

## Effect of Implementing Safety Guidelines on Nurses' Performance and Safety Parameters for Adolescents & Young Adults Undergoing Hemodialysis

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### Abstract

**Background:** A safety checklist is useful in the hemodialysis unit, as it can keep nurse focused and preventing mistakes under pressure. **Aim:** This study evaluates the effect of implementing safety guidelines on nurses' performance and safety parameters for adolescents & young adults undergoing hemodialysis. **Design:** A quasi-experimental design using one group pre-posttest. **Setting:** the research was conducted in the hemodialysis units at Mansoura University Children's Hospital and Ain-shams University Hospitals in Egypt. A total sample size of 80 nurses was recruited, 40 nurse from each setting and purposive sample of (41) adolescents and (41) young adults who fulfilling the inclusion and exclusion criteria. Three tools were used for data collection: nurses' knowledge regarding safety guidelines during hemodialysis questionnaire; Hemo Pause safety assessment observational checklist and hemodialysis Patient safety parameters questionnaire. **Results:** There are improvements in nurses' knowledge as evidenced by 70% and 82.5% of nurses had good knowledge and 97.5 and 80% of them had competent practice in both hospitals after implementing safety guidelines and Hemo-Pause checklist. Additionally, half of patients had high safety parameters in post intervention phase than in pre intervention which statistically significant difference at ( $p \leq 0.001$ ). **Conclusion:** this study highlights the positive impact of implementing safety guidelines and utilizing the Hemo-Pause checklist on nursing practice and safety parameters in hemodialysis for adolescents and young adults. **Recommendation:** continuous training and educational programs should be provided to enhance nurses' performance regarding patient safety and the use of checklists to enhance nurses' performance in providing safe and efficient care.

**Keywords:** *Adolescents, Hemodialysis, Safety guidelines, Parameters & Young adults*

### Introduction

Globally, the prevalence of chronic kidney disease (CKD) is rising to alarming proportions. This is becoming more common and occurs in many countries. Over one million people worldwide require renal replacement therapy, such as dialysis and renal transplantation, out of the more than 50 million recognized cases of chronic kidney disease. According to **Liyanage, et al. (2021)**, end-stage renal disease (ESRD) is a medical condition that necessitates expensive, long-term care. Hemodialysis is complex and intrusive treatment that puts susceptible patients at risk. Hemodialysis-associated complications have been reported to be responsible for 2-4% of patient deaths related to end-stage renal disease (**Kramer, et al., (2019)**). The prevalence of chronic kidney disease (CKD) in Egypt has witnessed a substantial rise, marking a 36% increase. From 2009 to 2019, CKD has climbed to the fifth position among the leading causes of mortality in the country. This alarming trend has emerged as a significant public health issue within Egypt, given that untreated CKD can advance to kidney failure and early cardiovascular ailments (**Farag, & El-Sayed, 2022**).

Chronic kidney disease (CKD) is regarded as a serious global public health issue among adolescents who are the individuals in the 10-19 years age group and young adulthood' who covers the age range of 10-24 years. Moreover, it is a degenerative illness that worsens over time and damages kidneys irreversibly (**Marcelli et al., 2019**). It also throws off the body's metabolism, fluid and electrolyte balance, and fluid balance. The CKD is linked to high rates of mortality and cardiovascular morbidity. It also causes unique issues in children, such as stunted growth and poor psychosocial adjustment, which negatively impacts adolescents and their families' quality of life. An accurate understanding of the epidemiology of childhood chronic kidney disease (CKD) is crucial for early detection, identifying reversible or preventive causes of progression, estimating prognosis, and supporting education for the adolescents and their caregivers (**Bray et al., 2020 & El Nagar, et al., 2020**). In young adult patients with chronic HD, multi-factorial markers of inflammation linked to anemia and malnutrition, hypertension, and adequate dialysis were associated with mortality. Medical errors pose a significant risk to adolescents and young

adults who have end-stage renal disease (ESRD). This population is particularly vulnerable due to the complex nature of their treatment, the presence of comorbidities, the use of multiple medications (poly pharmacy), the physiological effects of ESRD, and the need for coordination among different hospital departments to provide comprehensive care **Gotta, et al., (2021)**.

In a study conducted by **Treadwell, et al., (2013)**, it was found that approximately 49% of the surveyed patients expressed concerns about the possibility of errors during their hemodialysis (HD) treatment. The World Health Organization (WHO) has already highlighted the importance of enhancing safety in healthcare and has specifically emphasized the use of checklists as a means to achieve this goal. Research has demonstrated that the implementation of checklists has positive effects on patient safety, adherence to protocols and policies, communication, teamwork, and consistency of care by standardizing procedures. A multidisciplinary team of doctors, nurses, and administrators created the Hemo-Pause checklist through an iterative process that included literature reviews, surveys, and face-to-face consensus meetings. Furthermore, this approach of checklists' implementation has been shown to be effective in creating patient safety and quality assurance programs in the medical field (**Mehta et al., 2019**). The following steps on the Hemo-Pause checklist, which is meant to be manually completed while the hemodialysis session goes on are summarized in: Pre-session steps that including: identifying for the verification of the patient, reviewing of problems raised by the patient, and accessing to dialysis (including cannulation and infection control). While at the beginning of the session, the prescription for dialysate, the treatment plan (which includes blood pressure, target weight, length of treatment, and potential problems), and any issues with dialysis access (such as needle size and cannulation attempts) are reviewed. Finally, after the session, reviewing vital signs, blood loss, and dialysis access complications, target weight and treatment time are very necessary for patient' safety **Guttmann, et al., (2022) & Thomas, et al., (2020)**.

The cornerstone of high-quality healthcare is patient safety. A significant portion of the research defining patient safety and harm-stopping procedures has been on unfavorable treatment outcomes like morbidity and death. In order to prevent such unfavorable consequences, coordination and surveillance are critical functions of nurses. Dialysis units provide a number of obvious safety hazards, including poor hand hygiene, inadequate infection control, improper machine and equipment disinfection, and poor water quality. Therefore, enhancing the safety culture in

dialysis facilities is crucial for lowering patient risks of injury, preventing or limiting errors, and raising the standard of treatment provided **Ahmed, et al., (2019)**. In order to preserve safety in the hemodialysis unit, dialysis patient safety guidelines should be implemented in accordance with all other good practice principles. Dialysis safety guidelines centered on creating a set of accepted guidelines for safeguarding dialysis patients from blood-borne illnesses. Infection control procedures that ought to be followed by all medical professionals in order to guarantee the security of patients and employees include hand hygiene, environmental hygiene, wearing personal protective equipment, disposing of sharps properly, disinfecting surfaces, cleaning the surrounding area, and disinfecting hemodialysis machines, systems for treating water, and care of vascular access (**El-Aziz, et al., 2018**).

Hemodialysis are complex units that incorporate healthcare professionals from many fields and utilize cutting-edge technology to provide treatment for adolescent with CKD. Hemodialysis treatments are frequently administered by nurses; however, hazards are always possible. Because there is a higher chance of coming into contact with blood and bloodborne pathogens in hemodialysis settings, infection control procedures in accordance with conventional precautions are advised. Hemodialysis nurses play a vital role in delivering efficient and safe patient care while ensuring adherence to hemodialysis standards (**Abd Alfatah, et al., 2021**). They are responsible for maintaining a high standard of clinical care and, when necessary, seeking guidance from other experts to provide the appropriate level of care. It is essential for nurses to uphold the highest standard of practice in hemodialysis to ensure patients receive safe and effective care. In the case of pediatric patients, dialysis nurses have a crucial role in providing information, care, support, understanding, and therapeutic counseling to both the pediatric patient and their family throughout the entire illness journey (**Salih, et al., 2021 & El Nagar, et al., 2020**).

### Significance of the study

Adolescents and young adults undergoing hemodialysis face unique challenges in maintaining their health and well-being. Hemodialysis is a complex medical procedure that requires strict adherence to patient safety guidelines to prevent adverse events and complications (**Uthman, 2019**). Hemodialysis procedures involve various potential safety risks, such as infection, vascular access complications, and medication errors. Understanding how nurses identify and mitigate these risks, particularly in the context of adolescent patients, is essential to enhance patient safety. Nurses, as primary

healthcare providers in the hemodialysis setting, play a crucial role in ensuring the delivery of safe and effective care to adolescent patients (El Nagar, et al., 2020).

The effectiveness of a Hemo Pause checklist, specifically designed to address the unique needs and challenges of adolescents & young adults undergoing hemodialysis, needs to be explored. This checklist can serve as a tool to guide nurses in ensuring comprehensive and standardized care, minimizing errors, and improving patient outcomes (Silver et al., 2018). As well the introduction of patient safety guidelines and the Hemo Pause checklist may require changes in nurses' practice, including their knowledge, attitudes, and behaviors towards adolescent patients. Investigating the impact of these interventions on nurses' practice is crucial to identify areas for improvement and promote optimal care delivery. However, despite the existence of patient safety guidelines, there is a need to investigate the impact of implementing these guidelines, along with a specifically designed Hemo Pause checklist, on nurses' practice towards adolescents undergoing hemodialysis (Safouh, et al., 2019). Therefore, the current study was developed to evaluate the effect of applying safety guidelines and Hemo Pause checklist on nurses practice and safety parameters for adolescents & young adults undergoing hemodialysis.

#### Aim of the Study

The aim of the study was to evaluate the effect of implementing safety guidelines on nurses' performance and safety parameters for adolescents & young adults undergoing hemodialysis.

#### Hypothesis

- Implementation of safety guidelines is expected to improve nurses' performance for adolescents and young adults undergoing hemodialysis.
- Safety parameters of adolescents and young adults are expected to be improved after implementation of safety guidelines.

### Subject & Methods

#### Research design

To achieve the study goal, a quasi-experimental research design using one group pre posttest was employed.

#### Setting

The study was carried out in hemodialysis units at Mansoura University children's Hospital (MUCH) which is affiliated to the Ministry of Higher Education & Scientific Research and from Ain-shams university hospitals that is affiliated to the Ministry of Higher Education & Scientific Research in Egypt. The kidney dialysis unit in medical hospital in Ain shams university hospital was at the second floor and divided into three rooms, each room has 3 beds. In

relation to Ain shams specialized hospital, it was at the third floor and divided into 4 rooms, each room has 4 beds. The hemodialysis unit in MUCH is a very big department in the first floor it consists of 3 rooms, one big room suited for 16 pediatric patients and equipped with 16 hemodialysis machine and there is a space between patient and the nurses' station inside. The two other rooms one for peritoneal dialysis and the other room is single room with separate hemodialysis machine suited for pediatric patient with blood born disease like hepatitis.

#### Sample

The current study involved two groups according to sample size equation listed below a purposive sampling of 40 nurse from each hospital working in the previously mentioned study setting. Nurses from both genders, with different ages, educational background, and years of experience was involved in the present study. Also, the study includes a purposive sampling of 41 adolescents as well as 41 young adults from both gender who were admitted to the previously mentioned study setting and undergoing hemodialysis was involved in the current study.

#### Inclusion criteria for patients

- Adolescents and young adults undergoing hemodialysis and their ages ranging from 13-24 years old
- Both gender
- Undergoing hemodialysis for more than 6 months
- Having permanent fistula

#### Exclusion criteria for patients

- Peritoneal dialysis
- Adolescents and young adults undergoing temporary hemodialysis

#### Sample size justification for nurses

The following formula was used to determine the sample size according to (Wang & Chow, 2007)

$$n = (Z_{\alpha/2} + Z_{\beta})^2 * (p_1(1-p_1) + p_2(1-p_2)) / (p_1 - p_2)^2$$

The following criteria was used for the sample size calculation:  $\alpha/2$ : is the critical value of the Normal distribution at  $\alpha/2$  (e.g. for a confidence level of 95%,  $\alpha$  is 0.05 and the critical value is 1.96).  $Z_{\beta}$ : is the critical value of the Normal distribution at  $\beta$  (e.g. for a power of 80%,  $\beta$  is 0.2 and the critical value is 0.84).  $p_1$ : The expected sample proportions of Ain-Shams & Cairo University Hospitals nurses working in hemodialysis unit are 70% through the whole year according to (Frag & El-Sayed, 2022).  $p_2$ : The expected sample proportions of MUCH nurses are 40% working in hemodialysis unit through the whole year (Salih, et al., 2021). So,  $n = (1.96 + 0.84)^2 * (.7(1-.7) + .4(1-.4)) / (.7-.4)^2 = 39.2$ . So, sample size for nurses required per hospital is 40

**Sample size justification for adolescent and young adults**

The following formula was used to determine the sample size according to (Wang & Chow, 2007)

$$n = (Z_{\alpha/2} + Z_{\beta})^2 * (p_1(1-p_1) + p_2(1-p_2)) / (p_1 - p_2)^2$$

The following criteria was used for the sample size calculation:  $\alpha/2$ : is the critical value of the Normal distribution at  $\alpha/2$  (e.g. for a confidence level of 95%,  $\alpha$  is 0.05 and the critical value is 1.96.  $Z_{\beta}$ : is the critical value of the Normal distribution at  $\beta$  (e.g. for a power of 80%,  $\beta$  is 0.2 and the critical value is 0.84.  $p_1$ : Target population in Egypt are 69.7% through the whole year according to (Frag & El-Sayed, 2022).  $p_2$ : Target population in MUCH nurses are 40.5% working in hemodialysis unit through the whole year (Osman, et al., 2023). So,  $n = (1.96 + 0.84)^2 * (.697(1-.697) + (.405(1-.405)) / (.697 - .405)^2 = 41$  is the sample size for Adolescents and young adults undergoing hemodialysis.

**Tools of data collection**

Three tools were developed by the researcher after reviewing related literature to fulfill the aim of the study namely: patient safety parameter knowledge and practice for adolescents & young adults undergoing hemodialysis questionnaire sheet, Hemo Pause safety assessment observational checklist and hemodialysis patient safety parameters questionnaire sheet.

**Tool I: A structured questionnaire sheet for nurses' knowledge regarding safety guidelines during hemodialysis:**

The tool was developed by the researchers after reviewing related literature (Mohamed, 2016) and it included two parts. **Part (1):** Socio-demographic characteristics of Nurses. This part cover question about Gender, age, marital status, educational level and years of experience in hemodialysis unit. **Part (2):** nurses' knowledge and practice about patient safety guidelines towards adolescents & young adults undergoing hemodialysis questionnaire sheet. The part cover questions about patient safety parameter in hemodialysis unit concerning the following sub scales confirmation of patient data and identification, vascular access, patient falls, medication error, dealing with dialyzer and sterilization and infection prevention. The following is the scoring method that was designed for knowledge: two points is awarded for each complete correct answer, incomplete correct answer scored 1 and Incorrect responses, omitted statements received a zero. A total knowledge score of 80% or higher was regarded good knowledge, a score of 80% to less than 70% that was deemed average knowledge, and a score of less than 70% was considered poor knowledge according to (Ibrahim, Ouda, & Ismail, 2019).

**Tool II: Hemo Pause safety assessment observational checklist: -**

The tool was adopted from (Thomas, et al., 2019). It included 31 patient safety parameters that was evaluate in the form of done, not done and not applicable. The checklist includes parameters that must be done before, during and after dialysis session like patient identification, weight measurement, review patient allergy history, physician order, blood pressure & vital signs measurement ...etc. It was assessed before and after implementing patient safety guidelines and the Hemo Pause checklist. The scoring method that was designed for practice is two points is awarded for completed correct done. Not done and not applicable received a zero. The final score was calculated and categorized as competent practice when it exceeded 80% and incompetent practice when it fell below 80% according to (Ibrahim, Ouda, & Ismail, 2019).

**Tool III: Hemodialysis Patient safety parameters for Adolescents and young adults undergoing Hemodialysis questionnaire sheet**

The tool was developed by the researchers after reviewing related literature (Renal Physician Association, 2019). It included three parts: **Part (1).** Socio-demographic characteristics of adolescents & young adults including Gender, age and educational level. **Part (2).** Clinical and health history of adolescents & young adults undergoing hemodialysis. This section covers questions about age at diagnosis with end stage renal disease (ESRD), family history of ESRD, duration on hemodialysis, Number of dialysis days per week, dialysis access, presence of other chronic disease, and how many medications they take. **Part (3): hemodialysis Patient safety parameters questionnaire sheet:** The section comprises of questions covering the detailed inputs and outputs in each of the four major stages of a dialysis session. The acts or circumstances that could exacerbate or alleviate patient safety hazards were reflected in the inputs. In this case, the outputs indicated possible problems with patient safety prior to, during, and after the commencement of a patient's dialysis treatment, as well as whenever the patient is at the dialysis facility. Two parameters are used to characterize the safety survey questions: the potential safety issues and the stage of the dialysis session. Safety issues' characteristics included: a) categories of errors and safety issues; b) frequency of errors and safety issues; c) potential contributing variables; and d) actions and methods for handling errors and safety concerns. The final score was added up both before and after the checklist was used. A score of less than 50% for the overall means was deemed to be low safety. It was regarded as average if it fell between 50% and 70%. Adolescents and young adults were



deemed to have a high safety status if it was greater than 70% (Abd-Elghany, et al., (2023).

#### **Validity and reliability**

The adapted and translated data collection tool was tested for validity by five professionals in the field of nursing. Test of reliability was done using Alpha Cronbach's test for tool 1 was 0.81, tool 2 was 0.83 and tool 3 was 0.85.

#### **Ethical considerations**

Mansoura University nursing college provided ethical agreement with the following number (Ref. No. P 0491) after explaining the purpose, methods, and time frame of the study, approval was attained from the hospital's executive and the department manager. After discussing the purpose of the study, written consent clearance was attained from nurses, teenagers, and his or her caregivers and young adults. They receive guarantees about the privacy of the information gathered and their unrestricted freedom to discontinue participation in the study at any moment.

#### **Pilot study**

After the tools were finalized, pilot research was conducted on 10% of the total subject population (4 nurses in each hospital and 4 adolescents as well as 4 young adults) to demonstrate the tools' feasibility and applicability. The subjects in the pilot study were excluded from the total sample. The required modification was done accordingly.

#### **Fieldwork:**

The study's data was gathered during a six-month period, beginning in the second half of June 2023 and ending in November 2023. Three stages of data collecting were conducted: the assessment, implementation, and evaluation phases. In phase of assessment, the head nurse and the kidney dialysis nurses were informed about the purpose and design of the study. Using tool, I, the researchers assessed nurses' proficiency with patient safety Measure and the Hemo Pause checklist during this phase. Subsequently, a code number was assigned to every nurse, which they would use to identify themselves during the research. The researchers evaluated the practical level of nurses through direct observation. Using tool II, the researcher observed each nurse for an average of three hours per day, three days per week, over the course of one month. The researcher filled out observational checklists and recorded the nurses' practices with regard to applying patient safety guidelines and the Hemo Pause checklist. Using tool III, the researchers collected the patient safety parameters and gathered information regarding problems and safety indicators

Nurses received two practical and two theory session which were the part of the training program on the

Hemo Pause checklist and patient safety guidelines by the researchers on the implementation phase. The course was taught over the course of month, with two sessions each week that lasts about thirty to forty-five minutes. There were five nurses allocated in each group. The timing of the session fell between the morning and afternoon shifts. The theoretical sessions focused on overview of ESRD, patients' safety, nursing care for adolescents & young adults undergoing hemodialysis, complication, safety guidelines and practices for adolescent undergoing hemodialysis and the content of the Hemo-pause checklist. While, the practical sessions concentrated on the application and demonstration of Hemo Pause checklist intervention was done by the researchers, and then re-demonstration done by studied nurses. Every practical session carried out during the shift work. Nurses divided into small groups (for each five nurses) practical sessions were done in the nurses' working area to facilitate the training. Enough time given for discussions, clarifications, and any questions regarding the practical skills. Many teaching methods was used in each session included demonstration and return demonstration, displaying simple training videos for practical skills and power point presentation with pictures used in theoretical part. Nurses' knowledge and practice was evaluated pre and post two months after implementation of the training program using the previously mentioned study tools in the evaluation phase. Evaluation of the safety indicators and problems for patients undergoing hemodialysis before and after six months from the implementation of patient safety guidelines and Hemo Pause checklist for nurses was done using tool III.

#### **Statistical Analysis:**

The SPSS software, version (23), was used to edit, tabulate, and analyze the gathered data. To assess the statistically significant differences, descriptive statistics using numbers and percentages, as well as suitable statistical tests like mean and SD, t test, Chi-square ( $\chi^2$ ), t test, P-Value, and correlations are utilized.

Results

Table (1): Demographic characteristics of the studied nurses

Variables	Ain-Shams University Hospitals		Mansoura University Children's Hospital (MUCHs)	
	N (40)	%	N (40)	%
<b>Age (Years)</b>				
20-<30	4	10	18	45
31-<40	26	65	16	40
41-<50	10	25	6	15
<b>Mean ±SD</b>	28.6±5.89		31.52±7.56	
<b>Min-Max</b>	20-44		19-50	
<b>Gender</b>				
Male	21	52.5	12	30
Female	19	47.5	28	70
<b>Marital Status</b>				
Single	8	20	15	37.5
Married	19	47.5	17	42.5
Divorced	0	0	3	7.5
Widow	3	7.5	5	12.5
<b>Years of experience</b>				
2-<5	19	47.5	22	55
5-<10	17	42.5	7	17.5
≥10 years	4	10	11	27.5
<b>Level of education</b>				
Diploma in Nursing	18	45	20	50
Bachelor's degree in nursing	18	45	16	40
Master	4	10	4	10

Table (2): Nurses knowledge about Safety guidelines and Hemo Pause checklist for adolescents and young adult undergoing hemodialysis

Variables	Ain-Shams University Hospitals						Mansoura University Children's Hospital (MUCHs)						X <sup>2</sup>	P value
	Pre-intervention			3 months post-intervention			Pre-intervention			3 months post-intervention				
	Good	Average	Poor	Good	Average	Poor	Good	Average	Poor	Good	Average	Poor		
	N (40)			N (40)			N (40)			N (40)				
Total level of nurses' knowledge about hemodialysis and patient safet	22.5	35	42.5	82.5	12.5	5	55	27.5	17.5	87.5	5	7.5	36.402	≤0.001**
Total level of nurse's knowledge about patient safety concerning confirmation of patient data	57.5	20	22.5	90	10	0	67.5	25	7.5	82.5	15	2.5	14.627	≤0.001**
Total level of nurse's knowledge about patient safety concerning care of vascular access	15	15	70	57.5	12.5	30	20	5	75	37.5	20	42.5	21.934	≤0.001**
Total level of nurse's knowledge about patient safety concerning prevention of fall	10	7.5	82.5	62.5	17.5	20	5	15	80	47.5	30	22.5	60.549	≤0.001**
Total level of nurse's knowledge about patient safety concerning medication errors prevention	17.5	42.5	40	57.5	25	17.5	22.5	37.5	40	55	22.5	22.5	22.434	≤0.001**
Total level of nurse's knowledge about patient safety concerning dealing with dialyzer	12.5	32.5	55	60	17.5	22.5	15	37.5	47.5	57.5	27.5	15	36.59	≤0.001**
Total level of nurse's knowledge about patient safety concerning sterilization and hygiene techniques	32.5	27.5	40	77.5	12.5	10	40	30	30	72.5	15	12.5	24.790	≤0.001**

X<sup>2</sup>: The Chi-square test; \*\*: P<0.01

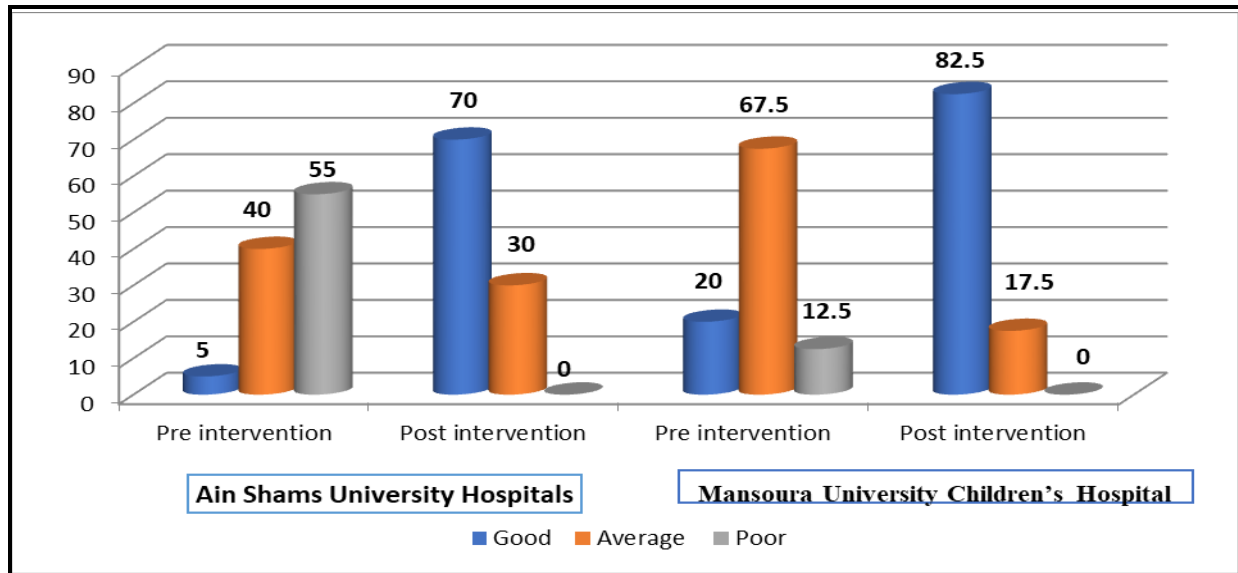


Figure (1): Total level of nurse's knowledge about safety guidelines and Hemo Pause checklist

Table (3): Total level of nurses' practices regarding Hemo Pause safety assessment observational checklist for adolescents and young adult undergoing hemodialysis

Variables	Ain-Shams University Hospitals				Mansoura University Children's Hospital (MUCHs)				X <sup>2</sup>	p. value
	Pre-intervention N (40)		3 months post-intervention N (40)		Pre-intervention N (40)		3 months post-intervention N (40)			
	Incompetent	Competent	Incompetent	Competent	Incompetent	Competent	Incompetent	Competent		
Before the patient arrives ('sign in') procedures	55	45	2.5	97.5	42.5	57.5	7.5	92.5	38.96	≤0.001**
Prior to cannulation and hemodialysis initiation (Time out) procedures	67.5	32.5	15	85	72.5	27.5	22.5	77.5	42.56	≤0.001**
After hemodialysis completion (Sign out) procedures	75	25	17.5	82.5	42.5	57.5	15	85	30.83	≤0.001**

X<sup>2</sup>: The Chi-square test; \*\*: P<0.01

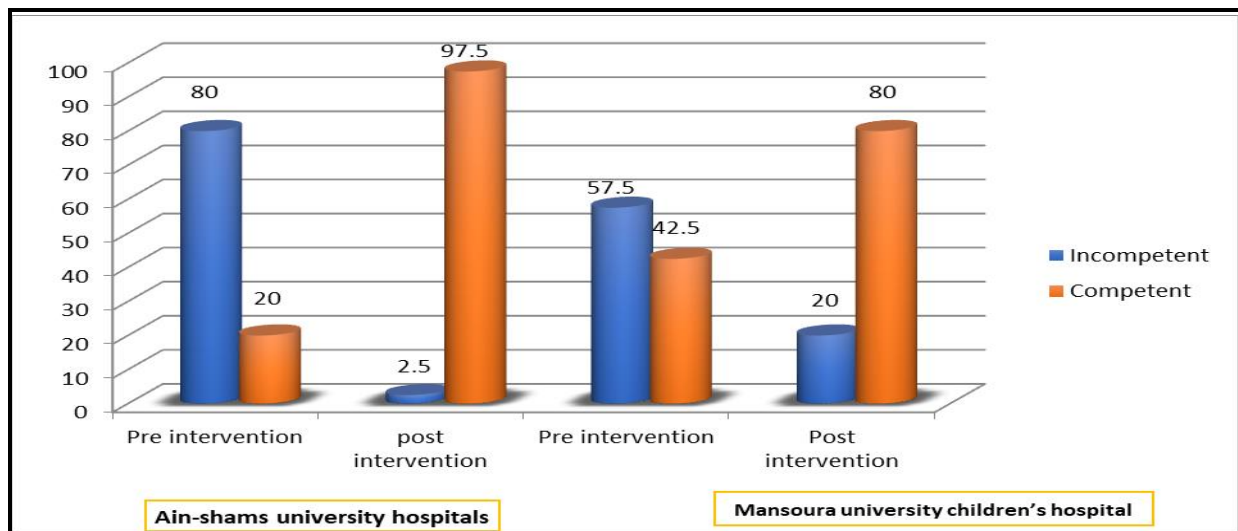


Figure (2): Total level of nurses' practices regarding assessment of Hemo Pause safety checklist

**Table (4): Demographic characteristics, clinical and health history of adolescent and young adult undergoing hemodialysis**

Variables	Young Adult		Adolescent	
	N (41)	%	N (41)	%
<b>Age (Years) Mean ±SD</b>	21.65±2.254		12.74±3.25	
<b>Gender</b>				
Male	22	53.7	21	51.2
Female	19	46.3	20	48.8
<b>Level of education</b>				
Basic Education	23	56.1	38	92.7
Secondary education	12	29.3	2	4.9
Higher education	6	14.6	1	2.4
<b>Family History of CKD</b>				
Yes	25	60.9	13	31.71
No	16	39.02	28	68.3
<b>Duration on Hemodialysis</b>				
less than 1 year	8	19.5	7	17.07
From 1 y to less than 5 years	29	70.7	24	58.5
From 5years to less than 10 years	4	9.8	10	24.4
<b>Number of days of dialysis per week</b>				
One time / week	0	0	1	2.4
Tow time/week	17	41.5	21	51.2
Three time/week	24	58.5	19	46.3
<b>Presence of chronic disease</b>				
No	11	26.8	19	46.3
Diabetes	6	14.6	9	21.9
Hypertension	5	12.2	8	19.5
Liver problem (hepatitis B, C & cirrhosis)	12	41.5	3	7.3
Blood disease	4	9.8	0	0
Others (Enlarger myocardia, Systemic lupus erythematosus, Bronchial asthma)	3	7.3	2	4.9

**Table (5): Hemodialysis safety parameters for adolescent and young adult undergoing hemodialysis**

Variables	Young Adult				Adolescent				Chi-Square	P-Value
	Pre-intervention		3 months post intervention		Pre-intervention		3 months post intervention			
	N (41)	%	N (41)	%	N (41)	%	N (41)	%		
<b>Total Safety parameters before the start of dialysis</b>										
• Low safety	8	19.51	0	0	5	12.2	0	0	57.54	≤0.001**
• Average safety	25	60.98	2	4.88	18	43.9	7	17.07		
• High Safety	8	19.51	39	95.1	18	43.9	34	82.9		
<b>Total Safety parameters at the start of dialysis</b>										
• Low safety	38	92.9	9	21.9	35	85.4	11	26.8	75.02	≤0.001**
• Average safety	3	7.3	13	31.7	6	14.6	11	26.8		
• High Safety	0	0	19	46.3	0	0	19	46.3		
<b>Total Safety parameters during dialysis</b>										
• Low safety	4	9.8	2	4.9	6	14.63	4	9.76	28.96	≤0.001**
• Average safety	20	48.8	7	17.07	26	63.4	9	21.95		
• High Safety	17	41.5	32	78.05	9	21.9	28	68.29		
<b>• Total Safety parameters at any time while patient at dialysis</b>										
• Low safety	10	24.4	2	4.9	2	4.9	1	2.4	51.65	≤0.001**
• Average Safety	21	51.2	4	9.8	30	73.2	10	24.4		
• High Safety	10	24.4	35	85.4	9	21.95	30	73.2		
<b>Total Safety parameters for patient under-dialysis treatment</b>										
• Low safety	10	24.4	0	0	2	4.9	0	0	76.52	≤0.001**
• Average safety	29	70.7	7	17.07	37	90.2	18	43.9		
• High Safety	2	4.9	34	82.9	2	4.9	23	56.1		



**Table (6): Correlation between total level of nurses' knowledge and total level of nurses' practices about safety guidelines and Hemo Pause checklist**

level of nurses' practices	Total level of nurse's knowledge											
	Ain-Shams University Hospitals						Mansoura University Children's Hospital (MUCHs)					
	Pre-intervention			3 months post-intervention			Pre-intervention Nurses practices			3 months post-intervention		
	Poor	Average	Good	Poor	Average	Good	Poor	Average	Good	Poor	Average	Good
<b>Sign in procedures</b>												
• Incompetent	35	17.5	2.5	0	0	2.5	5	30	7.5	0	2.5	5
• Competent	20	22.5	2.5	0	30	67.5	7.5	37.5	12.5	0	15	77.5
<b>Pre-post</b>	<b>r=0.580 P≤0.001**</b>						<b>r=0.404 P≤0.001**</b>					
<b>Time out procedures</b>												
• Incompetent	42.5	20	5	0	0	15	5	55	12.5	0	7.5	15
• Competent	12.5	20	0	0	30	55	7.5	12.5	7.5	0	10	67.5
<b>Pre-post</b>	<b>r=0.533 P≤0.001**</b>						<b>r=0.501 P≤0.001**</b>					
<b>Sign out procedures</b>												
• Incompetent	37.5	32.5	5	0	5	12.5	2.5	32.5	7.5	0	0	15
• Competent	17.5	7.5	0	0	25	57.5	10	35	12.5	0	17.5	67.5
<b>Pre-post</b>	<b>r=0.577 P≤0.001**</b>						<b>r=0.304 P≤0.006*</b>					
<b>Total</b>												
• Incompetent	45	30	5	0	0	2.5	5	42.5	10	0	7.5	12.5
• Competent	10	10	0	0	30	67.5	7.5	25	10	0	10	70
<b>Pre-post</b>	<b>r=0.787 P≤0.001**</b>						<b>r=0.385 P≤0.001**</b>					

\*\* : P<0.01

**Table (1):** Demographic characteristics of studied nurses. It was clear from this table that the age distribution of the nurses ranged from 20 to 50 years, with the majority (65%) of them falling within the 31-40 age group at Ain-shams university hospitals. While, about 45% & 40% of the studied nurses from MUCH were in the age group of 21-30 years and 31-40 years respectively. Female nurses constituted the majority in MUCH hospital (70%) compared to more than half of nurses (52.5%) were male at Ain-Shams University hospitals. Moreover, 47.5% & 55% of nurses had 2-5 years of experience at Ain-Shams University hospitals and MUCH respectively. About 45% and 50%; of nurses in Ain-Shams University hospitals and MUCH had diploma degree of nursing respectively, while, 45% & 40% of them had bachelor degree of nursing respectively.

**Table (2):** Illustrates nurses' knowledge about safety guidelines and Hemo Pause checklist for adolescents and young adult undergoing hemodialysis. Overall, there was a significant improvement in nurses' knowledge after a two-month intervention in both hospitals. The improvement was observed in the following patient data confirmation subscales, care of vascular access, prevention of falls, medication errors prevention, and dealing with dialyzers. The intervention had a positive impact on enhancing nurses' knowledge related to patient safety guidelines and Hemo Pause checklist with p value (p=≤0.001).

**Figure (1):** Shows total level of nurse's knowledge about safety guidelines and Hemo Pause checklist. It

is clear from this figure that 55% of nurses working in Ain-Shams university had low level of knowledge in the pre intervention compared to 70% had good knowledge in the post intervention phase. Additionally, 67.5% of nurses working in MUCH had average level of knowledge in the pre intervention compared to 82.5% had good knowledge in the post intervention phase. And the difference in both hospitals was statistically significant (p=≤0.001).

Total practices regarding Hemo Pause safety assessment observational checklist for adolescents and young adult undergoing hemodialysis was presented in **Table (3)**. The results showed a significant improvement in nurses' competence in performing care before the patient arrives ('sign in') prior to cannulation and hemodialysis initiation (Time out) and after hemodialysis completion (Sign out) with p value (p=≤0.001) in both hospitals.

Total level of nurses' practices regarding assessment of Hemo Pause safety checklist was illustrated in **Figure (2)**. It was noticed that 80% of nurses working in Ain-Shams hospitals had incompetent practice in pre intervention compared to 97.5% had competent practice in the post intervention phase. Moreover, 42.5% of nurses working in MUCH had competent practice in the pre intervention compared to 80% in the post intervention phase. And the difference in both hospitals was statistically significant (p=≤0.001).

**Table (4):** Shows demographic characteristics, clinical and health history of adolescent and young adult undergoing hemodialysis. It was clear from this

table that the mean age of young adult was 21.65±2.25 while the mean age of adolescent was 12.74±3.25. The majority of adolescents and young adults had basic education (92.7% & 56.1% respectively). About 60.9% of young adults had previous family history CKD, where 68.3 % of adolescents had negative family history of CKD. The duration of hemodialysis varied, with a significant number of adolescents and young adults receiving treatment from 1-5 years. The presence of other chronic diseases such as diabetes, hypertension, and hepatitis B & C was commonly observed in adolescents & young adults undergoing hemodialysis. Hemodialysis safety parameters for adolescent and young adult undergoing hemodialysis were illustrated in **Table (5)**. It was indicated in the young adult, before the intervention that, 92.9% of patients had low safety parameters at the start of dialysis, while 7.3% had average safety parameters. After two months, the percentage of patients with high safety parameters increased significantly to 46.34%, while the percentages of patients with low safety parameters decreased. Similarly, in adolescents before the intervention, 85.4% of adolescents had low safety parameters at the start of dialysis, while 14.6% had average safety parameters. After three months, the percentage of adolescents with high safety parameters increased significantly to 46.3%, while the percentages of patients with low safety parameters decreased and the difference was statistically significant ( $p \leq 0.001$ ).

**Table (6):** Examines the correlation between the total level of nurses' knowledge and the level of nurses' practices regarding safety guidelines and Hemo Pause checklist for adolescents and young adult undergoing hemodialysis. The results indicate there is a significant positive correlation between the level of nurses' knowledge about hemodialysis patient safety and their competence in all procedures assessed in both hospitals ( $p \leq 0.001$ ).

## Discussion

The global prevalence of chronic kidney disease (CKD) is on the rise, presenting a major public health challenge. Hemodialysis is a crucial treatment for adolescents and young adults afflicted with CKD, but it comes with inherent risks and complications. This age group faces unique and complex family, psychological, and physical issues. Despite advancements in CKD and end-stage kidney disease (ESKD) treatment, the long-term mortality rate for children, adolescents, and young adults with CKD remains significantly higher compared to their healthy counterparts (**Ferris et al., 2019**). The utilization of checklists has been proven to improve patient safety, adherence to protocols and regulations,

communication, teamwork, and consistency of care. A safety checklist might be especially useful in the hemodialysis unit, as it can keep nurse focused, precise, and able to recall information while preventing mistakes under pressure (**Ismail & Ismail, 2020**). For that reason, this study examined effect of applying safety guidelines and Hemo Pause checklist on nurses practice and safety parameters for adolescents & young adults undergoing hemodialysis. Concerning demographic characteristics of studied nurses, the current study findings demonstrated that, more than two thirds of them were in the age group of 31-40 years old in Ain-shams university hospitals while, two fifth of the studied nurses from Mansoura university children hospital (MUCH) were in the age group of 31-40 years. This finding was contradicted with **Ragab, et al., (2021)**, who conducted an Egyptian study about "Assessment of Nurses' Application of Guidelines for Management of Children Undergoing Hemodialysis" and reported that, the highest percentages of the studied nurses aged more than 45 years old. From the researcher point of view, the finding of the present study might be due to nurses at this age were not a newly graduates and they were at the middle age of their working career.

Regarding the educational level, the current study revealed that over two-fifths of nurses from MUCH and half of the nurses from Ain-Shams University hospitals held a diploma degree in nursing. This result in an agreement with **Ibrahim, et al., (2019)**, who conducted an Egyptian study about "Assessment of Nurses' Performance Regarding Care of Children Undergoing Hemodialysis Therapy." and proved that, the majority of nurses had secondary school of nursing diploma.

The results of the current study revealed that the majority of adolescents and young adults were male and had CKD for less than 5years. This result was in agreement with **Hassan, & Khalafallah, (2019)** who reported in their study the majority of adolescents with CKD were male and had renal failure from 4-6 years. On contrary, **El Nagar, et al., (2020) & Mohammed Abd-Elghany, et al., (2023)** found that most young adults and adolescents receiving hemodialysis were female. Regarding young adult disease comorbidity status revealed that more than two fifth of young adults had liver problem like hepatitis B, C and liver cirrhosis. It was reported in literature that HCV infection is common and associated with significant morbidity and mortality among dialysis patients and is more common in dialysis patients than in healthy populations. As well, adolescent's comorbidity revealed that diabetes and hypertension was the most common disease comorbidity.

Pertaining to the overall knowledge about safety guidelines and Hemo Pause checklist for adolescents and young adult undergoing hemodialysis, it was found in the present finding that, there was a significant improvement in nurses' knowledge after three-month intervention in both hospitals as evidenced by the higher frequencies of nurses in both previously mentioned settings had good knowledge regarding patient data confirmation, care of vascular access, prevention of falls, medication errors prevention, and dealing with dialyzers respectively, with a very high statistical significant differences at  $p < 0.001$ . This finding was in a harmony with **El-Aziz, et al., (2018)** who conducted a study about "Developing, Implementing and Evaluating Patients Safety Guidelines for Nurses at Hemodialysis Units in Ministry of Health Hospitals" and found that the highest percent of nurses (88.9%) had sufficient total knowledge score about patient safety guidelines in hemodialysis unit post of safety guidelines implementation, with statistical significant difference between nurses knowledge before and after scores the implementation of safety guidelines at  $p < 0.001$ . These findings might be attributed to provision of proper, regular educational programs, up-to-dated, or refresher courses about safety guidelines and Hemo Pause checklist and ongoing supervision for nurses that improve their knowledge

As regards nurses' total practices regarding Hemo Pause safety assessment observational checklist for adolescents and young adult undergoing hemodialysis, the current study explained that, the majority of nurses had competent level of practice regarding the following sub items; before the patient arrives ('sign in'), prior to cannulation and hemodialysis initiation (Time out) as well as after hemodialysis completion (Sign out) post 3 months of intervention with a highly statistical significant differences at  $p < 0.001$  in both hospitals. The result of the current study was supported by **Hafez, et al., (2020)** who studied "The Egyptian Society of Nephrology and Transplantation Hemodialysis Guidelines" and reported that there was an improvement in the total score of nursing performance after implementation of Guidelines as the higher proportion of them had a satisfactory performance about application of guidelines for management of patients undergoing HD. These present findings might be explained in the light of the fact that, good nurses' knowledge may value and improve their practice level.

It was indicated from the present study that, there was a significant positive association between the total level of nurses' knowledge and the level of nurses' practices regarding safety guidelines and Hemo Pause checklist for adolescents and young adult undergoing

hemodialysis at ( $p = \leq 0.000$ ). These finding may be due to nursing staff seeking for updating their information continuously which lead to the improvement of their performance. This result was agreed with **El-Aziz, et al., (2018)** who found that there is a positive correlation between nurses' total knowledge, and their practice related to safety guidelines in hemodialysis.

The study found substantial differences in safety parameters for adolescents and young adults, total scores during HD stages, and overall patient safety outcomes before and after employing Hemo Pause safety checklist. The majority of young adults and adolescents had low safety parameters at the start of dialysis, compared to half of them had high safety parameters in the post intervention phase and the difference was statistically significant ( $p = \leq 0.001$ ). Similarly, **Abd-Elghany, et al., (2023)** who conducted study about "Efficacy of Applying a Structured Checklist on Safety Outcomes of Hemodialysis Patients" and reported that the patient safety checklist significantly reduced the total mean score of adverse events for patients before and after application, with a statistically significant difference. Another study conducted by **Marrayyan, (2022)**, found considerable variations in the overall score of patient safety culture outcomes. These variations point to more factors that healthcare facilities and nursing leaders need to take into account when addressing patient safety. Additionally, **Ismail & Ismail, (2020)** study found a highly statistically significant difference between the pre- and post-application of patient safety standards.

However, in contrast to the aforementioned studies, **Atashzadeh-Shoorideh (2022)** assessed patient safety based on a nine-dimensional "patient safety principles checklist" in neonatal, pediatric, and adult intensive care units. The study compared ICUs of hospitals affiliated with two different medical sciences universities in Tehran and found no discernible variation in compliance with patient safety protocols between the two hospitals. These results suggest that the degree of adherence to patient safety protocols may vary across different healthcare settings. In conclusion, this study provides evidence of the positive impact of implementing safety guidelines and utilizing the Hemo-Pause checklist on nursing practice and safety parameters for adolescents and young adults undergoing hemodialysis. The findings support the importance of incorporating standardized protocols and checklists in healthcare settings to improve patient safety. Future research should explore the long-term effects of these interventions and examine their applicability in different healthcare contexts.

## Conclusion

This study highlights the positive impact of applying safety guidelines and utilizing the Hemo-Pause checklist on nursing practice and safety parameters in hemodialysis for adolescents and young adults undergoing. The current findings also suggest that standardizing procedures through the use of checklists, such as the Hemo-Pause checklist, promotes consistency and ensures that essential steps are not overlooked. This standardization can lead to improved patient outcomes and reduced variability in care delivery.

## Recommendations:

- Hospitals should prioritize the implementation of safety guidelines specific to hemodialysis units. This includes promoting infection control measures, medication error prevention, fall prevention and ensuring a safe working environment.
- Nurses should be encouraged to utilize the Hemo-Pause checklist during hemodialysis sessions. This checklist can serve as a guide to ensure comprehensive and standardized care, minimize errors, and improve patient outcomes.
- Healthcare providers, particularly nurses, should receive regular education and training on patient safety, infection control, and the use of checklists.
- Collaboration among healthcare professionals, including doctors, nurses, and multidisciplinary teams, is essential to develop and implement effective patient safety programs.
- Providing education to patients and their families about the importance of adherence to infection control measures.
- Regular evaluation and monitoring of adherence to safety guidelines and the effectiveness of the Hemo-Pause checklist should be conducted. Feedback from nurses and patients should be collected to identify areas for improvement and ensure continuous quality enhancement.

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