

Educational intervention in patients with end-stage chronic kidney disease: risk factors and associated complications

Intervenção educativa dos pacientes com doença renal crônica terminal: fatores de risco e complicações associadas

Intervención educativa de pacientes con enfermedad renal crónica terminal: factores de riesgo y complicaciones asociadas

ABSTRACT

Objective: to assess the knowledge of patients with end-stage chronic kidney disease regarding the risk factors and associated complications before and after an educational intervention. **Method:** an intervention and randomized study conducted with 101 participants divided into two groups of a hemodialysis sector from 2019 to July 2020. The analyses were performed using the McNemar, paired Student's t, Pearson's Chi-Square and Fisher's Exact tests, with a 5% significance level. **Results:** after the intervention, there was a significant reduction ($p < 0.05$) in the number of complications such as hypotension, hypoglycemia, cramps, nausea, tremors, chills and fever. The nursing and medical team verified the participants' active stance regarding the care measures for the arteriovenous fistula and the central venous catheter. The increase in knowledge about the hemodialysis process made it possible to understand the cause of the complications associated with the treatment. **Conclusion:** the educational action was effective and generated positive evaluation indicators, allowing the participants to become protagonists of self-care.

Keywords: Health Education; Knowledge Management; Nursing Care; Renal Dialysis; Public Health.

RESUMO

Objetivo: avaliar o conhecimento dos pacientes com doença renal crônica terminal quanto aos fatores de risco e complicações associadas antes e após uma intervenção educativa. **Método:** estudo de intervenção, randomizado com 101 participantes subdivididos em dois grupos de um setor de hemodiálise entre 2019 a julho de 2020. Para as análises fizeram-se testes McNemar, t-Student pareado, Qui-Quadrado de Pearson e Exato de Fisher, com nível de significância de 5%. **Resultados:** após intervenção, houve diminuição significativa ($p < 0,05$) das complicações como hipotensão, hipoglicemia, câimbra, náuseas, tremores, calafrio e febre. As equipes de enfermagem e médica verificaram posicionamento ativo dos participantes quanto aos cuidados com a fístula arteriovenosa e com o cateter venoso central. O aumento do conhecimento sobre o processo de hemodiálise propiciou entender a causa das complicações associadas ao tratamento. **Conclusão:** a ação educativa foi efetiva e gerou indicadores de avaliação positivos, permitindo que os participantes se tornassem protagonistas do autocuidado.


Descritores: Educação em Saúde; Gestão do Conhecimento; Cuidados de Enfermagem; Diálise Renal; Saúde Pública.

RESUMEN


Objetivo: evaluar el conocimiento de los pacientes con enfermedad renal crónica terminal sobre los factores de riesgo y las complicaciones asociadas antes y después de una intervención educativa. **Método:** estudio de intervención, aleatorizado con 101 participantes divididos en dos grupos de un sector de hemodiálisis entre 2019 a julio de 2020. Los análisis se realizaron mediante las pruebas de McNemar, t-Student pareada, Chi-Cuadrado de Pearson y Exacta de Fisher, con nivel de significancia del 5%. **Resultados:** tras la intervención hubo una disminución significativa ($p < 0,05$) de complicaciones como hipotensión, hipoglucemia, calambres, náuseas, temblores, escalofríos y fiebre. El personal médico y de enfermería verificó la posición activa de los participantes con respecto al cuidado de la fístula arteriovenosa y del catéter venoso central. El aumento del conocimiento sobre el proceso de hemodiálisis permitió comprender la causa de las complicaciones asociadas al tratamiento. **Conclusión:** la acción educativa fue efectiva y generó indicadores de evaluación positivos, permitiendo a los participantes convertirse en protagonistas del autocuidado.

Descriptores: Educación en Salud; Gestión del Conocimiento; Atención de Enfermería; Diálisis Renal; Salud Pública.

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INTRODUCTION

End-stage Chronic Kidney Disease (CKD) has a high prevalence of mortality, 20% a year in the United States, and 19.5% a year in Brazil, which turns it into a serious public health problem⁽¹⁻³⁾. CKD leads to progressive loss of the renal function and, when in the terminal phase, hemodialysis is necessary⁽²⁻³⁾. Hemodialysis is the main modality of renal replacement therapy for the treatment of CKD and covers approximately 70% to 90% of the patients⁽⁴⁻⁵⁾. To perform the treatment, all patients need an adequate vascular access and, among the access alternatives, are central venous catheter (CVC) and arteriovenous fistula (AVF)⁽⁴⁻⁵⁾. AVF is currently considered the access gold standard because it has better indicators for the risk of infections, hospitalizations, occurrence of central venous stenosis, mortality and costs in relation to the CVC⁽⁵⁾. Dysfunction of vascular accesses is one of the main complications that increases the patients' morbidity and mortality and is responsible for 20% to 30% of the annual hospital admissions after hemodialysis initiation⁽³⁾.

AVF and CVC can present complications, such as absence or decrease in blood flow, infections and thrombus development⁽⁶⁻⁸⁾. Worsening of these complications can be avoided by the early detection by the Nursing team and immediate assistance to avoid future hospitalizations⁽⁶⁾.

To avoid these complications, the patients' active participation and knowledge about the hemodialysis process and care involved with the vascular access, water and food intake contributes to the success of the care involved in the daily practice⁽⁹⁾. Hemodialysis increases the patients' survival, but it is a treatment that causes changes in the daily routine, requiring adaptations that can interfere with quality of life and require the modification of these patients' habits^(3,7).

Among other factors that can affect quality of life and adherence to the treatment are the patients' knowledge level about their disease and associated risk factors such as presence of diabetes, systemic arterial hypertension, smoking and alcohol consumption, which can hinder even more the renal functions and AVF healing⁽⁷⁻⁸⁾. A number of studies addressed the influence of the educational intervention on the understanding of fluid intake, self-care in hemodialysis patients and AVF care for the independence of patients with CKD and consequent success in care during dialysis⁽⁹⁻¹³⁾.

However, there is a gap in scientific knowledge in the teaching-learning process and in effective education strategies that encompass risk factors, such as failure due to AVF venous stenosis, tremors-chills and fever resulting from CVC-associated infections and, also, specific complications such as hypoglycemia, nausea, vomiting, hypotension, cramps and excessive weight gain between the sessions.

In the clinical practice, it is still a challenge for the Nursing team to intervene in the patients' knowledge so that they become active and take a stance in front of the professionals about the care process associated with their treatment in order to avoid complications and potential risks that would increase morbidity and mortality and compromise hemodialysis quality.

In view of the above, given the need for the patients to be able to better deal with the disease and hemodialysis through the intervention and implementation of educational actions in a collaborative way between patient-professional, the question is as follows: Can understanding the patients' knowledge about the hemodialysis process through an educational intervention contribute to the reduction of the risk factors and complications in patients with CKD? Facing this challenge and considering the scarcity of research studies on this theme, the purpose of this study was to assess the knowledge of patients with end-stage CKD regarding the risk factors and associated complications before and after an educational intervention.

METHOD

Study design, locus and period

An intervention study, randomized and based on pre- and post-intervention. The participants were recruited from the hemodialysis sector of a philanthropic health institution in the inland of Minas Gerais/Brazil. Data collection took place from June 2019 to July 2020. The design of this study was based on STROBE for its methodological design.

Inclusion and exclusion criteria

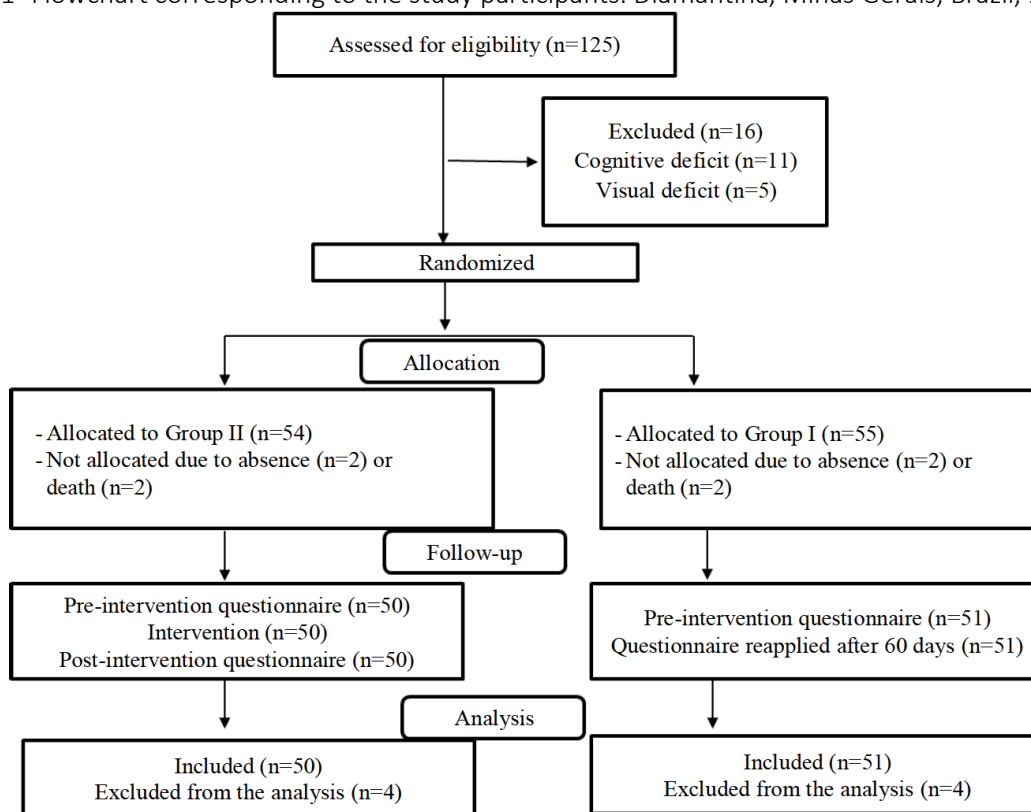
Adult patients over 18 years of age who presented end-stage CKD on dialysis were included. Visually or cognitively impaired patients, under 18 years of age and those who were confused or disoriented in time and space were excluded.

Sample

During the study period, the hemodialysis sector had 125 patients; of these, 16 were excluded and 109 underwent the randomization process using sealed envelopes and were randomized to one of two groups: I (control) and II (intervention). Group I: a pre-intervention questionnaire was applied and, after 90 days, there

was reapplication of the same questionnaire. Group II: a pre-intervention questionnaire was applied, as well as the educational intervention with distribution of a booklet and a post-intervention questionnaire. At the end of the entire study, Group I was also handed in the educational booklet (Figure 1).

Figure 1- Flowchart corresponding to the study participants. Diamantina, Minas Gerais, Brazil, 2020



Pre-test application

Prior to application of the questionnaire, a pre-test was carried out with 30 participants. These participants were recruited among the 125 patients undergoing treatment in the hemodialysis sector. In the end, the following variables were excluded: periodic use and knowledge of prescribed medications, as they did not generate relevant statistical data for this study, either because of the sample size or the profile of the participants included. The study was carried out 60 days after the pre-test and the final adapted questionnaire was applied again to these participants who were also randomized and entered the final sample.

Study protocol

In the first stage of the study, a semi-structured questionnaire, prepared by the researchers of this study, was applied before the

hemodialysis session to groups I and II, containing sociodemographic and clinical variables, previous history, risk factors, hospitalizations, interdialytic weight gain, knowledge and complications in hemodialysis and vascular access care.

Regarding the vascular access care measures, the participants were asked to mark the options they practiced at their homes or during the hemodialysis sessions. It was divided into: 1) AVF care: a) waits for the bleeding to stop after the session; b) hygiene of the limb containing the AVF before dialysis; c) requests rotation of the puncture site; d) inability to carry weight with the limb with AVF; e) does not sleep on the AVF arm; f) observes whether the AVF site present signs of inflammation and infection (heat, redness, swelling, pain and secretions); g) checks the presence of AVF thrill at least four times a day; h) keeps the punctured limb visible during the

session; g) does physical exercises to open and close the hands at least three times a day; h) keeps the dressing from 4 to 6 hours after the session; i) knows that it is not possible to puncture the access or collect exams from the AVF limb; j) does not remove crusts formed by punctures; k) knows that blood pressure should not be measured in the AVF limb; l) checks pulse daily; and m) does not wear clothes that compress the AVF site. 2) CVC care: a) does not wet the dressing; b) protects the dressing with plastic film in the bath; c) does not change the dressing at home; d) does not pull the catheter; e) does not sleep on the side where the catheter is inserted; f) does not open the dressing; g) does not touch the catheter insertion site; h) does not remain in places with a lot of dust and aerosols; i) observes if there is blood on the dressing; and j) communicates with the team in case of fever or pain where the catheter is inserted.

An observation script was also made so that the team of nursing technicians, nurses and physicians from the hemodialysis sector could apply it to the participants of this study. The script contained the following variables: presence of complications during hemodialysis, excessive weight gain between the sessions, food control, control of water intake, care with AVF or CVC. This observation script was applied by the multiprofessional team of the sector for two months, prior to the intervention.

In the second stage, an educational intervention was carried out through conversation circles recorded in a research diary, in which all participants shared their knowledge and experiences about vascular access, complications during hemodialysis, risk factors for hemodialysis, food control and fluid, interdialytic weight gain, and knowledge about the kidneys and the hemodialysis process.

In the conversation circles, printed images were also used to illustrate diverse information, so that the participants could better understand the theme under discussion. In addition to that, information transfer was avoided, encouraging active participation in the construction of knowledge with the objective of making patients stand before professionals regarding care with vascular access, water and food control during the hemodialysis sessions.

The conversation circles were carried out with groups of six participants at the most, in an airy room, lasting a maximum of sixty minutes, at alternate times so that the patients in the

intervention group did not have contact with those in the control group.

Three nurses from the sector also participated in the conversation circles, in order to try, through their daily practice, to minimize the negative points of each patient with regard to their knowledge on the clinical and risk care measures. It is noteworthy that the nurses in question did not reinforce the educational action with group I until the end of the study.

At the end of the conversation circle, the patients received a booklet, prepared by the authors themselves, in order to reinforce the variables of interest in this study and the patients' knowledge. The booklet served as reinforcement for the face-to-face intervention, so that the participants, when returning home, could recall the knowledge that was discussed in the conversation circles.

The third stage took place 90 days after the end of the intervention. The same semi-structured questionnaire used in the first stage was applied, both for group I and for group II. The same observational script of the first stage was also applied.

Data analysis

The data collected were categorized and analyzed using the Stata software, version 14.0. To assess the indicators of the intervention's impact, intragroup comparisons were used using the following statistical tests: McNemar test, for categorical and dichotomous variables, and paired Student's t test, for parametric continuous numerical variables (Mean±Standard Deviation). Data analysis was performed using frequency distribution for the categorical variables and, to verify the post-intervention association between the control and intervention groups, Pearson's Chi-Square or Fisher's Exact tests were used. For the post-intervention comparison between the control and intervention groups of the continuous variables, the Student's t test was used.

In the variables that presented statistical difference and had more than two categories, an analysis with Bonferroni correction was performed, in order to avoid type I errors derived from multiple comparisons. For the quantitative variables, data normality was verified using the Shapiro-Wilk test. The parametric variables were compared using Student's t test. The significance level considered was $p < 0.05$.

Ethical aspects

The research was approved by the Research Ethics Committee of *Universidade Federal dos*

Vales do Jequitinhonha e Mucuri, under opinion number 3,445,924/2019. All the participants signed the Free and Informed Consent Form.

The current study included 101 hemodialysis patients. In order to verify similarity between the variables of the two groups, Table 1 presents the sociodemographic profile, risk factors and hospitalizations of the research participants.

RESULTS

Table 1- Sociodemographic profile, risk factors and hospitalizations of the patients on hemodialysis at a philanthropic institution in Diamantina, Minas Gerais, Brazil, 2020

Variables	Total (N=101) n(%)	Control group (n=51) n(%)	Intervention group (n=50) n(%)	p-value*
Gender				0.772
Female	45(44.55)	22(43.14)	23(46.00)	
Male	56(55.44)	29(56.86)	27(54.00)	
Age				0.381
19-39 years old	25(24.75)	12(23.53)	13(26.00)	
40-59 years old	43(42.57)	25(49.02)	18(36.00)	
Over 60 years old	33(32.67)	14(27.45)	19(38.00)	
Schooling				0.910
Illiterate	9(8.91)	4(7.84)	5(10.00)	
Elementary School	71(70.29)	37(72.55)	34(68.00)	
High School	15(14.85)	8(15.69)	7(14.00)	
Technical Education	1(0.99)	0(0.00)	1(2.00)	
Higher Education	5(4.95)	2(3.92)	3(6.00)	
Risk factors				0.487
Yes	93(92.07)	48(94.12)	45(90.00)	
No	8(7.93)	3(5.88)	5(10.00)	
Arterial Hypertension		0.855		
Yes	78(77.23)	39(76.47)	39(78.00)	
No	23(22.77)	12(23.53)	11(22.00)	
Diabetes Mellitus				0.539
Yes	27(26.73)	15(29.41)	12(24.00)	
No	74(73.27)	36(70.59)	38(76.00)	
Dyslipidemia				0.200
Yes	11(10.89)	8(15.69)	3(6.00)	
No	90(89.11)	43(84.31)	47(94.00)	
Chronic Obstructive Pulmonary Disease				0.617
Yes	3(2.97)	1(1.96)	2(4.00)	
No	98(48.03)	50(98.04)	48(96.00)	
Depression				0.678
Yes	6(5.95)	4(7.84)	2(4.00)	
No	95(94.05)	47(92.16)	48(96.00)	
Smoker				0.444
Yes	8(7.92)	3(5.88)	5(10.00)	
No	93(92.08)	48(94.12)	45(90.00)	
Drinker				0.362
Yes	4(3.96)	1(1.96)	3(6.00)	
No	96.04	50(98.04)	47(94.00)	
Number of hospitalizations				0.698
None	30(29.70)	17(33.33)	13(26.00)	
From 1 to 3	48(47.52)	22(43.14)	26(52.00)	
From 4 to 6	14(13.86)	8(15.69)	6(12.00)	
From 7 to 9	5(4.95)	3(5.88)	2(4.00)	
More than 10	4(3.96)	1(1.96)	3(6.00)	

Note: *Pearson's Chi-Square or Fisher's Exact Test.

In relation to the type of vascular access, most (84, 83.16%) used AVF, 10 (9.90%) had CVCs, and 7 (6.94%) had used both CVC and AVF due to the time for AVF maturation. Table 2 presents the

results of applying the questionnaire for groups I and II before and after the educational intervention.

Table 2- Analysis of interdialytic weight gain, knowledge about the hemodialysis process, care with arteriovenous fistula and central venous catheter in hemodialysis patients at a philanthropic institution in Diamantina, Minas Gerais, Brazil, 2020

Variables (N=101)	Control group (n=51) n(%)			Intervention group (n=50) n(%)			p-value [†]
	Before	After	p-value*	Before	After	p-value*	
Kt/V			-			0.003 [‡]	<0.001 [‡]
Adequate 1.2-1.4 ^{AB}	39(76.47)	39(76.47)		43(86.00)	13(26.00)		
Low ≤ 1.2 ^A	12(23.53)	12(23.53)		7(14.00)	7(14.00)		
High > 1.4 ^B	-	-		-	30(60.00)		
Knows how the hemodialysis process works						<0.001	0.028
Yes	42(82.35)	40(78.43)	0.321	34(68.00)	48(96.00)		
No	9(17.65)	11(21.57)		16(32.00)	2(4.00)		
Describe the hemodialysis process			0.432			0.001 [§]	0.023 [§]
Does not know ^A	14(27.45)	15(29.42)		19(38.00)	2(4.00)		
Filters blood ^B	21(41.18)	20(39.21)		17(34.00)	12(24.00)		
Filters blood and removes excess fluid ^{AB}	10(19.61)	11(21.57)		7(14.00)	13(26.00)		
Performs functions of the kidneys ^{CA} (filters and removes excess fluid from blood)	6(11.76)	5(9.80)		7(14.00)	23(46.00)		
Central venous catheter concept			0.265			0.034	0.020
Knows	28(54.90)	26(50.98)		26(52.00)	43(86.00)		
Does not know	23(45.10)	25(49.02)		24(48.00)	7(14.00)		
Arteriovenous fistula concept						<0.001	0.014
Knows	32(62.75)	35(68.62)	0.242	24(48.00)	40(80.00)		
Does not know	19(37.25)	16(31.38)		26(52.00)	10(20.00)		
Number of care measures with the arteriovenous fistula	2.60±1.40	2.51±1.21	0.341	2.10±1.20	3.88±1.10	0.040	0.018
Number of care measures with the central venous catheter	1.62±0.19	1.52±0.11	0.211	1.78±0.18	3.32±0.17	0.023	0.010

Notes: *McNemar test or paired Student's t test for intragroup comparison. [†]Pearson's Chi-Square or Fisher's

Exact test for comparison of the control and intervention groups between categorical and dichotomous variables and, Student's t test for post-intervention continuous variables. [‡]Bonferroni correction (p<0.0083). [§]Bonferroni

correction (p<0.000625). ^{A,B,C} Equal letters mean similarity between the proportions of the group.

Table 3 presents the frequency and cause of hemodialysis-associated complications between groups I and II before and after the intervention.

Table 3- Presence of complications during hemodialysis and description of the cause, by patients of a philanthropic institution in Diamantina, Minas Gerais, Brazil, 2020

Complications hemodialysis VARIABLES (N=101)	during	Control group (n=51) n(%)		p-value*	Intervention group (n=50) n(%)		p-value*	p-value [†]
		Before	After		Before	After		
Hypotension				0.341			0.004	0.013
Yes	31(60.78)	30(58.82)			31(62.00)	18(36.00)		
No	20(39.22)	21(41.18)			19(38.00)	32(64.00)		
Hypoglycemia				0.357			0.527	0.726
Yes	18(35.29)	19(37.25)			18(36.00)	16(32.00)		
No	33(64.71)	32(62.75)			32(64.00)	34(68.00)		
Cramps				-			0.021	0.037
Yes	28(54.90)	28(54.90)			29(58.00)	16(36.00)		
No	23(45.10)	23(45.10)			21(42.00)	34(68.00)		
Nausea-Vomiting-Dizziness				-			0.032	0.045
Yes	7(13.73)	7(13.73)			16(32.00)	6(12.00)		
No	44(86.27)	44(86.27)			34(68.00)	44(88.00)		
Tremors-Chills-Fever				-			0.004	0.021

(continue)

Complications during hemodialysis	Control group (n=51) n(%)			Intervention group (n=50) n(%)			p-value [†]
	VARIABLES (N=101)	Before	After	p-value*	Before	After	
Yes	7(13.73)	8(15.68)	0.356	19(19.00)	2(4.00)		
Describe the cause of hypotension							<0.001 [‡] 0.006 [‡]
Does not know ^A	34(66.67)	32(62.74)	0.278	40(80.00)	17(34.00)		
Interdialytic excess weight ^B	7(13.73)	8(15.69)		3(6.00)	7(14.00)		
Ultrafiltrate removal beyond the amount supported ^{AC}	10(19.60)	11(21.57)		7(14.00)	16(32.00)		
Hypoglycemia	-	-		-	4(8.00)		
Catheter-associated infection	-	-		-	6(12.00)		
Describe the cause of hypoglycemia			0.398				0.006 [§] 0.022 [§]
Does not know ^A	38(74.51)	40(78.43)		36(72.00)	21(42.00)		
Decreased blood glucose ^B	3(5.88)	3(5.89)		3(6.00)	10(20.00)		
Ultrafiltrate removal beyond the amount supported ^C	4(7.84)	2(3.92)		2(4.00)	8(16.00)		
Inadequate food intake ^B	6(11.76)	6(11.76)		9(18.00)	11(22.00)		
Describe the cause of the cramps			0.343				0.001 0.002
Does not know ^A	32(62.75)	32(62.75)		32(64.00)	12(24.00)		
Ultrafiltrate removal beyond the amount supported ^B	10(19.61)	9(21.57)		10(20.00)	21(42.00)		
Interdialytic weight ^{AC}	5(9.80)	5(9.80)		3(6.00)	8(16.00)		
Hypotension and hypoglycemia ^{AB}	4(7.84)	5(9.80)		5(10.00)	9(18.00)		
Describe the cause of nausea, vomiting and dizziness							0.011 ^{**} 0.014 ^{**}
Does not know ^A	40(78.43)	40(78.43)	-	40(80.00)	24(48.00)		
Hypotension and hypoglycemia ^B	9(17.65)	9(17.65)		7(14.00)	11(22.00)		
Infection associated with catheter or arteriovenous fistula ^{AB}	1(1.96)	1(1.96)		1(2.00)	9(18.00)		
Due to medication use ^{AB}	1(1.96)	1(1.96)		2(4.00)	6(12.00)		
Describe the cause of tremors, chills and fever			0.342				0.011 ⁺⁺ 0.024 ⁺⁺
Does not know ^A	40(78.43)	42(82.35)		39(78.00)	22(44.00)		
Infection associated with catheter or arteriovenous fistula ^B	9(17.65)	7(13.73)		7(14.00)	16(32.00)		
Interdialytic weight ^{CA}	1(1.96)	1(1.96)		2(4.00)	4(8.00)		
Low immunity ^D	1(1.96)	1(1.96)		2(4.00)	8(16.00)		

Notes: *McNemar test for intragroup comparison. [†]Pearson's Chi-Square or Fisher's Exact Test for comparison of the control group and post-intervention intervention. [‡]Bonferroni correction (p<0.0083). ^{§||***†}Bonferroni correction (p<0.00625). ^{A,B,C}Equal letters mean similarity between the proportions of the group.

Table 4 presents the results from the professionals' observation script with regard to the

occurrence of complications associated with hemodialysis.

Table 4- Observations by the professionals related to the complications, excessive interdialytic weight gain, food and water intake and care with vascular access at a philanthropic institution in Diamantina, Minas Gerais, Brazil, 2020

Variables (N=101)	Control group (n=51) n(%)			Intervention group (n=50) (n%)			p-value [†]
	Before	After	p-value*	Before	After	p-value*	
Did the patient present complications?							
Hypotension							
Nursing Technician			0.317			0.818	0.504
Yes	19(37.25)	21(41.18)		16(32.00)	17(34.00)		
No	32(62.75)	30(58.82)		34(68.00)	33(66.00)		
Nurse			0.317			0.012	0.042
Yes	18(35.29)	19(37.25)		22(44.00)	12(24.00)		
No	33(64.71)	32(62.75)		28(56.00)	38(76.00)		
Physician			-			0.020	0.026
Yes	20(39.22)	20(39.22)		22(44.00)	13(26.00)		
No	31(60.78)	31(60.78)		28(56.00)	37(74.00)		
Tremors, chills and fever							
Nursing Technician			0.241			0.020	0.032
Yes	16(31.37)	18(35.29)		21(42.00)	10(20.00)		
No	35(68.63)	33(64.71)		29(58.00)	40(80.00)		
Nurse			0.310			0.031	0.038
Yes	16(31.38)	18(35.29)		24(48.00)	12(24.00)		
No	35(68.62)	33(64.71)		26(52.00)	38(76.00)		
Physician			0.245			0.015	0.019
Yes	17(33.33)	16(31.38)		12(24.00)	6(12.00)		
No	34(66.67)	35(68.62)		38(76.00)	44(88.00)		
Did the patient present excessive weight gain between the sessions?							
Nursing Technician			0.345			0.019	0.023
Yes	30(58.82)	28(54.90)		31(62.00)	18(36.00)		
No	21(41.18)	23(45.10)		19(38.00)	32(64.00)		
Nurse			-			0.032	0.040
Yes	20(39.21)	20(39.21)		12(24.00)	5(10.00)		
No	31(60.79)	31(60.79)		33(66.00)	29(58.00)		
Physician			0.231			0.041	0.001
Yes	29(56.86)	30(58.82)		30(60.00)	24(48.00)		
No	22(43.14)	21(41.18)		20(40.00)	26(52.00)		
Does he/she demonstrate control over food intake?							
Nursing Technician			0.317			0.617	0.609
Yes	24(47.05)	25(49.02)		23(46.00)	22(44.00)		
No	27(52.95)	26(50.98)		13(26.00)	15(30.00)		
Nurse			0.317			0.034	0.002
Yes	20(39.21)	19(37.25)		17(34.00)	31(62.00)		
No	31(60.79)	32(62.75)		33(66.00)	19(38.00)		
Physician			0.276			0.031	0.023
Yes	19(37.25)	18(35.29)		17(34.00)	28(56.00)		
No	32(62.75)	33(64.71)		33(66.00)	22(44.00)		
Does she/he demonstrate control over water intake?							
Nursing Technician			0.317			0.040	0.032
Yes	26(50.98)	27(52.94)		22(44.00)	32(64.00)		
No	25(49.02)	24(47.06)		28(56.00)	18(36.00)		
Nurse			0.317			0.023	0.001
Yes	27(45.10)	26(50.98)		19(38.00)	28(56.00)		
No	24(39.22)	25(49.02)		31(62.00)	22(44.00)		
Physician			-			0.010	0.004
Yes	27(52.94)	27(52.94)		17(34.00)	29(58.00)		
No	24(47.06)	24(47.06)		33(66.00)	21(42.00)		
Does he/she demonstrate performing care measures with the arteriovenous fistula?							
Nursing Technician			0.256			0.034	0.021
Yes	37(72.54)	38(74.50)		31(62.00)	45(90.00)		
No	14(27.46)	13(25.50)		19(38.00)	5(10.00)		
Nurse			0.456			<0.001	0.001
Yes	33(64.70)	34(66.66)		28(56.00)	40(80.00)		
No	18(35.30)	17(33.34)		22(44.00)	10(20.0)		

(continue)

Variables (N=101)	Control group (n=51) n(%)			Intervention group (n=50) (n%)			p-value [†]
	Before	After	p-value*	Before	After	p-value*	
Did the patient present complications?							
Physician			0.498			0.021	0.001
Yes	32(62.74)	31(60.78)		27(54.00)	45(90.00)		
No	19(37.26)	20(39.22)		23(46.00)	5(10.00)		
Does he/she demonstrate performing care measures with the central venous catheter?							
Nursing Technician			0.313			0.002	0.001
Yes	29(56.86)	28(54.90)		30(60.0)	45(90.00)		
No	22(43.14)	23(45.10)		20(40.00)	5(10.00)		
Nurse			0.321			0.001	0.012
Yes	28(54.90)	30(58.82)		33(66.00)	38(76.00)		
No	23(45.10)	21(41.18)		17(34.00)	12(24.00)		
Physician			0.345			0.001	0.001
Yes	30(58.82)	29(56.86)		29(58.00)	41(82.00)		
No	21(41.18)	22(43.14)		21(42.00)	9(18.00)		

Notes: *McNemar test for intragroup comparison. [†]Pearson's Chi-Square or Fisher's Exact Test for comparison of the control group and post-intervention intervention.

DISCUSSION

The results obtained from the sample of this study showed that 92.07% of the patients presented risk factors, which could influence both the complications between the hemodialysis sessions and those associated with the care and healing process of the AVF and CVC (Table 1). Previous studies corroborated the results of this research by identifying the comorbidities systemic arterial hypertension and diabetes mellitus as the main risk factors for the evolution of the clinical status of patients with end-stage CKD on hemodialysis and for the difficulty in vascular access healing⁽¹⁴⁻¹⁵⁾. These risk factors can lead to an increase in the number of hospitalizations, as observed in this study (Table 1). Another study also corroborated these findings by identifying a 62.50% rate of hospitalizations in a period of nearly nine months after initiating the hemodialysis treatment⁽¹⁶⁾.

The quality of hemodialysis is evaluated by Urea Kinetics (Kt/V), which identifies efficiency of the hemodialysis sessions and adequacy of the medical prescription⁽¹⁵⁻¹⁶⁾. The Kt/V value depends on the urea clearance of the dialyzer (K), the treatment time (t) and the patient's urea distribution volume (V). The appropriate Kt/V value is above 1.2⁽¹⁵⁻¹⁶⁾. In this study, it was verified that 60% of the patients after the intervention improved the quality of hemodialysis (Table 2), contributing to an improvement in the survival of patients with end-stage CKD⁽¹⁶⁾. This result may have generated an evaluation indicator, as the patients' knowledge and active participation in the care and treatment of their disease interfered with

the quality of hemodialysis⁽¹⁶⁾. Important concepts about the hemodialysis process, CVC, AVF and number of associated care measures also increased significantly ($p < 0.05$) after the intervention (Table 2). One study showed that, after three months of educational training with dialysis patients, knowledge about hemodialysis, concepts and care with AVF and CVC increased on average from 56.5% to 100% ($p = 0.000$)⁽¹²⁾. It therefore indicated the need for continuing education and development of a standard protocol for vascular access care.

Regarding the occurrence of complications during hemodialysis, the majority decreased significantly ($p < 0.05$), especially the presence of hypotension followed by cramps and tremors-chill-fever (Table 3). One study also identified occurrence of hypotension and cramps as the most prevalent complications in patients with CKD on hemodialysis⁽¹⁶⁾. In addition to home self-care, with the adoption of measures such as water and food control, to avoid complications the during hemodialysis sessions due to, above all, excessive withdrawal of liquid and minerals in a short period of time, it is necessary that the team checks weight, blood pressure, temperature, heart and lung sounds, peripheral edema, skin appearance and vascular access condition prior to the dialysis sessions⁽¹⁶⁻¹⁷⁾. During the sessions, the team must be aware of the presence of nausea and vomiting, tremors-chills-fever that can quickly change the patient's clinical status⁽¹⁶⁻¹⁷⁾. The existence of tremors-chills-fever is usually associated with the presence of infection, especially in patients with end-stage CKD, considered immunocompromised,

having an invasive vascular access, and frequently hospitalized due to complications and exposed to pathogenic microorganisms in the health institution⁽¹⁸⁾. At the end of the sessions, it is recommended to verify the presence of bleeding from the vascular access and any change in the patient's weight. When the cause of each of the complications specified in Table 3 was asked, all patients significantly increased their knowledge about them ($p < 0.05$).

When scored separately as hypotension and tremors-chill-fever, the complications decreased significantly ($p < 0.05$) when observed by the physicians, nurses and nursing technicians after the intervention (Table 4). With regard to excessive weight gain between the sessions, there was also a significant reduction ($p < 0.05$) for each of the professionals who observed, associated with an increase in the control of water and food intake. The patients recruited for this study showed a significant increase ($p < 0.05$) in AVF and CVC care. Although the number of care measures indicated by them increased after the intervention, none of the patients indicated 100% of all the care options presented in the questionnaire and observation script. It is recommended for educational actions to be constant and active within the reality of hemodialysis, as inadequate AVF management can cause complications such as thrombosis, edema, aneurysms, hematomas, infections and anastomotic disruption^(10,18). In this study, the following answers about AVF care after the intervention were common in all patients: "he/she knows that it is not possible to puncture the access or collect exams from the AVF limb" and "he/she knows that blood pressure should not be measured in the AVF limb". The other answers varied among the patients; answers that, before the intervention, were indicated by only 16% of the patients.

A study that assessed the patients' knowledge about AVF corroborated these answers by identifying that, among 335 of the evaluated patients, 96% answered that the main care measures with AVF were not measuring the pressure in the arm with the AVF and not drawing blood from the arm containing the AVF⁽¹³⁾. Although care measures associated with infection were not common answers in the patients, the explanation for the cause of tremors-chills-fever increased significantly ($p < 0.05$) when associated with infection in the AVF or CVC (Table 3). Important awareness raising in the patients, as cellulitis or bacteremia can occur in AVF, and

knowledge of the causes of these complications, can reflect on care and attention to the AVF site⁽¹³⁾.

Issues related to home AVF self-care, such as observation of phlogistic signs at the access site, carrying out small efforts and checking the thrill, were reported to a lesser extent in this study (20%), which corroborates with a prospective study in which it was verified that, among 101 patients, nearly 25% conducted all the self-care behaviors with AVF⁽¹⁸⁾. Other care measures that increased significantly ($p < 0.05$) were those associated with the CVC, which may have influenced the increase in knowledge about its concept (Tables 1 and 4). Long-term hemodialysis CVC can lead to bloodstream infection causing hemodynamic instability and metastatic infection⁽¹⁹⁾. Thus, active surveillance of complications during the sessions contributes to early treatment and reduction of hospitalizations and morbidity in patients with end-stage CKD, especially because short-term CVCs can also lead to bloodstream infection. For patients with CKD, there is a daily risk of colonization and future infections in the catheter insertion region, especially in the first seven days after CVC placement⁽¹⁹⁾. Signs of fever, dressings removed at home, induration, inflammation, presence of serous and purulent exudates, or hyperemia along the skin containing the CVC tunnel should be reported by the patients and observed by the Nursing team.

This study presented some limitations, such as its design, which did not allow inferring causality or an analysis of risk associated with morbidity and mortality, which could contribute to a more detailed study of the impact of the intervention on the patients' knowledge and on the prevention of adverse events between the hemodialysis sessions. Prospective and experimental studies are suggested for better analysis. In addition to that, the sample was limited to allow for a measurement of dialysis modalities (length of the dialysis sessions, dialyzers and vascular access) on the influence of complications during the hemodialysis sessions.

This study contributed to highlighting the importance of the Nursing team in the process of active surveillance of self-care and the knowledge of patients with end-stage CKD about their own disease, not only for monitoring adverse events in the hemodialysis sector, but also for providing effective and strategic actions of educational intervention that effectively implement public health control in the institution. In addition to that,

to the present day, the influence of active and monitored patient education has not been elucidated in the literature so that they could understand the concept of their disease, risk factors and complications associated with the hemodialysis process, and intervene in their care in order to understand possible serious adverse events that can affect them, such as infections, poor hemodialysis quality, pressure drop, cramps and even thromboembolic events resulting from the vascular accesses.

CONCLUSION

The educational action carried out with the intervention group was effective when compared before and after the conversation circle and generated positive evaluation indicators, allowing the research participants to become protagonists in self-care and critical in the guidelines during the treatment involving hemodialysis. In addition to that, when comparing the control group with the intervention group, it was verified that, after 90 days, there was an evolution in the knowledge of the group that received the intervention, when compared to the control group. The answers to the questionnaire obtained at the beginning of the study, when compared to those 90 days later, were similar for the control group, in addition to maintaining the same attitude on complications, food and water intake and care with the vascular accesses.

Therefore, the results of this study answered the research question, as knowledge about the risk factors such as comorbidities, interdialytic excess weight, lack of care with the vascular access and associated complications such as hypotension, tremors, chills and fever, contributed to the reduction in the incidence of these events in the hemodialysis sector.

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