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Knowledge, Attitude, and Practices of Patients Undergoing Maintenance Hemodialysis Regarding the Hemodialysis and Its Complications

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ABSTRACT

Objective: This study aimed to assess their knowledge, attitudes, and practices (KAP) regarding hemodialysis and its complications in a tertiary care setting. **Study design:** Cross-sectional observational study. **Setting:** Nephrology Department and Dialysis Unit of Nishtar Hospital, Multan. **Period:** November 2024 to April 2025. **Methods:** Using non-probability consecutive sampling, 148 clinically stable patients undergoing maintenance hemodialysis for ≥3 months were enrolled. Data were collected using a structured KAP questionnaire and analyzed in SPSS version 26. Knowledge, attitude, and practice scores were categorized and compared across demographic and clinical variables using t-test and ANOVA, with a significance level set at $p < 0.05$. **Results:** A total of 148 patients were enrolled, with a mean age of 55.74 ± 11.18 years and mean dialysis duration of 31.66 ± 14.32 months. Males comprised 66.9% of the participants, and 57.4% were aged 45–65 years. Adequate knowledge was observed in 55.4%, while 20.3% demonstrated good knowledge. Positive attitudes and good practices were noted in 36.5% and 20.3% respectively. Knowledge scores were significantly higher in males ($p < 0.001$) and those aged 45–65 years ($p = 0.008$). Employment, education, and complications like thrombosis and hypotension significantly influenced KAP scores, while diabetes and hypertension were linked to poorer attitude and practice. **Conclusion:** Knowledge, attitude, and practice regarding hemodialysis were suboptimal among patients. Focused educational interventions are needed to address deficiencies and promote effective self-management in the dialysis population.

INTRODUCTION

Chronic kidney disease (CKD) represents a significant global health burden, with its prevalence estimated between 10% and 16% worldwide, and even higher rates reported in developing countries. [1] In Pakistan, the incidence of end-stage renal disease (ESRD) has been reported between 17% and 35%, with the trend showing a continuous annual rise. [2] End-stage renal disease requires renal replacement therapy, among which hemodialysis is the most widely utilized modality, accounting for approximately 89% of patients receiving dialysis globally. [1,3] Despite technological advancements, hemodialysis is associated with multiple complications including cardiovascular diseases, infections, malnutrition, vascular access issues, and fluid overload. Cardiovascular complications alone contribute to nearly 50% of mortality among hemodialysis patients. Although AVF is considered the gold standard for vascular access due to its longer patency and lower infection risk, proper maintenance requires patient involvement in self-care behaviors. [4,5]

Evidence suggests that patients' knowledge, attitudes, and practices (KAP) towards hemodialysis and its complications significantly influence treatment outcomes. Studies conducted across diverse settings have highlighted critical deficiencies in patient knowledge and self-care behaviors. [6,7] In a South African study, 49.4% of hemodialysis patients scored below 50% on composite knowledge tests related to diet and access care, with 60.0% demonstrating negative attitudes and 61.4% reporting poor practices. [1] Similarly, in Pakistan, although 83.4% of patients exhibited adequate knowledge regarding hemodialysis and its complications, actual practice was notably lower, with only 74.7% following recommended measures, and limb elevation during swelling was practiced by merely 36.9% of patients. [2] A study in India similarly reported poor dietary adherence among hemodialysis patients despite reasonable awareness levels. [8] In Japan, lower mortality and better adherence among hemodialysis patients compared to the United States have been partly attributed to stronger patient knowledge and self-management behaviors. [9]

Several factors have been identified as determinants of KAP among hemodialysis patients, including educational status, health literacy, socioeconomic conditions, and language barriers. [10] Intervention programs focusing on structured patient education have demonstrated success in improving KAP scores, with a study from India reporting a post-education increase in knowledge from 38.75% to 61.25% among hemodialysis patients. [11] Given the increasing prevalence of ESRD and the high complication burden among patients undergoing maintenance hemodialysis, assessing their knowledge, attitudes, and practices is crucial for identifying existing gaps and developing targeted educational interventions. Therefore, the present study aims to evaluate the knowledge, attitudes, and practices regarding hemodialysis and its complications among patients undergoing maintenance hemodialysis at a tertiary care hospital.

MATERIALS AND METHODS

A cross-sectional study was conducted at the Nephrology Department and Dialysis Unit of Nishtar Hospital, Multan, from November 2024 to April 2025. Ethical approval was obtained from the Institutional Ethical Review Board of Nishtar Medical University, Multan (Approval Reference No. 18962/NMU), and written informed consent was taken from all participants prior to enrollment. A non-probability consecutive sampling technique was utilized. The sample size was calculated using the formula for single population proportion, assuming an 83.4% prevalence of adequate knowledge among hemodialysis patients, with a 95% confidence level and a 6% margin of error, yielding a minimum required sample size of 148 patients. [2]

Inclusion Criteria: Patients aged 18 years and above, diagnosed with end-stage renal disease (ESRD) and undergoing maintenance hemodialysis for at least three months were eligible for inclusion. Only those patients who were clinically stable, capable of understanding and responding to the study questionnaire, and willing to participate by providing written informed consent were recruited.

Exclusion Criteria: Patients undergoing peritoneal dialysis, those with cognitive impairment, psychiatric illness, or disturbances of consciousness were excluded. Patients recently hospitalized within the past three months for major complications, as well as those providing incomplete questionnaire responses, were also excluded.

Data Collection Procedure: Baseline demographic and clinical information was recorded, including age, gender, education, employment status, marital status, comorbidities, Vascular access, duration of hemodialysis, and number of hemodialysis sessions per week. The occurrence of recent complications over the past three months such as intradialytic hypotension, access site infections, cardiovascular complications, electrolyte imbalances, and thrombosis were also documented.

The outcome variables, namely knowledge, attitude, and practice levels regarding hemodialysis and its complications, were assessed using a specifically designed data collection form structured into three sections. The knowledge section included 30 multiple-choice questions, each scored as one point for a correct response, leading to a total knowledge score categorized as poor (0–10), adequate (11–20), and good (21–30). The attitude domain consisted of 8 statements evaluated on a 5-point Likert scale, with the total score categorized as negative (8–18), neutral (19–29), and positive (30–40). The practice domain comprised 11 Likert-scale items, and the total score was categorized as poor (11–25), moderate (26–40), and good (41–55). Data were collected prospectively through direct patient interviews and examination of patient medical records where required, ensuring accuracy and completeness at the point of entry. Confidentiality of all participant data was maintained throughout the study, and identifiers were removed prior to analysis.

Data were analyzed using SPSS version 26. Categorical variables were reported as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation. Knowledge, attitude, and practice (KAP) scores were categorized using predefined cut-offs. Group comparisons for mean KAP scores were performed using Independent Samples t-test for binary variables and One-way ANOVA for variables with more than two categories. A p-value <0.05 was considered statistically significant.

RESULTS

The mean age of patients was 55.74 ± 11.18 years. The average duration of maintenance hemodialysis was 31.66 ± 14.32 months. Among the 148 patients enrolled, the majority were aged 45–65 years (57.4%) and male (66.9%). Over half of the participants were unemployed (52.7%), and most were married (65.5%). Hypertension (70.9%) and diabetes (44.6%) were the most common comorbidities. AV fistula was the primary vascular access (69.6%), and over half of the patients received hemodialysis three times per week (53.4%). Notably, 39.2% experienced cardiovascular complications, while 30.4% each reported intradialytic hypotension, electrolyte imbalance, and thrombosis. Complete baseline characteristics are detailed in Table 1.

Table 1

Baseline Demographic and Clinical Characteristics of Patients Undergoing Maintenance Hemodialysis (n = 148)

Characteristic	Category	n (%)
Age Group	<45 years	36 (24.3)
	45 to 65 years	85 (57.4)
	>65 years	27 (18.2)
Gender	Male	99 (66.9)
	Female	49 (33.1)
Educational Status	No formal education	31 (20.9)
	Primary School	39 (26.4)
	Secondary School	45 (30.4)
	College/University	27 (18.2)
	Postgraduate	6 (4.1)
Employment Status	Employed	37 (25.0)
	Unemployed	78 (52.7)
	Retired	33 (22.3)
Marital Status	Single	24 (16.2)
	Married	97 (65.5)
	Divorced/Separated	15 (10.1)
	Widowed	12 (8.1)
Co-morbidities	Diabetes	66 (44.6)
	Hypertension	105 (70.9)
	Cardiovascular Disease	42 (28.4)
	Mineral Bone Disorder	45 (30.4)

Vascular Access Type	AV Fistula	103 (69.6)
	AV Graft	21 (14.2)
	Central Venous Catheter	24 (16.2)
Hemodialysis Sessions	2 per week	45 (30.4)
	3 per week	79 (53.4)
	Other	24 (16.2)
Complications	Intradialytic Hypotension	45 (30.4)
	Access Site Infections	37 (25.0)
	Cardiovascular Complications	58 (39.2)
	Electrolyte Imbalances	45 (30.4)
	Thrombosis	45 (30.4)

The mean knowledge score was 16.53 ± 5.31, the mean attitude score was 26.93 ± 5.13, and the mean practice score was 34.47 ± 6.99. Significant associations were noted between KAP scores and various demographic and clinical variables. Knowledge scores were higher in males (17.70 ± 5.43; p < 0.001) and patients aged 45–65 years (17.35 ± 5.37; p = 0.008). Practice scores were highest in those >65 years (38.22 ± 5.92; p < 0.001). Education was linked to attitude (p = 0.021) and practice (p = 0.002) scores, while employment status showed significant associations across all three domains (p < 0.05). Diabetes and hypertension were associated with lower attitude and knowledge scores, respectively. Central venous catheter users had the highest practice scores (39.25 ± 6.79; p = 0.001) (Table 2).

Table 2

Comparison of Mean Knowledge, Attitude, and Practice Scores Across Patient Characteristics (n = 148)

Variable		Knowledge Score (Mean ± SD)	p-value	Attitude Score (Mean ± SD)	p-value	Practice Score (Mean ± SD)	p-value
Gender	Male	17.70 ± 5.43	<0.000	27.00 ± 5.32	0.803	33.79 ± 6.64	0.090
	Female	14.18 ± 4.20		26.78 ± 4.77		35.86 ± 7.53	
Age Group	<45 years	14.17 ± 4.51	0.008	27.00 ± 5.78	0.518	36.50 ± 6.93	<0.000
	45–65 years	17.35 ± 5.37		26.59 ± 4.82		32.42 ± 6.65	
	>65 years	17.11 ± 5.34		27.89 ± 5.23		38.22 ± 5.92	
Education	No formal education	16.71 ± 4.03	0.326	24.61 ± 3.29	0.021	30.16 ± 7.76	0.002
	Primary School	16.15 ± 6.60		28.08 ± 4.18		36.38 ± 7.34	
	Secondary School	16.20 ± 5.09		28.07 ± 4.97		35.53 ± 5.56	
	College/University	16.44 ± 5.11		26.33 ± 6.69		34.67 ± 6.74	
	Postgraduate	21.00 ± 0.55		25.50 ± 0.55		35.50 ± 1.64	
Employment	Employed	15.46 ± 5.87	0.007	29.14 ± 3.90	0.006	37.27 ± 5.02	0.003
	Unemployed	17.81 ± 4.96		25.88 ± 6.05		34.35 ± 7.28	
	Retired	14.73 ± 4.79		26.91 ± 2.75		31.64 ± 7.16	
Marital Status	Single	16.50 ± 5.48	0.164	26.00 ± 5.71	0.052	33.63 ± 7.22	0.281
	Married	16.91 ± 5.14		26.73 ± 4.96		34.60 ± 6.68	
	Divorced/Separated	16.80 ± 6.26		26.60 ± 5.99		37.00 ± 7.91	
	Widowed	13.25 ± 4.52		30.75 ± 2.26		32.00 ± 7.64	
Comorbidities	Diabetes	16.55 ± 5.20	0.981	25.91 ± 5.06	0.030	32.27 ± 6.60	<0.000
	Hypertension	15.97 ± 5.53	0.044	26.31 ± 5.04	0.023	34.40 ± 7.25	0.844
	CVD	16.36 ± 6.75	0.800	28.07 ± 3.97	0.051	35.50 ± 7.28	0.262
	Mineral Bone Disorder	17.73 ± 5.68	0.069	26.33 ± 5.81	0.355	33.27 ± 7.30	0.166
Vascular Access	AV Fistula	16.30 ± 5.19	0.542	27.13 ± 4.93	0.209	33.57 ± 6.53	0.001
	AV Graft	17.71 ± 5.13		25.14 ± 6.35		33.43 ± 7.49	
	CVC	16.50 ± 6.02		27.63 ± 4.65		39.25 ± 6.79	
Dialysis Frequency	Twice Weekly	16.93 ± 6.94	0.768	28.73 ± 3.79	0.002	34.33 ± 7.09	0.359
	Thrice Weekly	16.24 ± 4.45		26.67 ± 5.29		35.08 ± 7.14	
	Others	16.75 ± 4.50		24.38 ± 5.71		32.75 ± 6.27	
Complications	Intradialytic Hypotension	18.73 ± 5.86	0.001	28.87 ± 4.52	0.002	33.47 ± 7.62	0.249
	Access Site Infections	16.27 ± 6.07	0.729	26.05 ± 5.70	0.234	35.57 ± 6.55	0.273
	Cardiovascular Complications	19.12 ± 5.03	<0.000	26.55 ± 5.49	0.478	34.74 ± 5.71	0.709
	Electrolyte Imbalance	17.87 ± 5.71	0.043	27.93 ± 5.36	0.115	35.13 ± 7.22	0.450
	Thrombosis	21.00 ± 3.24	<0.000	27.40 ± 5.40	0.459	34.87 ± 7.46	0.652

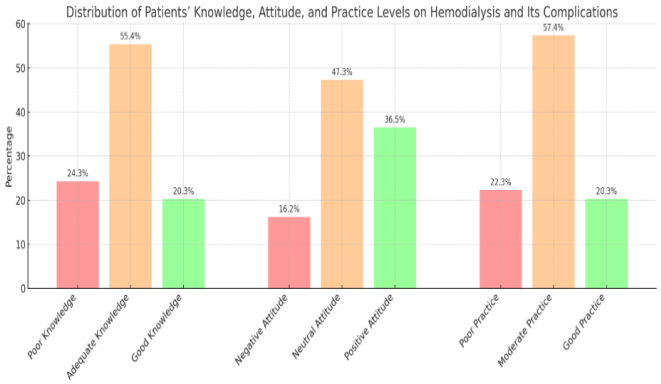
Independent Samples t-test was applied for dichotomous variables (e.g., gender, diabetes, hypertension), and One-way ANOVA was used for variables with more than two categories (e.g., education, age, employment). A p-value <0.05 was considered statistically significant.

Among the 148 patients, 82 (55.4%) had adequate knowledge, while 36 (24.3%) had poor and 30 (20.3%) good knowledge. Neutral attitudes were most common (70; 47.3%), followed by positive (54; 36.5%) and negative attitudes (24; 16.2%). Practice levels were predominantly moderate (85; 57.4%), with 33 (22.3%) reporting poor

and 30 (20.3%) good practice (Figure 1).

Figure 1

Distribution of Patients' Knowledge, Attitude, and Practice Levels on Hemodialysis and Its Complications



DISCUSSION

This study evaluated the knowledge, attitudes, and practices (KAP) regarding hemodialysis and its complications among patients undergoing maintenance hemodialysis in a tertiary care hospital. The mean age of participants was 55.7 ± 11.2 years, with most patients being older adults; a majority were male and had long dialysis vintage (mean 31.7 ± 14.3 months on dialysis). As expected, diabetes mellitus and hypertension were highly prevalent comorbidities, reflecting their role as leading causes of end-stage renal disease (ESRD). Knowledge scores averaged 16.5 ± 5.3 out of 30, indicating that only about one-fifth of patients achieved a "good" knowledge level (20.3% scoring 21–30) while over half had merely adequate knowledge (55.4% scoring 11–20) and 24.3% had poor knowledge (≤10 points). Attitude scores averaged 26.9 ± 5.1 (out of 40); 36.5% of patients exhibited a positive attitude, whereas nearly half (47.3%) were neutral and 16.2% expressed negative attitudes. Practice scores averaged 34.5 ± 7.0 (out of 55), with only 20.3% attaining good practice (41–55 points) and the majority (57.4%) falling in the moderate practice range.

Age was significantly associated with both knowledge regarding hemodialysis ($p = 0.008$) and practice scores ($p < 0.001$). Patients aged 45–65 years had the highest knowledge (17.35 ± 5.37), while those above 65 had the highest practice scores (38.22 ± 5.92). This finding supports earlier studies indicating better knowledge among middle-aged and elderly patients, possibly due to longer disease duration or greater healthcare interaction. [12] Conversely, Huang et al. reported declining knowledge with increasing age, emphasizing population differences. [13] Xu *et al.* similarly reported that younger patients on hemodialysis had better knowledge of dietary guidelines than older patients. [14] In the current study, males exhibited significantly higher knowledge scores than females (17.70 ± 5.43 vs. 14.18 ± 4.20; $p < 0.001$), in agreement with Liu et al., who also found better knowledge levels among male patients. [7]

Education level did not significantly influence knowledge in our study ($p = 0.326$) but was strongly associated with both attitude ($p = 0.021$) and practice ($p = 0.002$) scores. Patients with postgraduate education had the highest mean knowledge (21.00 ± 0.55) and practice (35.50 ± 1.64) scores. This aligns with multiple studies where higher educational attainment was a strong predictor of better practices and more proactive disease management. [15] Our findings reinforce that limited formal education can be a barrier to understanding dialysis care. Even so, it was apparent that all educational strata had knowledge gaps in specific areas (e.g. recognizing certain complications), implying that dialysis-specific education must supplement general education. Focused teaching for patients with lower literacy is especially warranted to ensure they comprehend essential self-management concepts. Employment status showed significant association across all domains—knowledge ($p = 0.007$), attitude ($p = 0.006$), and practice ($p = 0.003$)—with employed patients demonstrating superior scores. This is in line with findings from Li et al., who reported that employed individuals had higher engagement with health information and disease self-management. [3]

Among clinical variables, diabetes mellitus was significantly associated with lower attitude (25.91 ± 5.06; $p = 0.030$) and practice scores (32.27 ± 6.60; $p < 0.001$), highlighting the need for targeted counseling in this subgroup. Similar results were reported by Li et al., who found comorbidities, especially diabetes, to negatively impact adherence and self-care [7]. Hypertensive patients in our cohort had lower knowledge and attitude scores, consistent with findings from earlier regional surveys. [16] Vascular access type was significantly associated with practice scores ($p = 0.001$). Patients with central venous catheters had the highest practice score (39.25 ± 6.79), possibly reflecting increased contact with healthcare providers. Sreekala et al. noted that AV fistula users often showed poor AVF self-care knowledge despite prolonged use. [11] Dialysis frequency was not associated with knowledge or practice but was significantly related to attitude ($p = 0.002$). Patients dialyzed twice weekly reported more favorable attitudes. This contrasts with findings from a Chinese cohort where more frequent dialysis correlated with higher attitude and practice scores . [17]

In terms of complications, intradialytic hypotension and cardiovascular complications were significantly associated with higher knowledge scores, indicating heightened awareness following adverse events. Thrombosis had the highest mean knowledge score (21.00 ± 3.24; $p < 0.001$). Similar trends were noted by Huang et al., where patients who had experienced AVF complications showed greater concern and adherence post-intervention. [13] The categorical analysis in this study found that 55.4% of patients had adequate knowledge (11–20), 24.3% had poor knowledge (0–10), and 20.3% had good knowledge (21–30). For attitude, 47.3% showed neutral, 36.5% positive, and 16.2% negative dispositions, whereas practice scores indicated moderate (57.4%), poor (22.3%), and good (20.3%) behaviors. These findings closely resemble those of Li et al., who reported similar knowledge inadequacies and attitude discrepancies among dialysis patients. [3]

This study provides comprehensive insights into the knowledge, attitudes, and practices of patients undergoing maintenance hemodialysis, highlighting key

sociodemographic and clinical determinants. Its strengths include a structured questionnaire, adequate sample size, and domain-specific statistical analysis. However, being single-centered limits generalizability, and self-reported responses may introduce recall or social desirability bias. The cross-sectional design precludes causal inference. Future multicenter studies with longitudinal follow-up and interventional components are recommended to evaluate the impact of structured educational programs on improving dialysis-related knowledge, attitudes, and self-care behaviors, particularly among high-risk groups such as females, the less educated, and those with comorbidities.

CONCLUSION

This study highlights considerable gaps in dialysis-related knowledge, attitudes, and practices among patients undergoing maintenance hemodialysis. While most patients demonstrated adequate knowledge and moderate practice, only one-fifth attained good scores. Male gender, higher education, and employment were associated with better KAP scores, whereas comorbid diabetes and hypertension were linked with lower attitude and practice. Targeted patient education, particularly for high-risk subgroups, is essential to improve self-care behaviors, reduce complications, and enhance treatment outcomes in the hemodialysis population..

REFERENCES

1. Spies HC, van den Berg VL, Nel M. Knowledge, attitude and practices of patients receiving maintenance haemodialysis in Bloemfontein, South Africa. South Afr J Clin Nutr 2021;34(3):116–22. https://doi.org/10.1080/16070658.2020.1751415
2. Iqbal QTA, Shareef A, Afzal A, Ashraf S. Knowledge, Attitude and Practice in ESRD Patients on Hemodialysis. Prof Med J 2018;54(1):38–42. https://doi.org/10.29309/tpmj/18.4422
3. Li Z, Song L, Hua R, Xia F, Hu D, Luo Z, et al. Knowledge, attitudes, and practices toward cardiovascular complications among end-stage renal disease patients undergoing maintenance hemodialysis. BMC Public Health 2024;24(1). https://doi.org/10.1186/s12889-024-18945-5
4. Venegas-Ramírez J, Hernández-Fuentes GA, Palomares CS, Diaz-Martinez J, Navarro-Cuellar JI, Calvo-Soto P, et al. Vascular access type and survival outcomes in hemodialysis patients: a seven-year cohort study. Medicina (Kaunas) 2025;61(4):584. https://doi.org/10.3390/medicina61040584
5. Hornig C, Bowry SK, Kircelli F, Kendzia D, Apel C, Canaud B. Hemoincompatibility in hemodialysis-related therapies and their health economic perspectives. J Clin Med 2024;13(20):6165. https://doi.org/10.3390/jcm13206165
6. Duan DF, Wen Y, Yan Y, Li L, Xiao X, Li X, et al. Chinese healthcare workers' knowledge, attitudes, and practices in diabetic kidney management: a multi-centered cross-sectional study. Risk Manag Healthc Policy 2024;17:1211–25. https://doi.org/10.2147/rmhp.s354549
7. Li G, Peng W, Kong H, Hu F, Huang J, Han X, et al. Knowledge, attitudes and practices among patients with end-stage kidney disease towards hyperkalaemia management in Shenzhen, China: A cross-sectional study. BMJ Open 2025;15(3):e092619. https://doi.org/10.1136/bmjopen-2024-092619
8. Kanagarajah S, Velraja S, Arambakkam HJ. Knowledge, attitude, and practices of renal diets among hemodialysis patients. Biomed Biotechnol Res J 2022;6(1):86–92. https://doi.org/10.4103/bbrj.bbrj_200_21
9. Miyata KN, Shen JI, Nishio Y, Haneda M, Dadzie KA, Sheth NR, et al. Patient knowledge and adherence to maintenance hemodialysis: an international comparison study. Clin Exp Nephrol 2018;22(4):947–56. https://doi.org/10.1007/s10157-017-1512-8
10. Zibran MA, Mohammadnezhad M. Determinants of knowledge, attitude and practice in patients with both type 2 diabetes and chronic kidney disease in Fiji. F1000Research 2019;8:239. https://doi.org/10.12688/f1000research.18133.1
11. Jayan S, Jayaprakash DG. Knowledge, attitude and practice about arteriovenous fistula care in patients undergoing hemodialysis. Eur J Pharm Med Res 2024;11(1):1–5.
12. Peng Y, Huang Q, Yu Y, Zhu L, Yuan H. Knowledge, attitude, and practice toward nutrition support and management among hemodialysis patients. Sci Rep 2024;14(1):1–9. https://doi.org/10.1038/s41598-024-72366-3
13. Huang S, Liu X, Liu Y, Liu D. Knowledge, attitudes and practices regarding arteriovenous fistulas among uremic patients undergoing haemodialysis in China: a cross-sectional study. BMJ Open 2025;15(2):e093211. https://doi.org/10.1136/bmjopen-2024-093211
14. Xu F, Zhuang B, Wang Z, Wu H, Hui X, Peng H, et al. Knowledge, attitude, and practice of patients receiving maintenance hemodialysis regarding hemodialysis and its complications: a single-center, cross-sectional study in Nanjing. BMC Nephrol 2023;24(1):275. https://doi.org/10.1186/s12882-023-03212-w
15. Chen Z, Xu N, Chen X, Zhang X, Yin S, Xiao G, et al. Dietary knowledge-attitude-practice status in hemodialysis patients: a latent profile analysis. BMC Public Health 2024;24(1):18066. https://doi.org/10.1186/s12889-024-18066-z
16. Machaalani M, Seifeddine H, Ali A, Bitar H, Briman O, Chahine MN. Knowledge, attitude, and practice toward hypertension among hypertensive patients residing in Lebanon. Vasc Health Risk Manag 2022;18:541–53. https://doi.org/10.2147/VHRM.S374617
17. Lv T, Dong Y, Zhang H, Li Y. Knowledge, attitude, and practice regarding sarcopenia in maintenance hemodialysis patients in Northeastern China. Sci Rep 2024;14(1):24775. https://doi.org/10.1038/s41598-024-75395-0