

The Role of Nurse-led Health Education in Enhancing Treatment Adherence among Hemodialysis Patients: A Randomized Controlled Trial

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ABSTRACT

Background: For patients with end-stage renal disease, hemodialysis may be the only way to sustain life. However, it requires strict adherence to treatment to avoid its biopsychosocial burdens. **Objectives:** This study aims to estimate the efficacy of nursing health education based on the Theory of Planned Behavior (TPB) in improving treatment adherence among hemodialysis patients. **Methods:** This randomized controlled trial study involved 60 hemodialysis patients from the dialysis center of Telafer General Hospital, Nineveh, Iraq, from October 2024 to May 2025. The study participants were randomly divided into two groups (experimental group = 30 subjects and control group = 30 subjects). A specialized questionnaire consisting of the End-Stage Renal Disease-Adherence Questionnaire (ESRD-AQ) and TPB constructs scale was used in pre- and post-intervention tests to determine changes in adherence behavior, knowledge/perception, and TPB constructs over three time points (T0, T1, T2). Data was analyzed by descriptive and inferential statistics using the Statistical Package for Social Science (SPSS) software. **Results:** Most participants were in the age group of 60–69 years (21.7%). Statistically significant positive changes were noted among experimental group participants' adherence behavior, knowledge/perceptions, and TPB constructs at post-tests 1 and 2 ($p < 0.05$). Intention was associated with attitude and perceived behavioral control ($r = 0.442, 0.471; p < 0.05$), respectively. In addition, intention was associated with treatment adherence behavior ($r = 0.391$). No significant changes or correlations in the study variables were observed among the control group participants over time. **Conclusion:** This study suggests that nursing health education based on TPB effectively improves treatment adherence among hemodialysis patients.

Keywords: Chronic Kidney Disease; End-Stage Renal Disease; Hemodialysis; Nursing Health Education; Theory of Planned Behavior

INTRODUCTION

Chronic kidney disease is a growing public health problem, affecting approximately 16% of the global population and contributing to millions of annual deaths and disabilities, with a substantial social and economic burden on patients, their families, healthcare providers, and society as a whole (Paneerselvam *et al.*, 2025). Clinically, chronic kidney disease is a complex, progressive disease involving a gradual decline in kidney function until reaching End-Stage Renal Disease (ESRD) (Coimbra & Santos-Silva, 2025). Patients with ESRD need renal replacement therapy such as kidney transplant or hemodialysis (Yakupova *et al.*, 2023).

Hemodialysis is often the only method available for maintaining the lives of patients with ESRD in many countries, including Iraq (Abdul-Jabbar & Kadhim, 2022). However, patients on hemodialysis must strictly follow their treatment regimen, which includes regularly attending dialysis sessions, taking prescribed

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medications, and restricting fluids and food intake to achieve better health outcomes and improve their quality of life (Bazrafshan *et al.*, 2023).

Previous investigations found that adherence is a problem for 7–50% of patients (Gamal *et al.*, 2025). Multiple interdependent factors associated with patients, the healthcare system, and disease chronicity were singled out as the leading causes of poor adherence (Al-Khattabi, 2020). Nonadherence to treatment may lead to recurrent and prolonged hospitalizations, multiple physiological complications, and even death; hence the need to develop effective interventions that promote treatment compliance and improve health outcomes among hemodialysis patients (Zhang *et al.*, 2025). Conventional approaches, such as education, counseling, and digital health interventions, only moderately improve this aspect (Irajpour *et al.*, 2024). The most important of these efforts were educational initiatives aimed at improving patients' understanding of their disease and the importance of continued treatment (Dsouza *et al.*, 2023). The importance of nursing is emphasized in this regard, as nurses are healthcare professionals who interact directly with patients. They facilitate adherence to treatment by educating patients, managing symptoms, and supporting patients and their families (Alenezi *et al.*, 2024). Collaboration, engagement, and dialogue between nurses and patients can help nurses identify barriers to adherence and develop targeted interventions to improve treatment adherence (Baktash & Sulaiman, 2024). However, previous efforts have been insufficient in providing dialysis patients with a well-rounded nursing education to improve treatment adherence.

The decline in the effectiveness of traditional educational efforts may be related to the absence of a theoretical model to guide the process of enhancing treatment adherence (Singh *et al.*, 2023). The lack of a theoretical foundation for health education has led to ambiguity regarding the role of specific factors affecting treatment adherence, such as behavioral beliefs, subjective norms, demographic characteristics, behavioral control, and intention (Kamyab *et al.*, 2024). There is also uncertainty about the relationships between the essential elements of hemodialysis treatment adherence behavior (Asadizaker *et al.*, 2022).

In this context, the TPB has proven its efficiency in improving many health-related behaviors through health education among different populations (Hagger & Hamilton, 2025). Therefore, this theory can provide a valuable framework to understand, predict, and change treatment adherence behaviors among hemodialysis patients (Rich *et al.*, 2015). This study combines nursing health education and the psychological framework to bridge the knowledge gap between theory and practice. The goal is to offer a long-term, patient-centered approach to improving hemodialysis patient adherence and outcomes.

TPB is a social cognition model created by Ajzen in 1985 as an extension of Martin Fishbein's 1967 theory of reasoned action (Asare, 2015). The model proposes that an individual's decision to perform a specific behavior depends on three components: subjective norms, perceived behavioral control, and attitude toward the behavior (Ajzen, 2020).

Therefore, this study examined the effectiveness of nursing health education programs based on TPB in improving treatment adherence among individuals undergoing hemodialysis in Telafer City.

METHODOLOGY

Study Design

This experimental study used a randomized controlled trial approach.

Study Setting and Time

The study was conducted from October 2024 to May 2025 at the dialysis center of Telafer General Hospital in Nineveh Governorate, Iraq. The dialysis center, opened in 2023 by the Iraqi Ministry of Health, serves a population of about 750,000 people from western Nineveh. The three main ethnic groups are Turkmen, Arabs, and Yazidis (Baktash & Aziz, 2023).

Sampling

The target population of this study consisted of 72 hemodialysis patients attending Telafer General Hospital. The sample size was determined using G*Power software for a Friedman Test, assuming an effect size of 0.40, a significance level of $\alpha = 0.05$, and a statistical power of 0.95 (Sheikh *et al.*, 2022). The analysis indicated that a minimum of 36 participants was required (at least 18 per group).

A total of 60 hemodialysis patients aged over 12 years consented to participate in the study. This sample size exceeded the minimum requirement and ensured adequate statistical power to detect clinically meaningful differences. Additionally, the study was conducted in a single hemodialysis unit with a limited and well-defined patient population, which further justifies the sample size. Therefore, the sample was considered sufficient for the study design and planned statistical analysis.

Randomization

Following sample recruitment, each participant was assigned a particular number, which is the random allocation identifier (Hopewell *et al.*, 2025). The subjects were randomized into two groups using simple randomization: the intervention group (experimental group) and the non-intervention group (control group). The analysis was performed using the Statistical Package for the Social Sciences (SPSS) software for Windows, version 26. The result of the randomization process was 30 subjects in the experimental group and 30 subjects in the control group.

Data Collection and Instrumentation

The instrument used for data collection consists of three parts as described below:

The first part was designed to measure participants' demographic characteristics and clinical factors related to hemodialysis, such as age, gender, and marital status.

The second part involved using the End-Stage Renal Disease-Adherence Questionnaire (ESRD-AQ). This scale was developed by Kim *et al.* (2010) to determine treatment adherence behavior and knowledge/perception of hemodialysis through 46 items divided into five subscales that assess patients' general information (5 items), adherence to hemodialysis treatment (14 items), medications (9 items), and recommendations for fluid restrictions (10 items) and dietary restrictions (8 items). The questions selected to measure treatment adherence were 14, 17, 18, 26, 31, and 46, and the questions chosen to evaluate patients' knowledge/perception were 11, 12, 22, 23, 32, 33, 41 and 42. The ESRD-AQ was answered using a Likert scale, a yes/no answer, and multiple-choice questions. The adherence behavior score ranges from 0 to 1,200, and the highest score represents the greatest degree of treatment adherence (Kim *et al.*, 2010). The scores for the questions of knowledge/perception ranged from 1 (*very low*) to 5 (*very high*). The total score for knowledge/perception ranged from 8 to 40, with a higher score indicating higher knowledge/perception. The remaining questions were used to gather information from patients about their history of ESRD and renal replacement therapy.

The third part of the scale is designed according to TPB to measure its constructs (Sheikh *et al.*, 2022). The scale involves 36 items divided into four subscales as follows: attitude (14 items), subjective norms (8 items), perceived behavior control (11 items), and behavioral intention (3 items). All scale items were measured using a 5-point Likert scale ranging from 1 to 5 (1 = *strongly disagree*, 5 = *strongly agree*), except five items of the perceived power were reversed (1 = *strongly agree*, 5 = *strongly disagree*) to avoid bias. Total scores on the questionnaire ranged from 36 to 180. Higher scores represent a better degree of positive attitude, perceived subjective norms, perceived behavioral control, and perceived intentions related to adherence behavior.

Procedure

After randomly assigning samples to experimental groups, the study was conducted in three phases, corresponding to the nursing processes, as follows (Sassen, 2023).

Assessment (pretest T0): Included pretesting the participants of each group to collect the demographic data, hemodialysis treatment adherence level, hemodialysis knowledge/perception level, and TPB constructs. This step was essential to determine homogeneity among groups (Hopewell *et al.*, 2025).

Planning: Developing hemodialysis health education based on TPB constructs.

Implementation: Delivering the education program in two 30-minute sessions as follows:

The first session addressed renal failure and hemodialysis, as well as treatment adherence. It recognized the common barriers to patient adherence and the consequences of not adhering to treatment.

The second session focused on overcoming barriers to treatment adherence and increasing participants' perceived behavioral control through motivation and the influence of their significant others. Furthermore, the benefits of treatment adherence for hemodialysis patients were clarified during this period.

Ten experts validated the educational module. To enhance the intervention's efficacy and increase participants' engagement, the investigator employed various health education strategies and materials, including group discussions, PowerPoint presentations, real-life stories of hemodialysis patients who successfully adhered to their treatment, visual aids, and printed educational brochures. This diversity in health education strategies helps convey information in a simple and effective way, ensuring participants understand key concepts. The control group did not receive any educational interventions during this period.

Evaluation: The efficacy of the nurse-led TPB-based health education on hemodialysis treatment adherence was estimated by comparing the participants' results within and between groups over time in a post-test 1 (T1) immediately after completing the educational program and a post-test 2 (T2) after two months of the program. This second test was necessary to ensure that the change resulting from the educational program would continue over time (Figure 1).

Statistics

Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to measure the patients' characteristics prior to the pretest. Inferential statistics, including the chi-square and Mann–Whitney tests, were used to determine homogeneity between groups. The Friedman test was used to calculate changes in the degrees of adherence, knowledge/perception, and TPB constructs for two groups over time. A post-hoc Wilcoxon paired test with Bonferroni correction was used to determine where changes in patients' scores occurred (Pereira *et al.*, 2015). Finally, the Spearman test was used to measure the correlation between variables.

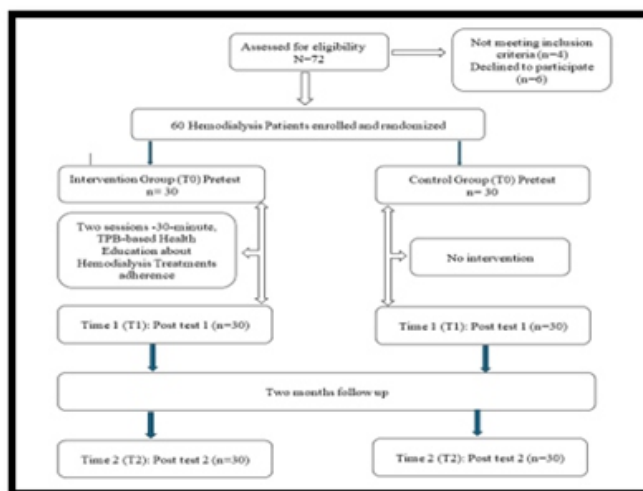


Figure 1: The Research Process

Ethical Considerations

The researchers obtained ethical clearance from the Collegiate Committee for Medical Research Ethics at the University of Mosul, Iraq, with reference number 45-CCMRE-Nur-24 16) on 28th October 2024.

RESULTS

Sample Pretesting, Characteristics, and Homogeneity between Groups

Table 1 shows that the largest proportion of participants belonged to the 60–69 years age group (21.7%). Regarding other demographic characteristics, most participants were male (58.3%), married (61.7%), illiterate (60.0%), and residing in urban areas (61.7%). Furthermore, no statistically significant differences were observed between the experimental and control groups at the pretest (T0) across the majority of studied variables ($p > 0.05$), indicating homogeneity between the two groups at baseline.

Table 1: Pretest Sample Characteristics and Homogeneity between Groups (n = 60)

Characteristics	Experimental group		Control group		Total		Test for association	
	Freq.	%	Freq.	%	Freq.	%	χ^2	p
Age								
10–19 years	1	3.3	4	13.3	5	8.3	6.779	0.342
20–29 years	3	10.0	1	3.3	4	6.7		
30–39 years	5	16.7	3	10.0	8	13.3		
40–49 years	4	13.3	5	16.7	9	15.0		
50–59 years	4	13.3	8	26.7	12	20.0		
60–69 years	9	30.0	4	13.3	13	21.7		
70+ years	4	13.3	5	16.7	9	15.0		
Gender								
Male	17	56.7	18	60.0	35	58.3	0.069	0.793
Female	13	43.3	12	40.0	25	41.7		
Social Status								
Single	6	20.0	8	26.7	14	23.3	2.456	0.483
Married	19	63.3	18	60.0	37	61.7		
Divorced	2	6.7	0	0.0	2	3.3		
Widowed	3	10.0	4	13.3	7	11.7		
Educational Level								
Illiterate	19	63.3	17	56.7	36	60.0	2.244	0.523
Elementary	8	26.7	12	40.0	20	33.3		
Middle School	2	6.7	1	3.3	3	5.0		
Tertiary Above	1	3.3	0	0.0	1	1.7		
Residence								
Urban	18	60.0	19	63.3	37	61.7	0.071	0.791
Rural	12	40.0	11	36.7	23	38.3		
Causes of Hemodialysis								
Excess Weight	0	0.0	0	0.0	0	0.0	NS	NS
Chronic Disease	30	100.0	30	100.0	60	100.0		
Kidney Transplant								
Yes	1	3.3	0	0.0	1	1.7	1.01	0.313
No	29	96.7	30	100.0	59	98.3		

Note: Freq= Frequency; %= Percentage; Significant at $p < 0.05$; N.S. = Not Significant; p values in this table are non-significant; χ^2 = Chi-square test

As shown in Table 2, the Mann–Whitney U Test revealed statistically significant differences between the experimental and control groups in hemodialysis adherence, medication adherence, and total treatment adherence, with higher mean scores observed in the control group ($p < 0.05$). No statistically significant differences were found between the two groups regarding fluid and diet adherence.

Additionally, there were no significant differences between groups in knowledge/perception domains or in the constructions of the Theory of Planned Behavior, including attitudes, subjective norms, perceived behavioral control, and intention ($p > 0.05$), indicating comparable psychosocial and cognitive characteristics between the groups.

Table 2: Pretest Comparison of Treatment Adherence, Knowledge/Perception, and Theory of Planned Behavior Constructs between Experimental and Control Groups

Variables	Experimental group		Control group		Test for association	
	M	SD	M	SD	Z	p
Hemodialysis Adherence	530.00	86.70	565.00	90.16	-2.22	0.02*
Medication Adherence	170.00	46.60	191.66	26.53	-2.19	0.02*
Fluid Adherence	95.00	33.08	81.66	42.51	-1.03	0.29
Diet Adherence	88.33	36.39	85.00	39.71	-0.456	0.64
Total Treatment Adherence	849.00	104.92	892.33	120.83	-2.11	0.03*
Knowledge/Perception about Hemodialysis	8.80	2.02	8.56	2.04	-0.456	0.64
Knowledge/Perception about Medication	8.40	1.58	8.70	1.39	-1.08	0.27
Knowledge/Perception about Fluid Restriction	7.36	2.78	7.03	3.01	-0.40	0.68
Knowledge/Perception about Diet Restriction	7.90	2.02	7.50	2.41	-0.68	0.49
Total (Knowledge/Perception)	32.46	4.70	31.80	5.14	-0.53	0.59
Behavioral Beliefs	17.53	1.47	16.96	1.71	-1.43	0.15
Outcome Evaluation	17.53	1.30	17.83	1.55	-0.78	0.43
Attitude	35.06	2.27	34.80	2.95	-0.64	0.52
Normative Beliefs	10.96	0.66	11.00	0.83	-0.45	0.64
Motivation to Follow	10.70	0.91	10.83	0.79	-0.62	0.53
Subjective Norms	21.66	1.26	21.83	1.51	-0.73	0.46
Controlling Beliefs	15.70	1.08	15.70	1.17	-0.05	0.95
Perceived Power	14.20	0.84	14.40	0.85	-1.04	0.29
Perceived Behavioral Control	29.90	1.44	30.10	1.78	-0.75	0.45
Intention	7.76	0.93	7.96	0.61	-0.91	0.36

Note: M= Mean; SD= Standard Deviation; Z= Z-Score test; p significant at 0.05; χ^2 = Chi-square test; ($p < 0.05$) indicated in bold(*) are significant

Determining Changes in Adherence Behavior, Knowledge/Perceptions, and TPB Constructs among Groups Over Time

As shown in Table 3, the mean scores of treatment adherence, knowledge/perception, and TPB constructs among participants in the experimental group significantly improved at T1 and T2 compared with baseline (T0) ($p < 0.05$). No statistically significant differences were observed between T1 and T2, indicating stability of the intervention effect over time.

From another perspective, the observed effect sizes ranged from 0.300 to 1.000, reflecting moderate to large intervention effects. Furthermore, the 95% confidence intervals for these effect sizes did not include zero for most variables, indicating that the observed improvements were statistically reliable and not attributable to random variation.

In contrast, the Friedman Test revealed no statistically significant changes over time among variables in the control group. These findings support the effectiveness of the TPB-based health education intervention in improving treatment adherence behaviors among hemodialysis patients.

Table 3: Change in Scores of Treatment Adherence, Knowledge/Perception, and TPB Constructs for the Experimental Group over Time (n = 30)

Variables	M(SD)			X ²	p	Effect size	95% CI
	T0	T1	T2				
Adherence Area							
Hemodialysis	530.00(86.70) ^a	600.00 (0.00) ^b	600.00(0.00) ^b	28.00	0.000	0.467	0.29 – 0.64
Medication	170.00(46.6) ^a	196.66(18.25) ^b	196.66(18.25) ^b	18.00	0.000	0.300	0.14 – 0.46
Fluid	95.00(33.08) ^a	141.66(18.95) ^b	141.66(18.95) ^b	44.00	0.000	0.733	0.58 – 0.89
Diet	88.33(36.39) ^a	126.66 (34.07) ^a	131.66(27.80) ^a	35.18	0.000	0.586	0.42 – 0.75
Total TA	849.00(104.92) ^a	992.33(25.20) ^b	992.33(25.20) ^b	52.00	0.000	0.867	0.74 – 0.99
Knowledge/Perception							
Hemodialysis	8.80(2.02) ^a	9.40 (0.49) ^a	9.40 (0.49) ^a	8.00	0.018	0.133	0.00 – 0.29
Medication	8.40(1.58) ^a	9.00 (.00) ^a	9.00 (0.00) ^a	12.00	0.002	0.200	0.04 – 0.36
Fluid Restriction	7.36 (2.78) ^a	9.13 (0.34) ^b	9.13 (0.34) ^b	22.00	0.000	0.367	0.20 – 0.53
Diet Restriction	7.90(2.02) ^a	9.10 (0.40) ^b	9.10 (0.40) ^b	24.00	0.000	0.400	0.23 – 0.57
Total Knowledge/ Perception	32.46 (4.70) ^a	36.63 (0.85) ^b	36.63 (0.85) ^b	46.00	0.000	0.767	0.61 – 0.92
TPB Concepts							
Behavioral Beliefs	17.53(1.47) ^a	28.20 (0.88) ^b	24.83 (1.26) ^c	60.00	0.000	1.000	0.88 – 1.00
Outcome Evaluation	17.53(1.30) ^a	28.16 (0.74) ^b	24.60 (1.42) ^c	60.00	0.000	1.000	0.88 – 1.00
Attitude	35.06(2.27) ^a	56.36(1.21) ^b	49.43 (2.41) ^c	60.00	0.000	1.000	0.88 – 1.00
Normative Beliefs	10.96 (0.66) ^a	16.20 (0.48) ^b	15.03 (0.61) ^c	57.47	0.000	0.958	0.84 – 1.00
Motivation to Follow	10.70 (0.91) ^a	16.16 (0.64) ^b	14.80 (0.88) ^c	58.20	0.000	0.970	0.86 – 1.00
Subjective Norms	21.66 (1.26) ^a	32.36 (0.99) ^b	29.83 (1.28) ^c	58.61	0.000	0.977	0.87 – 1.00
Controlling Beliefs	15.70(1.08) ^a	24.43 (0.77) ^b	21.70 (1.08) ^c	60.00	0.000	1.000	0.88 – 1.00
Perceived Power	14.20(0.84) ^a	20.63(.88) ^b	19.30 (0.91) ^c	55.86	0.000	0.931	0.80 – 1.00
Perceived Behavioral Control	29.90 (1.44) ^a	45.06(1.38) ^b	41.00 (1.23) ^c	60.00	0.000	1.000	0.88 – 1.00
Intention	7.76(0.93) ^a	12.66 (0.75) ^b	10.76 (0.85) ^c	60.00	0.000	1.000	0.88 – 1.00

Note: Superscript letters (a, b, c) indicate significant differences between groups (p < 0.05); Groups not sharing a common letter are significantly different according to the Friedman test, followed by Wilcoxon signed-rank tests with Bonferroni correction for multiple comparison; X² = Chi-square test

Assessing the Association between TPB Constructs and Treatment Adherence

Table 4 indicates the association between TPB constructs and treatment adherence for experimental group participants in post-test 1 (T1). The results of the Spearman Test showed a strong positive correlation between intention to treatment adherence and attitude (r = 0.442) and Perceived Behavioral Control (PBC; r = 0.471). Furthermore, intention was positively associated with treatment adherence behavior (r = 0.391).

Table 4: Association between TPB Constructs and Treatment Adherence for Experimental Group Participants in Post-test 1

No.	Variables	1	2	3	4	5	6	7	8	9	10
1.	Behavioral Beliefs										
2.	Outcome Evaluation	0.075									
3.	Attitude	0.862	0.536								
4.	Normative Beliefs	0.106	-0.045	0.036							
5.	Motivation to Follow	0.506	0.199	0.486	0.470						
6.	Subjective Norms	0.416	0.073	0.339	0.803	0.873					
7.	Controlling Beliefs	0.335	-0.195	0.181	0.470	0.278	0.368				
8.	Perceived Power	0.465	-0.067	0.374	0.122	0.318	0.214	0.367			
9.	Perceived Behavioral Control	0.528	-0.124	0.389	0.324	0.368	0.342	0.791	0.843		
10.	Intention	0.174	0.241	0.442	0.000	-0.070	0.037	0.224	0.051	0.471	
11.	Treatment Adherence										0.391

Note: p significant at 0.05; Significant r value (p < 0.05) indicated in bold

DISCUSSION

The findings of this randomized controlled trial indicated that nurse-led health education based on TPB significantly improved hemodialysis treatment adherence. A structured, instructional guideline based on TPB was used to ensure consistency in the implementation of the interventions. The same educator delivered all

health education sessions, which followed a standardized structure and used similar teaching materials (Szucs *et al.*, 2021). Interactive discussions and feedback were used to encourage participant engagement (Zhang & Hyland, 2022). These teaching methods and strategies ensured precise application of the intervention, thereby increasing the program's replicability in similar dialysis centers. Notably, all core TPB constructs significantly improved among participants in the intervention group after health education. No change was observed among participants in the control group. Specifically, subjects in the experimental group showed more positive attitudes toward adherence, greater perceived behavioral control, and stronger intentions to comply with prescribed hemodialysis treatment. Furthermore, the study results demonstrated significant improvements in treatment adherence, knowledge, and perception scores of the experimental group participants after education (Naskar & Lindahl, 2026).

These results highlight the importance of TPB-based health education in improving treatment adherence behaviors and addressing the longstanding issue of patient nonadherence in ESRD. The observed large effect size across all aspects of medication adherence and the TPB construct suggests that TPB-based health education has substantial potential to prevent nonadherence to treatment among hemodialysis patients. Therefore, the results of the present study align with those of the study of Sheikh *et al.* (2022) regarding the necessity of integrating theory-driven educational and behavioral interventions into routine ESRD patient care to enhance long-term treatment adherence and improve patient outcomes. Future research should investigate how long these effects last and evaluate their impact on clinical endpoints, such as reduced hospitalizations or improved dialysis adequacy. The study results imply that the intention to adhere to treatment increases as positive attitudes toward adherence and PBC grow. Therefore, a positive attitude and PBC are crucial in shaping the treatment adherence behavior of hemodialysis patients. This result aligns with the studies of Javaran *et al.* (2020) and Suh (2021), which highlighted the significant role of attitude and PBC in treatment adherence behaviors.

The study results indicated that intention is associated with treatment adherence. This implies that the stronger the intention, the greater the adherence and the fewer the complications. These results are consistent with those from the study of Sheikh *et al.* (2022), which revealed a positive correlation between hemodialysis treatment adherence score and intention to adhere as well as a strong positive association between intention and each of perceived positive attitude and perceived behavioral control. The relationship between attitude, PBC, intention, and treatment adherence sheds light on how future nursing health education programs for dialysis patients should be designed to maximize benefits and develop sustainable, realistic solutions to the problem of not adhering to treatment. This will improve patient health outcomes and quality of life (Ajzen, 2020).

The current findings illustrate substantial clinical and practical implications. Healthcare providers, especially nurses, can use TPB-based health education to encourage dialysis patients with kidney failure to adhere to treatment, which could reduce clinical consequences due to kidney failure. This uniform and structured approach to education can be easily incorporated into routine dialysis sessions and delivered by trained nursing staff without requiring additional resources. This makes the educational program practical, cost-effective, and applicable to similar clinical settings.

Limitations

This study encountered challenges at several levels, which may have impacted the generalizability and depth of the results. First, although the sample size calculation showed that the number of subjects recruited was sufficient to run the study, increasing the sample size could provide more substantial indications of the intervention's effect size and enable broader inferences or application of the results to a larger population. Second, the communication and comprehension issues regarding the health status of the participants, who were patients undergoing hemodialysis, caused problems in transmitting information to them. Some patients had difficulty comprehending the information provided.

CONCLUSION

The present study showed that nursing health education based on TPB is effective in improving treatment adherence among hemodialysis patients. The study clarified that attitudes and PBC play a significant role in treatment adherence for hemodialysis. Therefore, this study recommends applying the TPB framework to design nursing health education programs that focus explicitly on patients' attitudes and PBC with respect to hemodialysis treatment adherence. The study is clinically important because it highlights changes in treatment adherence among patients with hemodialysis. Moreover, its findings are important to find a solution to the problem of not adhering to hemodialysis treatment. Future studies should focus on generalizing the application of theory-based nurse-led health education to improve treatment adherence for other chronic diseases such as hypertension and diabetes.

Recommendation

The current study recommends that nurses use TPB as a framework for health education programs to improve treatment adherence among hemodialysis patients.

Conflicts of Interest

The authors declare that they have no competing interests.

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