Research Paper

Analysis of the nursing diagnosis of excess fluid volume in individuals undergoing hemodialysis: A cross-sectional study

DOI: http://doi.org/10.15446/av.enferm.v43n1.11

1 José Erivelton de Souza Maciel Ferreira
2 Tahissa Frota Cavalcante
3 Larissa Katlyn Alves Andrade
4 Caroline Evaristo Lourenço
5 Josemberg Pereira Amaro
6 Rafaella Pessoa Moreira

Abstract

Introduction: Monitoring renal patients for fluid overload is essential to prevent complications, ensure appropriate treatment, and maintain overall health.

Objective: To analyze the prevalence and associations of the defining characteristics of the nursing diagnosis *excess fluid volume* in individuals with chronic kidney disease undergoing hemodialysis.

Materials and method: A cross-sectional study was conducted with 92 patients at a dialysis clinic in a city in northeastern Brazil. Patients were assessed through interviews and physical examinations.

Results: The most prevalent defining characteristics were azotemia (100%), altered blood pressure (96.74%), intake exceeding output (91.31%), edema (85.87%), decreased hemoglobin (66.30%), weight gain over a short period of time (54.35%), and oliguria (40.22%).

Conclusion: Early identification of azotemia, altered blood pressure, intake exceeding output, edema, decreased hemoglobin, rapid weight gain, and oliguria supports the diagnosis and proper management of excess fluid volume, and contributes to the effectiveness of the hemodialysis regimen.

Descriptors: Nursing; Nursing Diagnosis; Nursing Process; Renal Dialysis; Chronic Renal Insufficiencies (font: DeCS, BIREME).

1 Universidade da Integração Internacional da Lusofonia Afro-Brasileira (Redenção, Brazil).
ORCID: https://orcid.org/0000-0003-2668-7587
Email: eriveltonsmf@gmail.com
Contribution: study design, literature review, data analysis, initial drafting of the manuscript, and final critical revision.

2 Universidade da Integração Internacional da Lusofonia Afro-Brasileira (Redenção, Brazil).
ORCID: https://orcid.org/0000-0002-7758-4273
Email: tahissa@unilab.edu.br
Contribution: supervision of study development, guidance of data analysis, interpretation stages, critical review, and final approval of the manuscript.

3 Universidade da Integração Internacional da Lusofonia Afro-Brasileira (Redenção, Brazil).
ORCID: https://orcid.org/0000-0002-9804-5252
Email: larissakatlyn4567@gmail.com
Contribution: data collection and organization, literature review, textual revision, and preparation of bibliographic references.

4 Universidade da Integração Internacional da Lusofonia Afro-Brasileira (Redenção, Brazil).
ORCID: https://orcid.org/0000-0002-1351-0320
Email: carolineevaristol@gmail.com
Contribution: data collection, discussion of results, and formatting of the manuscript based on the journal's guidelines.

5 Universidade da Integração Internacional da Lusofonia Afro-Brasileira (Redenção, Brazil).
ORCID: https://orcid.org/0000-0003-0945-6066
Email: josemberg.amaro@aluno.unilab.edu.br
Contribution: data collection, database construction and tabulation, review of preliminary version of the text, and suggestion of adjustments to article structure.

6 Universidade da Integração Internacional da Lusofonia Afro-Brasileira (Redenção, Brazil).
ORCID: https://orcid.org/0000-0003-2341-7936
Email: rafaellapessoa@unilab.edu.br
Contribution: coordination of the research team, supervision of all stages of the study, in-depth critical review, and methodological refinement of the manuscript.

Citation: Ferreira JESM; Cavalcante TF; Andrade LKA; Lourenço CE; Amaro JP; Moreira RP. Analysis of nursing diagnosis excessive fluid volume in people on hemodialysis: A cross-sectional study. Av. enferm. 2025;43(1):117299. https://doi.org/10.15446/av.enferm.v42n3.117299

Recibido: 30/10/2024
Aceptado: 22/03/2025

ISSN (impreso): 0121-4500
ISSN (en línea): 2346-0261

Análisis del diagnóstico de enfermería de volumen excesivo de líquidos en personas en hemodiálisis: estudio transversal

Resumen

Introducción: monitorizar a los pacientes con enfermedad renal para detectar el exceso de líquidos es esencial para prevenir complicaciones, asegurar un tratamiento adecuado y promover el mantenimiento del estado de salud general.

Objetivo: analizar la prevalencia y las asociaciones de las características definitorias del diagnóstico de enfermería "volumen de líquidos excesivo" en personas con enfermedad renal crónica en tratamiento de hemodiálisis.

Materiales y método: estudio transversal realizado con 92 pacientes atendidos en una clínica de hemodiálisis en una ciudad del noreste de Brasil. La recolección de datos se llevó a cabo mediante entrevista clínica y examen físico.

Resultados: las características definitorias más prevalentes fueron azotemia (100 %), alteración de la presión arterial (96,74 %), ingesta que excede la eliminación (91,31 %), edema (85,87 %), disminución de la hemoglobina (66,3 %), aumento de peso en un corto período (54,35 %) y oliguria (40,22 %).

Conclusión: la identificación temprana de signos como azotemia, alteración de la presión arterial, ingesta superior a la eliminación, edema, disminución de hemoglobina, aumento acelerado de peso y oliguria permite el diagnóstico y manejo oportuno del volumen de líquidos excesivo, lo cual contribuye a optimizar la efectividad del régimen de hemodiálisis y a mejorar los resultados clínicos del paciente.

Descriptores: Enfermería; Diagnóstico de Enfermería; Proceso de Enfermería; Diálisis Renal; Insuficiencia Renal Crónica (fuente: DeCS, BIREME)

Análise do diagnóstico de enfermagem "volume de líquido excessivo" em pessoas em hemodiálise: estudo transversal

Resumo

Introdução: monitorar pacientes com doença renal quanto à sobrecarga de líquidos é essencial para prevenir complicações, garantir um tratamento adequado e manter a saúde geral.

Objetivo: analisar a prevalência e as associações das características definidoras do diagnóstico de enfermagem "volume de líquidos excessivo" em pessoas com doença renal crônica em hemodiálise.

Materiais e método: estudo transversal foi realizado com 92 pacientes em uma clínica de diálise em uma cidade do Nordeste do Brasil. Os pacientes foram avaliados por meio de entrevistas e exames físicos.

Resultados: as características definidoras mais prevalentes foram azotemia (100%), alteração na pressão arterial (96,74%), ingestão superior à eliminação (91,31%), edema (85,87%), diminuição da hemoglobina (66,30%), ganho de peso em curto período (54,35%) e oligúria (40,22%).

Conclusão: a identificação precoce de azotemia, alteração na pressão arterial, ingestão que excede a eliminação, edema, diminuição da hemoglobina, ganho rápido de peso e oligúria favorece a identificação e o manejo adequado do volume de líquido excessivo, além de aprimorar a eficácia do regime de hemodiálise.

Descritores: Enfermagem; Diagnóstico de Enfermagem; Processo de Enfermagem; Diálise Renal; Insuficiência Renal Crônica (fonte: DeCS, BIREME).

Introduction

Chronic kidney disease (CKD) is a globally prevalent condition and represents a significant public health challenge (1). Modifiable factors associated with this condition include obesity and smoking, while non-modifiable factors encompass diabetes mellitus (DM) and arterial hypertension (AH). The seriousness of CKD is underscored by its high morbidity and mortality rates, which significantly impact healthcare systems and the quality of life of affected individuals (2, 3).

It is estimated that approximately 850 million people worldwide are affected by CKD, according to the International Society of Nephrology (4). In Brazil, more than 10 million individuals are estimated to have CKD, with an annual increase of approximately 40,000 new cases (5). In the Northeastern region, around 530,000 people are believed to be affected, with the state of Ceará recording a total of 579 cases (6).

According to the Brazilian Dialysis Census, more than 90% of CKD patients receive dialysis treatment (6). Among the available modalities, hemodialysis is the most commonly used in Brazil. This therapy replaces hemofiltration functions and facilitates the excretion of harmful substances that must be eliminated from the body (3).

Patients with CKD encounter numerous challenges that lead to significant lifestyle changes, particularly in relation to dietary restrictions and fluid intake, especially water restriction (7-9). Studies indicate that, regardless of disease duration, patients experience difficulties in maintaining appropriate fluid control (7).

In this context, nurses play a crucial role in managing fluid overload, through continuous monitoring, patient education, and guidance to promote adequate fluid balance. Studies have demonstrated that excess fluid volume (EFV) is associated with many complications in CKD patients undergoing hemodialysis and may lead to serious outcomes such as cardiovascular disease, hypotension, muscle cramps, pulmonary congestion, acute pulmonary edema, and anemia, further worsening the patient's clinical condition (10-12).

To address the complexity of treatment and prevent complications, it is essential that healthcare professionals develop individualized care plans that consider the specific needs and limitations of each patient, thereby ensuring humanized care (13). In this regard, the Nursing Process (NP) is a systematic and humanistic tool employed by nurses in clinical practice. For the purposes of classification and standardization, NANDA International (NANDA-I) provides nursing diagnoses that

recognize alterations in fluid volume as human responses requiring targeted nursing interventions. One such diagnosis is EFV (code: 00026), defined as a "surplus intake and/or retention of fluid" (14).

The nursing diagnosis of EFV includes the following defining characteristics: restlessness; anxiety; azotemia; pulmonary congestion; pleural effusion; jugular vein distention; edema; altered mental status; weight gain over a short period of time; altered urine specific gravity; hepatomegaly; intake exceeding output; decreased hemoglobin; decreased hematocrit; oliguria; altered respiratory pattern; presence of S3 heart sound; altered blood pressure; altered pulmonary artery pressure; increased central venous pressure; positive hepatojugular reflex; and adventitious breath sounds (14).

This evaluation is necessary because no studies have been identified that specifically assess the EFV nursing diagnosis in patients with chronic kidney disease undergoing hemodialysis. Furthermore, this research has the potential to improve the quality of life and health outcomes of individuals living with CKD and receiving hemodialysis, as well as enhance the quality of nursing care. Additionally, the findings may provide insights into nephrology nursing practices in both public and private healthcare settings in Portuguese-speaking countries and other regions globally. It is expected that this study will contribute to reducing the financial burden on health services—particularly dialysis clinics—by decreasing the incidence of complications related to the EFV nursing diagnosis in this patient population.

This study, therefore, seeks to answer the following questions: What is the prevalence of the EFV nursing diagnosis in individuals with CKD undergoing hemodialysis therapy? Which defining characteristics are most commonly observed in the study population? Is there a statistical association between sociodemographic and clinical data and the EFV diagnosis and its defining characteristics?

Given these considerations, the objective of this study was to examine the prevalence of the defining characteristics associated with the nursing diagnosis EFV in individuals with chronic kidney disease undergoing hemodialysis.

Materials and method

This cross-sectional observational study was conducted at a dialysis center located in a city in northeastern Brazil. The city is recognized as a regional reference center for the treatment of patients with CKD.

Data collection occurred over a nine-month period, from August 2022 to May 2023, until the entire selected sample had been evaluated. During this period, data were collected from patients who regularly attended the clinic for hemodialysis. The clinic serves an average of 140 patients, of whom 92 (65.7%) agreed to participate, thus representing a significant proportion of the clinic's population. As this was a single-center study with a finite population, sample size calculation was not required.

The study population included individuals diagnosed with CKD who were undergoing hemodialysis and being followed at the dialysis clinic in Baturité, Brazil. Inclusion criteria were defined to ensure that participants appropriately represented the target population: having a medical diagnosis of CKD, undergoing hemodialysis treatment for at least 8 months, being registered and monitored at the Baturité dialysis clinic, being 18 years of age or older, and having a nursing diagnosis of EFV as determined by a team of nurses and senior nursing students trained in the use of a previously validated instrument (15). This instrument includes social and general health data, as well as specific items related to the nursing diagnosis under investigation. When applicable, subscales were used to assess individual characteristics (e.g., anxiety and depression via the Hospital Anxiety and

Depression Scale – HADS). Following the assessment, each case was discussed between the research nurse and a nephrology specialist to confirm the presence of the EFV diagnosis.

Exclusion criteria were applied to ensure participant safety and the integrity of the data, excluding individuals with conditions that compromised their ability to understand or cooperate with the research, such as permanent or temporary cognitive impairments, and those who were hemodynamically unstable. These conditions were assessed using the instrument developed by Folstein *et al.* (16).

To optimize time and participant convenience, data collection was divided into three stages. First, physical examinations were conducted prior to the hemodialysis session to capture relevant physical data, as the procedure itself could result in hemodynamic, metabolic, volume-related, neurological, and laboratory changes that might introduce bias. During the hemodialysis session, additional clinical and socioeconomic information was collected, making use of the treatment period. Some data were also gathered post-session to monitor the progression of certain parameters measured by the instruments. This approach enabled a comprehensive and holistic assessment of the participants' health status.

To ensure consistency in data collection, two instruments were employed: one for controlling and monitoring participant selection and sociodemographic characterization, and another for identifying the EFV nursing diagnosis. These instruments allowed for an in-depth assessment of the participants' social, economic, and demographic conditions, as well as the following defining characteristics of the diagnosis under investigation: restlessness, altered blood pressure, presence of S3 heart sound, altered respiratory pattern, adventitious breath sounds, pulmonary congestion, pleural effusion, jugular vein distention, positive hepatojugular reflex, hepatomegaly, edema, weight gain over a short period of time, intake exceeding output, oliguria, anxiety, altered mental status, azotemia, altered urine specific gravity, decreased hemoglobin, and decreased hematocrit.

Laboratory test results were obtained from the examination database maintained by the dialysis clinic. All data were processed in accordance with ethical guidelines for handling secondary data, with authorization from both the healthcare facility and the study participants.

Once collected, the data were organized using Microsoft Office Excel and subjected to descriptive statistical analysis to identify patterns and trends within the dataset. The descriptive analysis included calculations of absolute frequencies, percentages, measures of central tendency, and measures of dispersion. In addition, non-parametric inferential statistical analyses were conducted due to the non-normal distribution of the data and the small sample size. The Mann-Whitney, Spearman, and Kruskal-Wallis tests were applied.

All ethical and legal principles governing research involving human participants were strictly observed. The confidentiality of participant identities was maintained throughout all stages of the study, and participation was entirely voluntary. The study received approval from the Research Ethics Committee of the Universidade da Integração Internacional da Lusofonia Afro-Brasileira, ensuring compliance with all applicable ethical standards (Protocol number: 56761422.6.0000.5576).

Results

The prevalence of EFV was 65.7%. In other words, of the 140 patients initially assessed, 92 were diagnosed with this condition. All subsequent analyses were conducted based solely on these 92 patients.

As shown in Table 1, the majority of participants were adults (56.52%), male (56.52%), self-identified as brown (68.48%), had not completed primary education (43.48%), were married (50%), lived with family members (72.82%), retired (80.43%), and reported a monthly income equivalent to one minimum wage (68.48%).

Table 1. Distribution of sociodemographic variables among participants diagnosed with EFV, 2024

Variable		N (%)
Age (age group)	Adult	52 (56.52%)
	Elderly	40 (43.48%)
Sex	Male	52 (56.52%)
	Female	40 (43.48%)
Color/race	White	9 (9.78%)
	Black	17 (18.48%)
	Brown	63 (68.48%)
	Yellow	3 (3.26%)
Education	No formal education	17 (18.48%)
	Incomplete primary education	40 (43.48%)
	Complete primary education	9 (9.78%)
	Incomplete high school	5 (5.44%)
	Complete high school	15 (16.30%)
	Higher education	6 (6.52%)
Religious practice	Yes	84 (91.30%)
	No	8 (8.70%)
Marital status	Single	19 (20.65%)
	Married	46 (50.00%)
	Stable union	12 (13.04%)
	Widowed	8 (8.70%)
	Divorced	7 (7.61%)
Living arrangement	Lives alone	4 (4.35%)
	Lives with a companion	20 (21.74%)
	Lives with relatives	67 (72.82%)
	Other	1 (1.09%)
Work situation	Employed	7 (7.61%)
	Unemployed	11 (11.96%)
	Retired	74 (80.43%)
Monthly Income	< 1 minimum wage	3 (3.26%)
	1 minimum wage	63 (68.48%)
	> 1 minimum wage	26 (28.26%)

Source: authors.

The data presented in Table 2 indicate that the majority of participants underwent three hemodialysis sessions per week (90.23%), with each session lasting between two and four hours (54.35%). Most patients demonstrated adequate disease control (72.83%), sufficient knowledge about chronic kidney disease (53.26%), and good adherence to treatment (85.87%). After hemodialysis sessions, participants generally experienced a weight loss of between 1 and 4% (63.04%) or a weight gain of up to 3%. Additionally, the absence of depressive symptoms was observed in most participants (85.87%). Notably, the majority had never undergone a kidney transplant nor undergone compatibility testing (65.22%). These clinical findings provide a comprehensive overview of the health status and disease management among individuals with chronic kidney disease in the study population.

Table 2. Distribution of clinical variables among participants diagnosed with EFV, 2024

Variables		N (%)
Number of hemodialysis sessions per week	Two sessions	2 (2.17%)
	Three sessions	83 (90.23%)
	Four sessions	7 (7.60%)
Length of hemodialysis session	2-4 hours	50 (54.35%)
	4 hours or more	42 (45.65%)
Control of underlying diseases	Adequate	67 (72.83%)
	Slightly adequate	22 (23.91%)
	Inadequate	3 (3.26%)
Knowledge about chronic kidney disease	Adequate	49 (53.26%)
	Slightly adequate	31 (33.70%)
	Inadequate	12 (13.04%)
Adherence to treatment	Adequate	79 (85.87%)
	Slightly adequate	10 (10.87%)
	Inadequate	3 (3.26%)
Percentage of weight loss after hemodialysis session	8-14% loss or 6-7% gain	2 (2.17%)
	5-8% loss or 4-5% gain	27 (29.35%)
	Loss of 1-4% or gain of up to 3%	58 (63.04%)
	No change in weight	5 (5.44%)
Depression	Present	13 (14.13%)
	Absent	79 (85.87%)
Undergone kidney transplant	Yes	2 (2.17%)
	No, but has previously undergone a compatibility test	30 (32.61%)
	No, and has never undergone a compatibility test	60 (65.22%)

Source: authors.

The data presented in Table 3 were analyzed to identify the most prevalent defining characteristics of EFV. The most frequently observed characteristics were azotemia (100%), altered blood pressure (96.74%), intake exceeding output (91.31%), edema (85.87%), decreased hemoglobin (66.30%), weight gain over a short period of time (54.35%), restlessness (43.48%), and oliguria (40.22%).

Table 3. Prevalence of the defining characteristics of EFV in the sample, 2024

Variables		N (%)
Excess fluid volume	Present	92 (100%)
Azotemia	Present	92 (100%)
Alteration in blood pressure	Present	89 (96.74%)
	Absent	3 (3.26%)
Intake exceeds output	Present	84 (91.31%)
	Absent	8 (8.69%)
Edema	Present	79 (85.87%)
	Absent	13 (14.13%)
Decrease in hemoglobin	Present	61 (66.30%)
	Absent	31 (33.70%)
Weight gain in short period of time	Present	50 (54.35%)
	Absent	42 (45.65%)
Restlessness	Present	40 (43.48%)
	Absent	52 (56.52%)
Oliguria	Present	37 (40.22%)
	Absent	32 (34.78%)
	Anuric	23 (25.00%)
Alteration in breathing pattern	Present	19 (20.65%)
	Absent	73 (79.35%)
Anxiety	Present	16 (17.39%)
	Absent	76 (82.61%)
Pulmonary congestion	Present	14 (15.22%)
	Absent	78 (84.78%)
Jugular vein distension	Present	10 (10.87%)
	Absent	82 (89.13%)
Positive hepatojugular reflex	Present	10 (10.87%)
	Absent	82 (89.13%)
Adventitious breath sounds	Present	6 (6.52%)
	Absent	86 (93.48%)
Presence of S3 heart sound	Present	3 (3.26%)
	Absent	89 (96.74%)
Hepatomegaly	Present	2 (2.17%)
	Absent	90 (97.83%)

Variables		N (%)
Pleural effusion	Absent	92 (100%)
Alteration in mental status	Absent	92 (100%)

Source: authors.

The statistical analysis presented in Table 4 revealed no significant associations between the prevalence of the defining characteristics of EFV and the participants' sociodemographic or clinical data.

Table 4. Association between sociodemographic and clinical variables and the prevalence of defining characteristics of the nursing diagnosis of EFV, 2024

Sociodemographic and clinical characteristics Variables	Prevalence of defining characteristics of EFV Average/correlation	*p*-value
Sex		0.220[a]
Male	1.24±0.24	
Female	1.14±0.38	
Age		0.137[b]
Average	-0.261	
Marital status		0.559[c]
Single	1.35±0.24	
Married	1.29±0.36	
Widower	1.40±0.27	
Divorced	1.16±0.19	
Race		0.470[c]
White	1.18±0.28	
Black	1.29±0.34	
Mixed	1.34±0.31	
Education		0.651[c]
No formal education	1.32±0.29	
Incomplete primary education	1.29±0.37	
Complete primary education	1.39±0.18	
Complete high school	1.26±0.26	
Religion		0.463[c]
Present	1.30±0.32	
Absent	1.39±0.11	
Living arrangement		0.824[c]
Alone	1.32±0.37	
Only with a partner	1.40±0.46	
With family members	1.28±0.24	
Friends and/or acquaintances	1.10	

Sociodemographic and clinical characteristics Variables	Prevalence of defining characteristics of EFV Average/correlation	*p*-value
Work situation		0.872[c]
Employed	1.24±0.11	
Unemployed	1.25±0.34	
Retired	1.32±0.32	
Monthly income		0.658[b]
Average	-0.079	
No. of hemodialysis sessions		1.00[a]
Three sessions	1.31±0.31	
Four sessions	1.21	
Duration of sessions		0.545[a]
2 to 4 hours	1.25±0.21	
> 4 hours	1.36±0.38	
Disease control		0.862[c]
Adequate	1.34±0.37	
Slightly adequate	1.25±0.19	
Inadequate	1.16	
Knowledge about CKD		0.664[c]
Adequate	1.36±0.39	
Slightly adequate	1.24±0.23	
Inadequate	1.33±0.18	
Adherence to treatment		0.777[c]
Adequate	1.31±0.32	
Slightly adequate	1.21±0.20	
Inadequate	1.39±0.40	
Percentage of weight loss after hemodialysis		0.329[c]
8-14% loss or 6-7% gain	1.47	
5-8% loss or 4-5% gain	1.27±0.27	
Loss of 1-4% or gain of up to 3%	1.26±0.23	
No change in weight	2.42	
Depression		0.093[a]
Present	1.57±0.48	
Absent	1.25±0.24	
Transplant		0.306[c]
Yes	1.68	
No. but has been called for a compatibility test before	1.37±0.44	
No. and has never been asked to take the compatibility test	1.26±0.23	

Sociodemographic and clinical characteristics Variables	Prevalence of defining characteristics of EFV Average/correlation	*p*-value
Time on hemodialysis (months)		
Average	0.233	0.184[b]
Patient's initial weight		
Average	-0.246	0.161[b]
Height		
Average	-0.255	0.146[b]
BMI		
Average	-0.234	0.182[b]
Diabetes Mellitus		0.916[a]
Present	1.33±0.39	
Absent	1.29±0.25	
Systemic Arterial Hypertension		0.699[a]
Present	1.31±0.33	
Absent	1.31±0.24	
Heart Failure		0.930[a]
Present	1.33±0.36	
Absent	1.27±0.24	
Dyslipidemia		0.096[a]
Present	1.11±0.11	
Absent	1.33±0.32	
Prostatic hyperplasia		0.261[a]
Present	1.05	
Absent	1.31±0.31	
Respiratory problems		0.084[a]
Present	1.00±0.15	
Absent	1.33±0.31	
Gastroesophageal reflux or other types of reflux		0.474[a]
Present	1.47	
Absent	1.30±0.31	

Note: [a]Mann-Whitney test; [b]Spearman's correlation test; [c]Kruskal-Wallis test.
Source: authors.

However, the relationship between each clinical and sociodemographic variable and each defining characteristic of the nursing diagnosis was individually assessed. Given the large volume of data, only the statistically significant associations are summarized in Table 5.

Table 5. Associations between sociodemographic and clinical variables and the defining characteristics of the nursing diagnosis of excess fluid volume, 2024

Sociodemographic and clinical variables	Defining characteristics of EFV						
	Anxiety	**Decreased serum hemoglobin**	**Psychomotor agitation**	**Adventitious breath sounds**	**Edema**	**Presence of S3 heart sound**	**Altered blood pressure**
Sex (Male/female)	$p = 0.025^a$ / 0.040^b [OR = 0.280; IC95% = 0.132-0.926]	$p = 0.001^a$ / 0.002^b [OR = 1.69; IC95% = 1.19-2.41]	*	*	*	*	*
Age (years) (>60/<60)	*	*	$p = 0.002^a$ / 0.003^b [OR = 0.244; IC95% = 0.0991-0.603]	$p = 0.042^a$ / 0.082^b [OR = 7.29; IC95% = 0.816-65.1]	$p = 0.027^a$ / 0.035^b [OR = 5.10; IC95% = 1.06-24.5]	*	*
Education (Low/high level)	*	*	-	*	*	$p = 0.029^a$ / 0.087^b [OR = 9.87; IC95% = 0.840-116]	*
Religion (Present/absent)	*	*	$p = 0.009^a$ / 0.019^b [OR=0.0924; IC95% = 0.0109-0.786]	*	*	*	
Living arrangements (Alone/with others)	*	*	-	*	*	*	$p = 0.012^a$ / 0.126^b [OR = 0.0698; IC95% = 0.00487-1]

Sociodemographic and clinical variables	Defining characteristics of EFV						
	Anxiety	**Pulmonary congestion**	**Hepatomegaly**	**Weight gain over short period of**	**Oliguria**	**Psychomotor agitation**	**-**
Monthly income (<1/>1 minimum wage)	$p = 0.031^a$ / 0.034^b [OR = 7.35; IC95% = 0.919-58.9]	$p = 0.057^a$ / 0.103^b [OR = 6.13; IC95% = 0.759-49.5]	$p = 0.023^a$ / 0.078^b [OR=0.0737; IC95% = 0.00342-1.59][c]	$p = 0.055^a$ / 0.066^b [OR = 2.46; IC95% = 0.970-6.25]	$p = 0.032^a$ / 0.037^b [OR = 0.367; IC95% = 0.144-0.930]	-	*
Number of hemodialysis sessions (<4/>4 weekly sessions)	-	-	$p = 0.053^a$ / 0.187^b [OR = 0.0976; IC95% = 0.00556-1.71]	*	*	$p = 0.029^a$ / 0.038^b [OR = 0.189; IC95% = 0.0369-0.964]	*
Duration of sessions (<4/>4 hours)	$p = 0.002^a$ / 0.002^b [OR = 0.141; IC95% = 0.0374-0.543]	$p = 0.035^a$ / 0.044^b [OR = 0.278; IC95% = 0.0802-0.966]	*	$p = < .001^a$ / $< .001^b$ [OR = 0.176; IC95% = 0.0704-0.439]	*	*	*
Control of underlying diseases (Adequate/little or no adequacy)	*	*	*	*	$p = 0.016^a$ / 0.018^b [OR = 3.66; IC95% = 1.23-10.9]	*	*
Hemodialysis time	*	*	*	$p = 0.033^a$ / 0.046^b [OR = 2.67; IC95% = 1.07-6.66]	*	*	*

Sociodemographic and clinical variables	Defining characteristics of EFV						
	Pulmonary congestion	**Intake exceeds output**	**Anxiety**	**Presence of S3 heart sound**	**Weight gain over short period of**	**Hepatomegaly**	-
Gastroesophageal reflux disease (Present/absent)	$p = 0.006^a$ / 0.121^b [OR = 0.0395; IC95% = 0.00134-1.17]^c	$p = 0.001^a$ / 0.091^b [OR = 36.6; IC95% = 1.16-1154]^c	*	*	*	*	*
Dyslipidemia (Present/absent)	*	*	-	$p = 0.007^a$ / 0.125^b [OR = 0.0409; IC95% = 0.00138-1.21]^c	$p = 0.044^a$ / 0.079^b [OR = 9,00; IC95% = 0.801-101]	$p = 0.007^a$ / 0.125^b [OR = 0.0409; IC95% = 0.00138-1.21]	*
Depression (Present/absent)	*	*	$p = 0.031^a$ / 0.046^b [OR = 3.86; IC95% = 1.07-14.0]	*	*	*	*
	Jugular vein distension	**Positive hepatojugular reflex**	**Decreased serum hematocrit levels**	**Hepatomegaly**	-	-	-
Diabetes mellitus (Present/absent)	$p = 0.015^a$ / 0.029^b [OR = 0.206; IC95% = 0.0525-0.807]	$p = 0.015^a$ / 0.029^b [OR = 0.206; IC95% = 0.0525-0.807]	$p = 0.049^a$ / 0.070^b [OR = 0.349; IC95% = 0.119-1.02]	*	*	*	*
Hypertension (Present/absent)	*	*	*	$p = 0.036^a$ / 0.167^b [OR = 0.0843; IC95% = 0.00475-1.50]	*	*	*

Note: [a]Chi-square test of independence; [b]Fisher's exact test; [c]Haldane-Anscombe correction applied; *$p > 0.05$
Source: authors.

Regarding sex, a significant association was observed with decreased hemoglobin levels (p = 0.001/0.002), indicating that female individuals undergoing hemodialysis for CKD have a 69% higher likelihood of presenting this clinical characteristic compared to males. Additionally, an association was found between sex and anxiety (p = 0.025/0.040), suggesting that male sex may act as a protective factor, as women on hemodialysis have a 72% higher risk of developing this condition.

Younger individuals demonstrated a stronger association with restlessness (p = 0.002/0.003), whereas altered respiratory sounds (p = 0.042) and edema (p = 0.027/0.035) were more prevalent among older participants. Regarding educational level, a significant association was identified with the presence of the third heart sound (p = 0.029), suggesting that individuals with lower education levels may be at higher risk for this clinical manifestation. Furthermore, religion was associated with restlessness (p = 0.009/0.019), indicating a potential protective effect among certain religious groups.

Household composition was significantly associated with altered blood pressure (p = 0.012) among individuals with CKD on hemodialysis. Given that the odds ratio (OR) was less than 1, living alone may be associated with a lower risk, while living with others may be linked to greater blood pressure variability. Income was significantly associated with anxiety (p = 0.031/0.034), as well as other clinical manifestations such as pulmonary congestion, hepatomegaly, weight gain, and oliguria, although some of these associations showed borderline statistical significance.

Among treatment-related parameters, the duration of hemodialysis sessions was a determining factor for several clinical characteristics. Rapid weight gain (p < 0.001/ < 0.001) and psychomotor agitation (p = 0.029/0.038) were more common in patients undergoing shorter dialysis sessions. The odds ratios for these associations indicate that longer session durations are associated with a reduced risk of weight gain and psychomotor agitation, with ORs of 0.176 and 0.189, respectively, thus suggesting a protective effect.

Patients with CKD undergoing hemodialysis who received the EFV nursing diagnosis also showed significant associations with comorbidities and clinical characteristics. Gastroesophageal reflux disease was associated with a lower risk of pulmonary congestion (p = 0.006/0.121), while dyslipidemia was associated with a higher risk of short-term weight gain (p = 0.007/0.125) and a lower likelihood of exhibiting a third heart sound, based on the chi-square test of independence (p = 0.044).

Additionally, depression was associated with a higher likelihood of anxiety (p = 0.031/0.046), with individuals experiencing both conditions being 3.86 times more likely to present with anxiety than those without depression. DM was associated with a reduced risk of jugular vein distention and a positive hepatojugular reflux (p = 0.015/0.029), suggesting a lower likelihood of these clinical signs in individuals with DM. In contrast, hypertension was associated with decreased hematocrit (p = 0.036), indicating a reduced risk, although the wide confidence interval warrants cautious interpretation.

All clinical and sociodemographic variables were cross-referenced with the clinical indicators of the nursing diagnosis under study. However, no additional significant associations were identified beyond those reported.

Discussion

Sociodemographic and clinical factors associated with the nursing diagnosis of EFV

This study highlights significant associations between sociodemographic and clinical factors in patients with CKD undergoing hemodialysis and the defining characteristics of the nursing diagnosis of EFV. Male sex, low educational attainment, and comorbidities such as depression and dyslipidemia emerged as key factors in CKD progression and fluid volume control. Although males constituted the majority of the sample—consistent with findings from other studies (17)—female participants undergoing hemodialysis exhibited a higher risk of anxiety and low hemoglobin levels. Anemia may be associated with diminished iron stores and reduced erythropoietin production (18), while anxiety may reflect a greater emotional burden, decreased perceived social support, and heightened psychological vulnerability (19). Male sex, conversely, may serve as a protective factor due to distinct coping strategies (20), emphasizing the importance of individualized approaches in the clinical and psychological management of these patients.

Ethnic, genetic, and socioeconomic factors also significantly influenced the risk and progression of CKD among participants. Individuals who self-identified as brown or black have been shown to exhibit a higher predisposition to renal failure, as demonstrated by Santos *et al.* (21) and Sousa *et al.* (22). Income influences both mental health and the clinical management of disease. Patients with lower socioeconomic status may experience financial hardship related to treatment, limited access to healthcare services, and reduced social support. These factors can exacerbate anxiety, supporting the observed positive association between income and psychological and clinical indicators (23). The associations between income and clinical manifestations such as pulmonary congestion, hepatomegaly, weight gain, and oliguria further suggest that economic barriers negatively impact adherence to fluid control, worsening volume overload and its complications. These findings underscore the need for multidisciplinary strategies to reduce disparities in CKD treatment access and care.

Age also played a significant role in symptom manifestation among individuals with CKD undergoing hemodialysis. Younger patients diagnosed with EFV were more likely to experience restlessness, possibly due to the psychological stress of adapting to a chronic illness and challenges related to self-management. This agitation may also stem from electrolyte imbalances (24) or pulmonary congestion (18). In contrast, older patients showed a higher prevalence of altered respiratory sounds and edema, likely related to the aging process and associated comorbidities that impair hemodynamic and metabolic compensatory mechanisms.

From a sociodemographic perspective, the observed association between religion and restlessness suggests that spiritual engagement may offer protective benefits, mitigating the emotional and psychological burden of disease and fluid volume overload in patients on hemodialysis. Religious involvement often provides a network of social, emotional, and spiritual support, in addition to fostering health-promoting behaviors and mental well-being. Such support can be essential in helping patients manage the stress and challenges associated with hemodialysis, thereby reducing restlessness—one of the defining characteristics of the nursing diagnosis under study (25).

It is also important to highlight that many participants demonstrated adequate knowledge of their health condition, likely due to prolonged exposure to CKD and hemodialysis. This finding emphasizes the value of continuous patient education, particularly during the early stages of the disease, to

promote improved long-term management and quality of life (23). Moreover, this study reinforces existing literature on the importance of fluid intake control during hemodialysis, as excessive fluid retention or failure to achieve dry weight can increase mortality risk (27).

The emotional and psychological challenges faced by patients with CKD, particularly depression, were also evident. Depression is a common comorbidity in individuals undergoing hemodialysis, and addressing this issue through a comprehensive approach to care is essential to improving patient well-being and ensuring timely interventions, such as kidney transplantation (28, 29). In the present study, depression was statistically associated with a greater likelihood of anxiety, with the odds of anxiety being 3.86 times higher in patients with depression compared to those without. Depression may heighten stress perception and make individuals more susceptible to symptoms of anxiety (30, 31).

Clinical aspects and impact on fluid volume management in hemodialysis patients

Regarding the clinical variables of this population, this study identified hypertension as one of the most prevalent comorbidities among patients with CKD, which is reflected in the high prevalence of the defining characteristic of altered blood pressure. Hypertension is both a cause and a consequence of CKD and is consistently associated with disease progression (32). This interrelationship underscores the importance of effective blood pressure control as a central component of CKD management.

Notably, hypertension was also associated with hepatomegaly—a defining characteristic of the EFV nursing diagnosis—suggesting that proper fluid control not only stabilizes blood pressure but also prevents complications related to volume overload and cardiovascular dysfunction. Household composition also demonstrated a strong association with altered blood pressure among patients with EFV undergoing hemodialysis. The relationship between living arrangements and blood pressure suggests that individuals living alone may have a lower risk of blood pressure variability, whereas those living with others may experience greater fluctuations. However, existing literature emphasizes that social support from family members can promote better control of blood pressure and other clinical indicators by providing emotional support that facilitates disease coping and treatment adherence (33). Therefore, family dynamics should be evaluated in a broader context, considering the emotional and social dimensions that influence cardiovascular health and CKD management.

Short-term weight gain and fluid intake exceeding output were also significantly prevalent among participants, highlighting fluid retention as a key clinical concern. This finding is consistent with prior studies, which identify fluid retention as a common challenge in hemodialysis patients (34). When not properly managed, fluid retention can lead to complications such as edema, pulmonary congestion, hypertension, and heart failure—exacerbating CKD symptoms and hindering effective clinical management (29). The production of less than 400 mL of urine per day, or oliguria, was another frequently observed defining characteristic. This condition, especially prevalent in the later stages of CKD, indicates the kidneys' diminished ability to regulate fluid and metabolic balance, resulting in fluid and toxin accumulation in the body (29). Oliguria is a critical indicator of disease severity and should be closely monitored to adjust therapeutic interventions and minimize related complications.

Weight gain in hemodialysis patients was significantly associated with the duration of dialysis sessions. Patients undergoing longer sessions had a lower risk of short-term weight gain. Odds ratio analysis revealed that extended dialysis sessions were associated with a reduced probability of weight gain, suggesting a protective effect through more effective fluid removal and metabolic

regulation. Moreover, weight gain was also associated with dyslipidemia, indicating that patients with lipid metabolism disorders may be at greater risk, possibly due to altered metabolic pathways that interfere with fluid balance. These findings reinforce the importance of tailored therapeutic strategies, including adjustments to dialysis session duration and careful management of metabolic comorbidities like dyslipidemia, to ensure proper fluid control and minimize complications from fluid overload.

The association between DM and clinical signs of fluid overload—such as jugular vein distension and a positive hepatojugular reflux—presents divergent interpretations in the literature. In this study, DM was associated with a reduced risk of these signs, suggesting a lower likelihood of their occurrence in diabetic patients. However, DM is also known to increase the prevalence of complications related to fluid overload (35), such as jugular distension, due to its role in CKD progression and cardiovascular compromise. Other researchers (36) propose that diabetic patients may exhibit different physiological responses, with greater compensatory capacity—particularly under good glycemic control—potentially explaining a lower prevalence of these signs. Therefore, the literature reflects a nuanced understanding, with the relationship between DM and fluid overload varying according to factors such as glycemic control, disease duration, and coexisting comorbidities.

Implications for nursing practice and review of the nursing diagnosis of EFV

Awareness of these findings is essential for nurses to facilitate the early identification of EFV and to develop effective care plans for individuals with CKD undergoing hemodialysis. A study by Fernandes *et al.* (20), which investigated the prevalence of EFV in a sample of 100 patients, also identified a high occurrence of this nursing diagnosis—corroborating the results of the present study. The data reinforce the strong correlation between CKD and EFV, as demonstrated by the associations between sociodemographic and clinical factors and the defining characteristics of this diagnosis. This relationship underscores the need for clinical interventions aimed at optimizing fluid volume management in hemodialysis patients, with the objective of achieving improved clinical outcomes and enhanced quality of life.

In this context, health education and a multidisciplinary approach are essential strategies for effective management. The integration of nephrologists, nurses, nutritionists, and other healthcare professionals facilitates comprehensive and individualized support, ensuring high-quality care that is tailored to the specific needs of this population.

A conceptual revision of the EFV nursing diagnosis remains necessary, particularly in light of recent updates to the NANDA-I taxonomy (2024-2026) (14). The inclusion of "chronic kidney disease" and "hemodialysis" as associated conditions, and the identification of "dialyzed individuals who do not achieve adequate fluid removal" as a risk population, represent important progress in acknowledging the vulnerability of this group. However, patients with CKD undergoing dialysis should be broadly recognized as a risk population for the EFV diagnosis, regardless of the effectiveness of fluid removal during therapy.

Individuals on hemodialysis frequently encounter challenges in fluid balance management due to factors such as limited adherence to fluid restrictions, variations in ultrafiltration efficiency, and differing physiological responses to treatment. Furthermore, CKD intrinsically impairs the regulation of extracellular fluid volume, rendering these individuals inherently susceptible to fluid accumulation. Studies indicate that even patients with seemingly adequate fluid control may

still experience intermittent episodes of fluid overload (35, 36), emphasizing the need for a more inclusive criterion to define risk populations within nursing diagnoses.

Therefore, the redefinition of the EFV concept should consider all individuals undergoing dialysis as being at potential risk for this condition, as dialysis alone does not ensure complete and continuous fluid removal. Adopting this broader perspective would enable earlier and more targeted nursing interventions, ultimately contributing to improved clinical outcomes and a better quality of life for this vulnerable population.

Study limitations

The present study is limited by the absence of specific urine output assessments and the inability to measure pulmonary arterial pressure and central venous pressure outside the hospital setting. These limitations underscore the need to incorporate supplementary diagnostic resources and advanced monitoring technologies to improve the precision and effectiveness of care for patients with CKD undergoing hemodialysis. The adoption of innovative technologies and the establishment of continuous monitoring protocols could facilitate more accurate fluid volume control and help prevent complications associated with CKD.

Conclusions

This study identified that the most prevalent defining characteristics of the nursing diagnosis EFV among patients with CKD undergoing hemodialysis were azotemia, altered blood pressure, edema, rapid weight gain, oliguria, and decreased hemoglobin levels. Significant associations were observed between sociodemographic and clinical variables. Notably, women had a higher risk of low hemoglobin and anxiety. Younger patients exhibited greater agitation, while older individuals presented with higher rates of edema. Lower educational attainment was associated with the presence of a third heart sound, and household composition influenced blood pressure variability, with increased risks among those living with others.

The duration of hemodialysis sessions was associated with a reduced risk of short-term weight gain and psychomotor agitation. Regarding comorbidities, dyslipidemia was linked to an increased risk of weight gain, while diabetes mellitus was associated with a lower likelihood of jugular vein distension and hepatojugular reflux. These findings underscore the importance of individualized management strategies that account for both sociodemographic and clinical factors to optimize treatment and outcomes in this patient population.

The relevance of these findings to nursing practice is clear, as they demonstrate how a comprehensive assessment of clinical and sociodemographic variables can guide more effective and personalized nursing interventions, thereby improving patient outcomes and quality of life. The results reinforce the importance of a comprehensive approach in the care of patients on hemodialysis, with nurses playing a pivotal role in the early detection of complications and the development of tailored care plans.

This study also highlights the value of future research employing standardized nursing taxonomies such as NANDA-I to deepen understanding of the defining characteristics and related behaviors associated with nursing diagnoses in specific populations. To enhance the NANDA-I taxonomy, this study proposes the formal inclusion of "patients with CKD" as a population at risk for EFV, and the recognition of CKD as an associated condition.

References

(1) Evans M; Lewis RD; Morgan AR; Whyte MB; Hanif W; Bain SC *et al*. A narrative review of chronic kidney disease in clinical practice: Current challenges and future perspectives. Adv Ther. 2022;39(1):33-43. https://doi.org/10.1007/s12325-021-01927-z

(2) Law JP; Pickup L; Pavlovic D; Townend JN; Ferro CJ. Hypertension and cardiomyopathy associated with chronic kidney disease: Epidemiology, pathogenesis and treatment considerations. J Hum Hypertens. 2023;37(1):1-19. https://doi.org/10.1038/s41371-022-00751-4

(3) Silva OM; Kuns CM; Bissoloti A; Ascari RA. Perfil clínico e sócio demográfico dos pacientes em tratamento de hemodiálise no oeste catarinense. Rev Saúde (Sta. Maria). 2018;44(1):1-10. https://doi.org/10.5902/2236583416918

(4) Feehally J. A unique role in global nephrology: The International Society of Nephrology, 2011-2020. Kidney Int. 2020;98(2):253-260. https://doi.org/10.1016/j.kint.2020.05.011

(5) Martins JDN; Carvalho DNR; Sardinha DM; Santos APG; Souza MWO; Aguiar VFF. Contribuições da enfermagem na potencialização do processo de adaptação ao paciente com doença renal crônica. Nursing. 2019;22(257):3198-3202. https://doi.org/10.36489/nursing.2019v22i257p3198-3202

(6) Neves PDMM; Sesso RCC; Thomé FS; Lugon JR; Nascimento MM. Censo Brasileiro de Diálise: análise de dados da década 2009-2018. J. Braz Nephrol. 2020;42(2):191-200. https://doi.org/10.1590/2175-8239-JBN-2019-0234

(7) Figueiredo D; Sousa H; Costa E; Ribeiro F; Paúl C; Ribeiro O. Challenges perceived by adults undergoing maintenance hemodialysis: Insights from a qualitative study to inform the design of self-management interventions in renal care settings. Kidney Int Rep. 2023;8(3):S369. https://doi.org/10.1016/j.ekir.2023.02.833

(8) Lafta A; Ukrainetz J; Davison S; Thompson S; Bello A; Braam B. Inter- and intradialytic fluid volume changes and vascular stiffness parameters in patients on hemodialysis. PLoS One. 2022;17(2):e0262519. https://doi.org/10.1371/journal.pone.0262519

(9) Castro MCM. Conservative management for patients with chronic kidney disease refusing dialysis. Braz J Nephrol. 2019;41(1):95-102. https://doi.org/10.1590/2175-8239-jbn-2018-0028

(10) Spigolon DN; Teston EF; Souza FO; Santos B; Souza RR; Moreira Neto A. Nursing diagnoses of patients with kidney disease undergoing hemodialysis: A cross-sectional study. Rev Bras Enferm. 2018;71(4):2014-2020. https://doi.org/10.1590/0034-7167-2017-0225

(11) Debone MC; Pedruncci ESN; Candido MCP; Marques S; Kusumota L. Nursing diagnosis in older adults with chronic kidney disease on hemodialysis. Rev Bras Enferm. 2017;70(4):800-805. https://doi.org/10.1590/0034-7167-2017-0117

(12) Cavalcanti APS; Ferreira RS; Silva MR; Kimura CSFG; Vieira ECB; Marui FRRH *et al*. Fatores de risco para complicações cardiovasculares em pacientes em tratamento hemodialítico. Glob Acad Nurs. 2021;2(3):e166. https://doi.org/10.5935/2675-5602.20200166

(13) Lima CC; Balbino PC; Souza CC; Salgado PO. Diagnósticos de enfermagem identificados em sujeitos portadores de hipertensão arterial. Enferm. Brasil. 2017;16(5):267-275. http://dx.doi.org/10.33233/eb.v16i5.1028

(14) Herdman TH; Kamitsuru S; Lopes CT. NANDA International Nursing Diagnoses: Definitions and Classification. 13th ed. New York: Wiley-Blackwell; 2024.

(15) Azevedo VNG; Cavalcante TF; Jansen RC; Moreira RP, Lira ALBC, Oliveira-Kumakura ARS. Validation of an instrument to assess fluid control in outpatient hemodialysis patients. J Nurs Educ Pract. 2022;12(12):30-36. https://doi.org/10.5430/jnep.v12n12p30

(16) Folstein MF; Folstein SE; McHugh PR. "Mini-mental state:" A practical method for grading the cognitive state of patients for the clinician. J. Psychiatr. Res. 1975;12(3):189-198. https://doi.org/10.1016/0022-3956(75)90026-6

(17) GBD 2021 Diseases and Injuries Collaborators. Global incidence, prevalence, years lived with disability (YLDs), disability-adjusted life-years (DALYs), and healthy life expectancy (HALE) for 371 diseases and injuries in 204 countries and territories and 811 subnational locations, 1990-2021: A systematic analysis for the Global Burden of Disease Study 2021. The Lancet. 2024;403(10440):2133-2161. http://doi.org/10.1016/S0140-6736(24)00757-8

(18) Molomjamts M; Ingolfsland EC. Identification of reference genes for the normalization of retinal mRNA expression by RT-qPCR in oxygen induced retinopathy, anemia, and erythropoietin administration. PLoS One, 2023;18(4):e0284764.

(19) Furtak G; Lerch N; Kozłowski M; Tkacz P; Piekara E; Łagódka, M *et al*. Assessment of IL-8, RANTES, MIG, MCP-1, IP-10, and IL-12p70 and their association with anxiety and quality of life in patients with chronic kidney disease or after kidney transplantation. Int J Mol Sci 2024;25(24):13449. https://doi.org/10.3390/ijms252413449

(20) Fernandes MICD; Silva PKA; Dantas ALM; Paiva MGMN; Araújo MGA; Lira ALBC. Pacientes em hemodiálise com diagnóstico de enfermagem volume de líquidos excessivo: aspectos socioeconômicos e clínicos. Cogitare Enferm. 2015;20(1):161-170. http://doi.org/10.5380/ce.v20i1.37627

(21) Santos LSF; Bertholy CRSS; Espindola SP; Santos PR; Severiano SGC; Freitas SES. Doenças e agravos prevalentes na população negra: revisão integrativa. Nursing. 2019;22(250):2756-2765. https://doi.org/10.36489/nursing.2019v22i250p2756-2765

(22) Sousa DF; Damasceno JR; Cavalcante TF; Araujo MFM; Araujo TM. Genetic factors in renal failure and diabetes mellitus in the black population: A systematic review and meta-analysis. J Nurs Health Sci. 2019;5(2):43-49. https://www.rroij.com/open-access/genetic-factors-in-renal-failure-and-diabetes-mellitus-in-the-black-population-a-systematic-review-and-metaanalysis.pdf

(23) Mokiao R; Hingorani S. Food insecurity and kidney disease: Symptoms of structural racism. Clin J Am Soc Nephrol 2021;16(12):1903-1905. https://doi.org/10.2215/CJN.07860621

(24) Hariharan N; Chkhikvadze L; Mateshvili A; Sebastian AM; Mathew NS; Shavgulidze E *et al*. Association of sleep problems with dialysis shifts in patients undergoing hemodialysis in Tbilisi, Georgia. Cureus. 2024;16(7):e63733. https://doi.org/10.7759/cureus.63733

(25) Tinel JS; Souza DC; Santana JRC; Marinho CLA. Religious/spiritual coping in people with chronic kidney disease: A cross-sectional study. Rev Cuid. 2024;15(2):e2797. https://doi.org/10.15649/cuidarte.2797

(26) Martins MV; Mata AMLL; Camerini DM; Murta AR. Fatores que influenciam a adesão ao tratamento de hemodiálise para doença renal crônica. Rev. Cient. Faminas. 2017;12(1). https://periodicos.faminas.edu.br/index.php/RCFaminas/article/view/362

(27) Fernandez-Prado R; Peña-Esparragoza JK; Santos-Sánchez-Rey B; Pereira M; Avello A; Gomá-Garcés E *et al*. Ultrafiltration rate adjusted to body weight and mortality in hemodialysis patients. Nefrologia (Engl Ed). 2021;41(4):426-435. https://doi.org/10.1016/j.nefroe.2021.10.005

(28) Vallejos Saldarriaga JF; Ortega Reyna EZ. Niveles de depresión y factores sociodemográficos en pacientes con insuficiencia renal crónica en tratamiento de hemodiálisis en Perú. Cienc. Psicol. 2018;12(2):205-214. https://doi.org/10.22235/cp.v12i2.1683

(29) Botelho ML; Correia MDL; Ribeiro E; Ferreira RC; Duran ECM. Análise de conteúdo do diagnóstico de enfermagem "Volume de líquido excessivo (00026)" em pacientes renais. Rev Bras Enferm. 2022;75(4):1-8. https://doi.org/10.1590/0034-7167-2021-0058

(30) Hatamkhani S; Roshan S; Shiva A. Role of melatonin as an adjunctive treatment for depression and cognitive impairment in hemodialysis patients: A randomized, double-blind clinical trial. Iran JPsychiatry. 2025;20(1):39-47. https://doi.org/10.18502/ijps.v20i1.17400

(31) Mohammadi R; Varjoshani NJ; Bousari MP; Ghahremani Z. The association of family function with anxiety and depression among patients undergoing hemodialysis: A cross-sectional study in Iran. Maedica, 2024;19(4):742-749. https://doi.org/10.26574/maedica.2024.19.4.742

(32) Burnier M; Damianaki A. Hypertension as cardiovascular risk factor in chronic kidney disease. Circ Res. 2023;132(8):1050-1063. https://doi.org/10.1161/circresaha.122.321762

(33) Webster AC; Nagler EV; Morton RL; Masson P. Chronic kidney disease. The Lancet. 2017;389(10075):1238-1252. h ttps://doi.org/10.1016/s0140-6736(16)32064-5

(34) Cordero Guzmán Y; Hernández Morejón E; Gallardo Cajiga MJ; Rodríguez Gonzáles Y; Gutiérrez Sánchez S. Comportamiento clínico epidemiológico de la insuficiencia renal crónica en pacientes diabéticos. La Palma, 2022. Ciencia y Tecnología –Serie de Conferencias. 2022;1(3):234. https://doi.org/10.56294/sctconf2022234

(35) Phang CC; Ng LC; Kadir HA; Liu P; Gan S; Choong, LH *et al*. Recurrent hospitalizations for fluid overload in diabetes with kidney failure treated with dialysis. Cardiorenal Med. 2024;14(1):612-623. https://doi.org/10.1159/000542446

(36) Tan JK; Kadir HA; Lim GH; Thumboo J; Bee YM; Lim CC. Trends in fluid overload-related hospitalisations among patients with diabetes mellitus: The impact of chronic kidney disease. Ann Acad Med Singap. 2024;53(7):435-445. https://doi.org/10.47102/annals-acadmedsg.2024136