenous fistula puncture care in the pre-instructional guidelines implementation. While most of the nurses had a satisfactory total level of knowledge, four-fifths of them had a competent total level of practice in the post-instructional guidelines' implementation with a highly statistically significant difference (p-value < 0.000). Also, there was a highly statistically significant positive correlation between nurses' total knowledge and total practice level pre- and post-implementation. **Conclusion:** The study findings confirmed the effectiveness of the instructional guidelines in improving nurses' knowledge and practices concerning arteriovenous fistula puncture care for hemodialysis children. **Recommendation:** Implementing periodical instructional programs for nurses concerning arteriovenous fistula puncture care is necessary to update and improve their performance.

Keywords: Arteriovenous Fistula; Hemodialysis Children; Instructional Guidelines; Nurses' Performance

INTRODUCTION

Chronic Kidney Disease (CKD) represents a major global health concern in children, frequently attaining epidemic proportions and exerting profound negative effects on children's quality of life. It is recognized as "evidence of structural or functional kidney abnormalities that persist for at least 3 months, with or without a decrease of GFR less than 60 ml/minute/1.73 m²" (Hedin *et al.,* 2025). When kidney function deteriorates irreversibly and progressively, it is referred to as Chronic Renal Failure (CRF), a condition in which the body's ability to maintain metabolic, fluid, and electrolyte balance fails, resulting in uremia (Bakheet *et al.*, 2025).

Management for CRF in children focuses on delaying disease progression, reducing associated complications, and meeting both physiological and emotional demands in order to ensure an optimal quality of life. The treatment modalities involve dialysis and kidney transplantation. Dialysis is classified into two types: Hemodialysis (HD) and peritoneal dialysis (Kliegman & Geme, 2025). Vascular Access (VA) is essential for

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the HD procedure and may be established through an Arteriovenous Fistula (AVF), synthetic graft, or centralized intravenous line. An AVF represents "a surgically created anastomosis between an artery and a vein, typically located in the forearm or upper arm." This connection improves blood flow and pressure within the vein, encouraging it to expand and strengthen, allowing for reliable, longer patency and easy access to blood vessels (Hockenberry *et al*., 2024). The complication of HD access occurs when a fistula is repeatedly punctured at the same spot, potentially leading to vascular injury, fibrosis, vessel wall thickening, pseudoaneurysm, infiltration, lumen narrowing, infection, and decreased blood flow volume. Furthermore, there are few blood vessels available for making a fistula. So, maintaining the integrity of AVF is critical for extending its functional longevity and promoting the effectiveness of HD treatment (Naheed *et al*., 2023).

The pediatric nurse working in a hemodialysis unit has a pivotal role in keeping the patency of AVF through contributing to preventive, promotive, and curative aspects within the unit aimed at extending its functional lifetime, such as regular fistula assessment, strict adherence to infection control measures, preparation of AVF equipment, using appropriate cannulation techniques, and giving ongoing education, therapeutic counseling, and psychological support to the child and family during the entire illness (Ragab *et al*., 2021). Proper cannulation techniques for VA are essential to ensure the long-term viability of AVF, because an improper cannulation technique will cause many complications. So that, the pediatric nurse must acquire and refine cannulation skills to avoid improper pain and psychological distress for the child, ensure optimal functioning of the VA, and prevent complications (Sayed *et al*., 2025).

Moreover, pediatric nurses' knowledge and skills in VA management are critical for child safety, efficient use of resources, adherence to evidence-based practice guidelines, and achieving optimal children's outcomes. Accordingly, establishing and maintaining a high standard of performance among nurses assigned to pediatric hemodialysis units is crucial to ensure the delivery of competent and high-quality care for children (Mahdy *et al*., 2022).

Significance of the Study

Globally, between 1990 and 2016, the number of deaths attributed to CKD grew from 599,200 to 1,186,560. Through this period, CKD advanced in its global mortality ranking, moving from the 36th leading cause of death in 1990 to the 19th cause in 2013 and was ranked as the 12th leading cause of death in 2016. According to predictions, it may become the 5th leading cause of death worldwide by 2040 (Liu *et al*., 2023).

In recent years, the prevalence of CKD among children has increased significantly. Globally, it ranged from 15 to 74 cases of children per million populations (Khalid *et al*., 2023). Internationally, the incidence and prevalence of End-Stage Renal Disease (ESRD) among United States children have remained relatively stable, with an incidence rate of 12 cases per million population and a total prevalence of about 5,400 children (Almond *et al*., 2021). In the Middle East, the prevalence of CRF within children in Saudi Arabia is 80 to 120 per million population (Mokbel *et al*., 2022).

In Egypt, the predestined annual incidence of ESRD is roughly 74 cases per million population, while the reported prevalence for CRF among children stands at 264 per million, indicating a continuous rise in the number of children receiving maintenance dialysis over the past three decades (Al Rafay *et al.*, 2021). Indeed, VA serves as a vital lifeline for children undergoing HD, and efficient cannulation plays a pivotal role in maintaining its functionality. In addition, establishing and maintaining functional AVF remains the primary challenge in achieving effective HD. Therefore, implementing strategies aimed at extending AVF lifetime is necessary (Mahdy *et al*., 2022).

From this perspective, the researcher recognized the critical necessity to develop and implement instructional guidelines aimed at enhancing the performance of pediatric hemodialysis nurses in caring for AVF punctures. This is crucial to ensure safe VA, achieve effective HD, and decrease complications in children.

Aim of the Study

The study's aim was to evaluate the effect of instructional guidelines on nurses' performance regarding

care of arteriovenous fistula puncture for hemodialysis children, through assessing nurses' knowledge and practices regarding care of arteriovenous fistula puncture for hemodialysis children; developing and implementing instructional guidelines for pediatric hemodialysis nurses according to their actual needs; and evaluating the effect of instructional guidelines regarding arteriovenous fistula puncture care on nurses' knowledge and practices.

Research Hypothesis

The instructional guidelines will improve nurses' performance regarding arteriovenous fistula puncture care for hemodialysis children.

METHODOLOGY

Study Design

The study was a quasi-experimental design.

Setting

The study was carried out at a pediatric hemodialysis unit affiliated with Beni-Suef University Hospital. The pediatric hemodialysis unit, located on the ground floor of the hospital's medical building, comprised two rooms: a negative room equipped with nine hemodialysis machines and a positive room containing 3 hemodialysis machines. There were 36 children receiving hemodialysis in this unit; of them, 30 children were using AVF, and 6 children were using a central venous catheter (permcath) for hemodialysis.

Sample

A purposive sample composed of 50 nurses was used. These nurses were chosen based on the following inclusion criteria: Both genders, age more than 20 years, all registered nurses despite their educational level, nurses give direct care to children receiving hemodialysis and exclude students with internships.

Data Collection Tools

Data was gathered utilizing two tools.

Tool I: Interviewing Questionnaire Sheet:

The tool was adapted by the researcher in Arabic from Mahdy (2022) and Hockenberry *et al*. (2024), after reviewing the related literature to collect data pertaining to the following portions:

Part 1: Nurses' demographic characteristics included age, gender, education, years of clinical experience, and prior attendance of training courses concerning AVF care.

Part 2: Bio-social characteristics of children included:

A- Namely: age, gender, educational level, birth order, and parental relations.

B- Clinical data of children concerning chronic disease, hemodialysis duration, number of sessions per week, session duration, site of AVF, causes of changing AVF, duration of using the current AVF, and complications of AVF.

Part 3: Nurses' knowledge regarding arteriovenous fistula and its care: It was utilized twice: prior to and immediately following the instructional guidelines implementation. It comprised 29 questions with multiple choices categorized under the following:

A-Concerned with nurses' knowledge about arteriovenous fistula: It included 12 questions regarding definition (one question), sites (one question), aim (one question), advantages (one question), duration required for AVF maturation (one question), and complications resulting from AVF puncture (seven questions).

B-Concerned with nurses' knowledge regarding care of arteriovenous fistula puncture: It included 17 questions regarding the role of the nurse before cannulation of AVF (4 questions), the role of the nurse during

cannulation of AVF (6 questions), the role of the nurse after needle removal (4 questions), and the nurse's role in managing complications resulting from AVF puncture (3 questions).

Scoring system: A unique scoring system was utilized to assess the knowledge of nurses related to arteriovenous fistula puncture and its care for hemodialysis children based on their responses. Each completely correct answer was awarded a score of (2), a partially correct answer was awarded a score of (1), and an incorrect or unknown answer was awarded a score of (zero). The total score summed to 58, which was then transformed into a percentage and categorized as the following:

- Satisfactory knowledge ≥75% (44≤58) score
- Unsatisfactory knowledge <75% (0<44) score

Tool II: Observational Checklists

The researcher adapted the tool from Maria & Jitka (2014) and Bowden & Greenberg (2016) to assess nurses' clinical practices regarding arteriovenous fistula puncture care. It was utilized two times: prior to and following instructional guidelines implementation. It included a total of 67 steps classified as follows:

A- Pre-Cannulation phase: This part encompassed 12 steps evaluating various preparatory steps, including environmental preparation (4 steps), equipment and material preparation (1 step), child preparation (3 steps) and AVF assessment (4 steps).

B- Cannulation phase: This part included 44 steps separated into two primary subcategories. Subcategory 1: infection control practices (31 steps) encompass hand hygiene (14 steps), hand disinfection with alcohol (3 steps), applying sterilized gloves (10 steps), and disinfecting of AVF site (4 steps). Subcategory 2: cannulation procedure (13 steps).

C- Post-Cannulation Phase: This part included 11 steps related to extraction of needle and application of hemostasis techniques.

Scoring system: based on the responses of nurses, a unique scoring system was used to evaluate nurses' practices related to arteriovenous fistula puncture and its care for hemodialysis children. Scored (1) for each step done correctly and scored (zero) for each step not done or done incorrectly. The total score summed to 67 and which was then transformed into percentage and classified as follows:

- Competent Practices ≥85% (57- 67) score.
- Incompetent Practices <85% (0 - <57) score.

Content Validity

A panel of three pediatric nursing experts evaluated the tools' content validity. These experts were selected to assess the tools' content validity for clarity, accuracy, relevance, comprehensiveness, understanding, and applicability. Their opinion was elicited regarding the layout, format and sequence of the questions and all of their remarks were taken into consideration and the tools were regarded as valid from the experts' point of view.

Reliability

To ensure the level of relationship between the questionnaire items, the reliability of the data collection tools were examined utilizing Cronbach's alpha test, and results were 0.94 regarding the interviewing questionnaire sheet and 0.96 regarding the observational checklists, which reveal a high internal consistency level for both tools.

Pilot Study

10% of the total sample (5 out of 50 nurses) took part in a pilot study in June 2024 to assess applicability, clarity, and feasibility of study tools as well as to gauge the time required for completion. The pilot study's findings stated that no modification was required. As a result, the final study sample comprised the nurses who

took part in the pilot study.

Fieldwork

To accomplish the objectives of the study, four sequential phases were undertaken: assessment, planning, implementation, and evaluation. These phases spanned a period of nine months, beginning in July 2024 and ending in March 2025.

Assessment Phase

During this phase, structured interviews with nurses were undertaken to gather initial data utilizing specified data collection tools. The researcher maintained a presence in the unit three days every week. Before beginning to gather data, the researcher introduced herself, clarified the study aim and objectives, duration, and procedures, and obtained verbal consent from the participating nurses and written approval from administrators of the hospital. The researcher obtained data regarding children undergoing hemodialysis via Arteriovenous Fistula (AVF) by reviewing medical records and their caregiver. Subsequently, the participating nurses administered the interviewing questionnaire sheet (Tool I). Additionally, every nurse was individually noticed while providing direct care for children using the observational checklists (Tool II) to assess their practical competencies. This pre-intervention assessment phase, covering both knowledge and practices, lasted four weeks (from early July to early August 2024).

Planning Phase

Relying on the initial data gathered during the assessment phase and an extensive review of relevant literature, the researcher developed instructional guidelines tailored to the needs of nurses. These guidelines were created, refined, and adapted from relevant literature with the aim of enhancing knowledge and practice of nurses related to arteriovenous fistula puncture care for hemodialysis children. The content was developed to align with the nurses' cognitive level and was presented in simplified Arabic to facilitate understanding. A variety of teaching methods were employed during the implementation phase, including lectures, brainstorming sessions, group discussions, demonstrations, and re-demonstrations. To facilitate effective learning and skill acquisition, teaching media comprised printed booklets, video aids, a training doll, and real equipment.

Program Construction: It lasted one month (from early August to early September 2024).

Phase of Implementation

This phase lasted six months, starting in September 2024 and ending in February 2025. The implementation phase was carried out in structured sessions. Each session began with a brief recap of the past topics and an outline of the objectives for the new subject. The participating nurses were split into nine groups of five to six; the total duration of the program ranged between 4 and 8 hours per group, allocated as follows: four theoretical sessions, each lasting approximately 30 to 45 minutes, and four practical sessions, each ranging from 45 to 60 minutes. Sessions were held three times per week and scheduled based on nurses' availability. Each session also incorporated 10 minutes for discussion and feedback, complemented by the dissemination of a booklet to all nurses as instructional media. All sessions were repeated for each nurse's group.

Phase of Evaluation

Upon completion of the instructional guidelines, a post-intervention assessment was conducted to evaluate nurses' knowledge and practical skills using the same tools applied in the pre-intervention phase. The objective of this evaluation was to evaluate the effectiveness of the instructional guidelines in improving nurses' performance regarding arteriovenous fistula puncture care. The evaluation was carried out promptly following program implementation and lasted one month (March 2025).

Statistical Analysis

Data analysis was performed utilizing version 28 of the Statistical Package for Social Sciences (SPSS). Descriptive statistics were employed to summarize the data, presenting categorical variables as frequencies

and percentages, while continuous variables were portrayed as means and standard deviations. Inferential statistics included the chi-square (χ^2) test and Fisher's exact test to determine the significance of relationships between categorical variables. For parametric data with a normal distribution, paired *t*-tests were applied to compare mean values. Additionally, Pearson's correlation coefficient (*r*) was utilized to measure the strength and direction of the relationship between two ranked variables, whether both were quantitative or one qualitative and the other quantitative. The research hypotheses were tested using these statistical techniques. Statistical significance was defined at a *P*-value ≤ 0.05, with high significance at a *P*-value ≤ 0.01 and no significance at a *P*-value > 0.05.

Ethical Consideration

The Ethics Committee for Scientific Research at the Faculty of Nursing, Helwan University, Egypt, granted research approval to carry out the study with reference number 38 on 2nd January 2024. In addition, institutional approval for data collection was obtained from the general manager of Beni-Suef University Hospital, Egypt, on 9th June 2024.

RESULTS

Table 1: Distribution of the Studied Nurses Regarding their Characteristics (n=50)

Characteristics	No.	Percentage (%)
Age (years)		
20 < 25	**32**	**64**
25 < 30	11	22
30 < 35	4	8
≥ 35	3	6
Mean ± SD	**25.3 ± 4.38**	
Gender		
Male	14	28
Female	**36**	**72**
Qualification		
Technical Institute of Nursing	**40**	**80**
Bachelor of Sciences in Nursing	10	20
Experience (years)		
< 2	15	30
2 < 4	**25**	**50**
4 < 6	6	12
≥ 6	4	8
Mean ± SD	**2.96 ± 1.72**	
Attending Training Courses about Care of Arteriovenous Fistula (AVF)		
Yes	13	26
No	**37**	**74**

Table 1 illustrates that about two-thirds (64%) of participating nurses were between the ages of 20 and 25, with a mean ± SD age of (25.3±4.38) years. Almost three-quarters (72%) of nurses were female. In terms of qualification, four fifths (80%) had a Technical Institute of Nursing, while no one had a nursing diploma or master's degree. Concerning professional experience at the pediatric hemodialysis unit, half of the nurses (50%) reported between 2 and less than 4 years, with a mean ± SD (2.96±1.72). Additionally, about three quarters (74%) of nurses reported not having attended any previous training courses related to arteriovenous fistula care.

Table 2: Distribution of the Studied Nurses Regarding their Total Level of Knowledge About Care of AVF Puncture Pre and Post Instructional Guidelines Implementation (n=50)

Studied Nurses' Total Level of Knowledge						
	Pre- implementation		Post- Implementation		χ^2	*P*-value
	No.	%	No.	%		
Satisfactory	11	22	46	92	49.980	0.000**
Unsatisfactory	39	78	4	8		

** *Highly statistically significant P-value < 0.001; Chi-square test= χ^2*

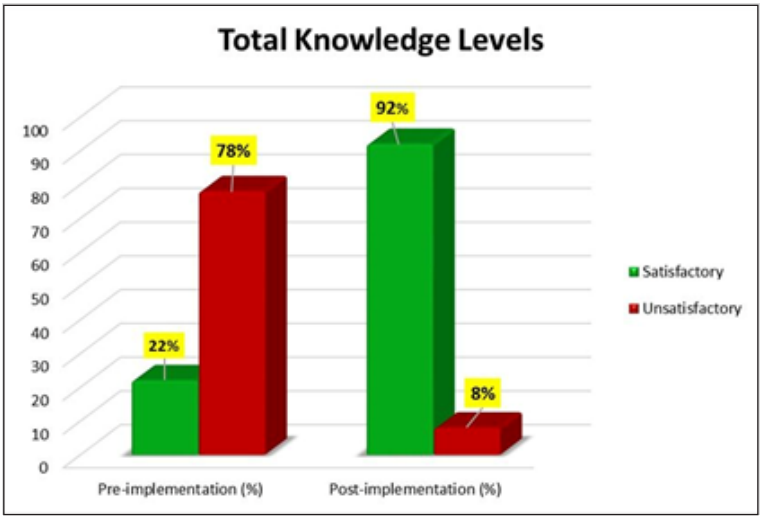

Figure 1: Percentage Distribution of the Studied Nurses Regarding their Total Level of Knowledge about AVF Puncture Care Pre and Post Instructional Guidelines Implementation (n=50)

Table 2 and Figure 1 demonstrates that more than three-quarters of the nurses studied (78%) had an unsatisfactory total level of knowledge regarding care of arteriovenous fistula puncture in the pre-instructional guidelines' implementation. While most of them (92%) had a satisfactory total level of knowledge in the post-instructional guidelines' implementation with a highly statistically significant difference (p-value < 0.000).

Table 3: Distribution of the Studied Nurses Regarding their Total Level of Practice About Care of AVF Puncture Pre and Post Instructional Guidelines Implementation (n=50)

Nurses' Total Level of Practice						
	Pre- Implementation		Post- Implementation		$\chi 2$	*P*-value
	No.	%	No.	%		
Competent	6	12	40	80	46.538	0.000**
Incompetent	44	88	10	20		

*** Highly statistically significant P-value < 0.001*

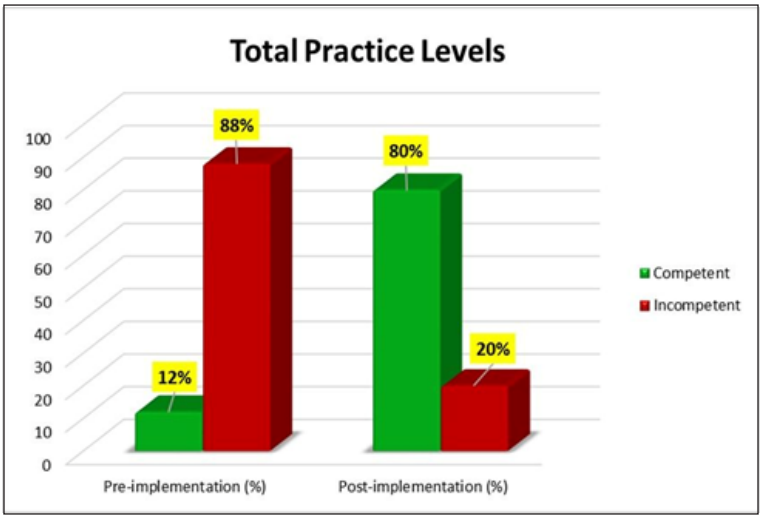

Figure 2: Percentage Distribution of the Studied Nurses Regarding their Total Level of Practice Concerning AVF Puncture Care Pre and Post Instructional Guidelines Implementation (n=50)

Table 3 and Figure 2 illustrate that the majority of the nurses studied (88%) had an incomplete total level of

practice regarding care of arteriovenous fistula puncture in the pre-instructional guidelines' implementation. While four fifths of them (80%) had a competent total level of practice in the post-instructional guidelines' implementation with a highly statistically significant difference (*P* value = <0.000).

Table 4: Correlation between the Studied Nurses' Total Level of Knowledge and their Total Level of Practice Regarding Care of AVF Puncture Pre and Post Instructional Guidelines Implementation (n=50)

Variables	Total Knowledge			
	Pre- instructional guidelines Implementation (n=50)		Post- instructional guidelines Implementation (n=50)	
	r	*P*-value	*r*	*P*-value
Total Practice	0.727	0.000**	0.622	0.000**

*r: Pearson Correlation Coefficient; ** Correlation is significant at the 0.01 level (two-tailed)*

Table 4 demonstrates that there was a highly statistically significant positive correlation between studied nurses' total knowledge and total practice pre- and post-instructional guidelines implementation (r = 0.727, 0.622, P = 0.000).

DISCUSSION

Regarding characteristics of the nurses studied, the current study (Table 1) indicated about two-thirds of nurses were between the ages of 20 and 25 years. This finding disagrees with the result reported by Fadhil and Ajil (2024), where about half of the nurses were aged between 25 and 30 years. This disparity could be attributed to the fact that most nurses in this study were recent graduates. Furthermore, due to the physical and mental demands of dialysis care, older nursing staff can face challenges handling the workload requirements, making younger nurses more suitable for staffing such specialized units.

In accordance with gender distribution, the present study (Table 1) found almost three-quarters of nurses were female. This result aligns with Alsolami and Alobaidi (2024), who reported that a majority of nurses were female. This pattern reflected the broader landscape of the nursing profession in Egypt, where nursing is predominantly practiced by women. This could also be related to the comparatively recent admission of male students to nursing programs, making nursing in Egypt a traditionally female-dominated profession. With respect to education, the current study (Table 1) indicated four-fifths of nurses were graduates of a technical institute of nursing. This finding is consistent with Hammam *et al.* (2024), who reported that about two-fifths of nurses held the same qualification. According to the researcher's interpretation, this tendency could be explained by the fact that technical nursing institutes tend to supply healthcare institutions with a greater number of nursing graduates compared to nursing faculties.

In terms of professional experience, the present study (Table 1) discovered half of nurses had worked in pediatric hemodialysis units for two to less than four years. This result contrasts with the results of a study conducted by Mohamed *et al*. (2023), where two-fifths of the nurses possessed between five and ten years of experience. According to the researcher's interpretation, the majority of nurses in this study were recent graduates of technical nursing institutes, which could account for this discrepancy. With regard to attendance at previous training courses relevant to AVF care, the recent study (Table 1) demonstrated almost three-quarters of nurses had not previously attended any such training. This finding contrasts with Ashor *et al*. (2025), who reported that over half of the nurses had not received previous training on AVF care. This could be caused by the absence of a structured continuing education department within the hospital, limited motivation among nurses to participate in training courses, staffing shortages, and the high workload typically encountered in pediatric hemodialysis units.

On assessing nurses' total level of knowledge, the present study (Table 2) indicated more than three-quarters of nurses had an unsatisfactory total level of knowledge regarding AVF puncture care in the pre-instructional guidelines' implementation. This finding is in the same line as Elsaied (2024), who stated that about two-thirds of nurses had an unsatisfactory total level of knowledge concerning the care of children undergoing hemodialysis. This result might stem from insufficient training opportunities on AVF care in

pediatric hemodialysis settings and a lack of qualifications of the nursing staff, as well as a lack of professional incentives and decreased motivation among nurses to update or enhance their knowledge base. In addition, the present study (Table 2) demonstrated that most nurses had satisfactory total levels of knowledge in the post-instructional guidelines' implementation with highly statistically significant differences. This finding is congruent with Bayumi *et al*.(2020), who found most of the nurses had a satisfactory total level of knowledge after the educational program implementation and there were highly statistically significant differences between the pre-test and post-test. This improvement could be ascribed to the instructional program's focused and comprehensive nature, its relevance to pediatric AVF care, and the program's effectiveness in promoting knowledge acquisition among nurses.

On investigating nurses' total level of practice, the current study (Table 3) stated that the majority of nurses had an incompetent total level of practice regarding care of arteriovenous fistula puncture in the pre-instructional guidelines' implementation. This finding is in agreement with Ibrahim *et al*. (2019), who reported that more than half had an incompetent total level of practice regarding the care of a child undergoing hemodialysis therapy. This deficiency might stem from limited access to ongoing training programs and professional development opportunities focused on AVF care, lack of application of nurses' knowledge, and ambiguity surrounding role expectations due to the lack of clearly defined job descriptions in the pediatric hemodialysis unit.

Moreover, after instructional guidelines implementation, four-fifths of nurses had a competent total level of practice, with highly statistically significant differences between the pre-test and post-test. This finding is congruent with Mahdy *et al*. (2022), who found that most of the nurses had a competent total level of practice related to the care of AVF puncture for children undergoing hemodialysis, with highly statistically significant differences between the pre-test and post-test. The improvement observed could be attributed to the nurses' keenness to improve their practices, the application of instructional guidelines, and using different teaching methods that effectively led to a significant improvement in nurses' practices.

On investigating the correlation between studied nurses' total knowledge and their total practice, the current study (Table 4) showed that there was a highly statistically significant positive correlation between nurses' total knowledge and their total practice regarding AVF puncture care for hemodialysis children in the pre and post instructional guidelines implementation. These findings are approved with Mahdy *et al*. (2022), who indicated that there was a highly statistically significant positive correlation between studied nurses' total knowledge and total practices related to care of AVF puncture for children undergoing hemodialysis in both before and after educational guidelines implementation, supporting the notion that improved knowledge contributes directly to enhanced clinical practice. This finding might be since nurses' practices are directly influenced by their knowledge, besides that knowledge is the baseline for the practices and essential to achieve best practices and improve the quality of nursing care provided to children, also knowledge without practices had no effect.

Limitations

This study had some limitations, including a relatively small sample size, a single-center setting, and a non-randomized design, which may restrict the generalizability of the findings. In addition, the evaluation was conducted over a short-term period, which reduces the ability to assess the sustainability of the intervention effects. Furthermore, lack of patient outcome data limits the ability to assess the broader impact of the intervention. Future research should include larger multi-center randomized studies with long-term follow-up and measure both nurse performance and patient outcomes for stronger evidence.

CONCLUSION

In light of the current study findings, it can be concluded that the instructional guidelines were effective in improving nurses' knowledge and practice regarding care of AVF puncture for hemodialysis children, supporting the study hypothesis. Meanwhile, there was a highly statistically significant positive correlation between nurses' total knowledge and total practice level regarding care of AVF puncture for hemodialysis children pre- and post-instructional guidelines implementation. Future research should investigate the long-

term sustainability of these improvements, assess their impact on patient outcomes, and explore strategies for integrating similar programs into routine training across diverse pediatric hemodialysis units.

Recommendation

According to the findings of the current research, it was recommended to implement periodical instructional courses for nurses concerning arteriovenous fistula puncture care to update and improve their performance, along with the distribution of standardized protocols and evidence-based practices guideline booklets encompassing all necessary nursing competencies in this field. Replication of the study using a larger probability-based sample across multiple pediatric hemodialysis units is recommended to enhance the generalizability of the findings. Future research should also focus on the development and evaluation of health instructional programs that emphasize optimal maintenance of hemodialysis vascular access for both parents and children.

Conflict of Interest

The authors declare that they have no competing interests.

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