

Factors Associated with Hemodialysis Adherence Among Patients with Chronic Kidney Disease at Murni Teguh Memorial Hospital, Medan, in 2025

Faktor-Faktor yang Berhubungan dengan Kepatuhan Hemodialisis pada Pasien Penyakit Ginjal Kronik di Rumah Sakit Murni Teguh Medan Tahun 2025

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Abstract

Background: Hemodialysis adherence requires sustained engagement with a demanding treatment regimen. **Objective:** To examine factors associated with adherence at Murni Teguh Memorial Hospital, Medan. **Methods:** This analytical cross-sectional study included 172 purposively selected patients. Adherence was assessed using a modified six-item End-Stage Renal Disease Adherence Questionnaire. Associations were examined using chi-square tests and multivariable logistic regression. **Results:** Overall, 115 patients (66.9%) were adherent. Education, knowledge, and family support were associated with adherence (all $p < 0.001$), whereas age, sex, and dialysis duration were not ($p = 0.866$, 0.357 , and 0.212 , respectively). Adherence was 92.6% with good family support and 5.9% with poor support. Family support was the only significant adjusted term ($\text{Exp}[B] = 416.36$; 95% confidence interval [CI], 43.08–4024.31); sparse discordant observations and the wide interval limited precision. A post hoc unadjusted Firth analysis yielded an odds ratio of 164.10 (95% CI, 51.86–694.10). **Conclusion:** Family support was strongly associated with self-reported adherence. Family-centered counseling merits evaluation, but the cross-sectional design and imprecise estimates preclude causal interpretation.

Keywords: chronic kidney disease; family support; hemodialysis; treatment adherence; treatment knowledge

Abstrak

Latar Belakang: Kepatuhan hemodialisis memerlukan keterlibatan berkelanjutan dalam regimen terapi yang kompleks. **Tujuan:** Menganalisis faktor-faktor yang berhubungan dengan kepatuhan di Rumah Sakit Murni Teguh Medan. **Metode:** Penelitian analitik potong lintang ini melibatkan 172 pasien yang dipilih secara purposif. Kepatuhan dinilai menggunakan modifikasi enam butir End-Stage Renal Disease Adherence Questionnaire. Hubungan antarvariabel dianalisis menggunakan uji chi-square dan regresi logistik multivariabel. **Hasil:** Sebanyak 115 pasien (66,9%) tergolong patuh. Pendidikan, pengetahuan, dan dukungan keluarga berhubungan dengan kepatuhan (seluruhnya $p < 0,001$), sedangkan usia, jenis kelamin, dan lama hemodialisis tidak menunjukkan hubungan bermakna (masing-masing $p = 0,866$; $0,357$; dan $0,212$). Kepatuhan mencapai 92,6% pada kelompok dukungan keluarga baik dan 5,9% pada kelompok dukungan kurang. Dukungan keluarga merupakan satu-satunya variabel yang bermakna setelah penyesuaian ($\text{Exp}[B] = 416,36$; interval kepercayaan [IK] 95%, 43,08–4024,31); sedikitnya pengamatan yang berlawanan dengan pola utama dan lebarnya interval membatasi presisi estimasi. Analisis Firth tanpa penyesuaian secara post hoc menghasilkan odds ratio 164,10 (IK 95%, 51,86–694,10). **Kesimpulan:** Dukungan keluarga berhubungan kuat dengan kepatuhan yang dilaporkan pasien. Konseling berpusat pada keluarga layak dievaluasi, tetapi desain potong lintang dan estimasi yang kurang presisi tidak memungkinkan interpretasi kausal.

Kata kunci: dukungan keluarga; hemodialisis; kepatuhan terapi; pengetahuan terapi; penyakit ginjal kronik



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Introduction

Chronic kidney disease (CKD) is a major public health challenge, with substantial implications for patients, families, and health systems. An international consensus estimated that approximately 700 million people live with CKD worldwide [1]. A systematic analysis also documented a considerable burden across Asia, although prevalence estimates varied with population characteristics and diagnostic methods [2]. For patients who develop kidney failure, hemodialysis remains a major form of kidney replacement therapy [3].

In Indonesia, Riskesdas 2018 reported a prevalence of doctor-diagnosed chronic kidney disease of 0.38% among people aged 15 years or older [4]. This diagnosis-based estimate should not be equated with prevalence established through systematic kidney-function and albuminuria testing. At Murni Teguh Memorial Hospital in Medan, service records described an average monthly hemodialysis caseload of 309 patients. The hospital participates in the Jaminan Kesehatan Nasional/BPJS Kesehatan service framework; nevertheless, access to scheduled care does not necessarily remove practical difficulties related to transportation, family assistance, or understanding treatment requirements.

Comprehensive dialysis care combines the prescribed dialysis treatment with nutritional, medication, and psychosocial management [5]. Adherence therefore extends beyond attendance to include completion of prescribed sessions, medication use, fluid restriction, and dietary recommendations [6]. The End-Stage Renal Disease Adherence Questionnaire (ESRD-AQ) was developed to assess several of these behaviors in patients receiving in-center hemodialysis [7]. Studies have linked non-adherence to treatment-related problems and adverse clinical outcomes, underscoring the importance of evaluating the complete regimen rather than attendance alone [8–10]. Adherence reflects the interaction of individual understanding, treatment demands, psychosocial resources, and the care environment. Contemporary studies identify perceived social support and self-care capacity as relevant components of this process [11,12]. Indonesian and international research has also examined health literacy, medication adherence, and nutrition-related behaviors, with associations differing across instruments and patient groups [13–16]. Family involvement warrants particular attention because assistance with travel, daily routines, and emotional adjustment may coexist with considerable caregiver burden [17,18].

Locally relevant evidence is needed to distinguish potentially modifiable support needs from demographic differences in adherence. This study examined the associations of age, sex, educational attainment, dialysis duration, treatment knowledge, and family support with hemodialysis adherence at Murni Teguh Memorial Hospital. It also assessed which factors remained statistically associated with the outcome in a multivariable model.

Methods

Study design, setting, and participants

An analytical cross-sectional study was conducted in the hemodialysis unit of Murni Teguh Memorial Hospital, Medan, Indonesia. The target population comprised patients with CKD receiving maintenance hemodialysis. The unit's reported average monthly caseload of 309 patients provided the service context for recruitment; it was not a count of unique eligible patients approached for this study.

Patients presenting to the unit were assessed against the eligibility criteria and enrolled purposively until 172 participants had been included. The specified inclusion criteria were receipt of hemodialysis for at

least three months, an ability to communicate and read and write, stable hemodynamic status, and willingness to provide written informed consent. Patients who were not receiving hemodialysis routinely were excluded. This facility-based, non-probability approach selected patients available during treatment and did not provide every patient in the wider CKD population with a known probability of inclusion.

Variables and measurements

Data were collected through structured questionnaires and interviews. Age was categorized as >65 or ≤65 years, and sex as male or female. Educational attainment was classified as higher education, secondary education (senior high school), or low education (primary or junior high school). Dialysis duration was categorized as ≤4 or >4 years.

Treatment knowledge was assessed with ten true-or-false statements addressing the purposes of hemodialysis, removal of excess fluid, consequences of missed treatment, session frequency and duration, and medication, fluid, and dietary requirements. The questionnaire included positively and negatively worded statements; examples addressed whether hemodialysis removes toxins and whether sessions may be shortened. Scores of ≥6 were categorized as high knowledge and scores of <6 as low knowledge.

Family support was assessed using seven items covering accompaniment to dialysis, encouragement to attend, assistance with fluid and dietary management, information-seeking, availability of help, and satisfaction with support. Each item was scored from 1 (never) to 5 (always), giving a possible total of 7–35. Scores of ≥34 were classified as good support and scores of <34 as poor support. These labels refer to the study's operational categories rather than a universal clinical classification.

Adherence was assessed using a locally modified six-item ESRD-AQ behavioral questionnaire [7]. The items covered missed dialysis sessions, the frequency and extent of session shortening, medication-taking, fluid restriction, and dietary adherence. Attendance and shortening items referred to the preceding month, whereas medication, fluid, and dietary items referred to the preceding week. A score of ≥800 defined adherence and a score of <800 defined non-adherence. This threshold was the operational criterion used in the study; the composite outcome should not be interpreted as an objective measure of dialysis attendance alone.

Statistical analysis

Categorical variables were summarized as frequencies and percentages. Adherence percentages within each factor category used the category total as the denominator. Bivariate associations were assessed using Pearson's chi-square tests. Variables with $p < 0.25$ in bivariate screening—education, knowledge, dialysis duration, and family support—were entered jointly into the multivariable logistic model. The modeled event was non-adherence (1), with adherence coded as 0. Regression coefficients, standard errors, exponentiated coefficients, and 95% confidence intervals (CIs) are presented on the original analysis scale. Education was represented by a single ordered-category term. Statistical significance was defined as a two-sided $p < 0.05$.

Adherence proportions are presented with 95% Wilson CIs. A post hoc, unadjusted Firth-penalized logistic regression assessed the association between family support and adherence, with good support coded as 1, poor support as 0, adherence as 1, and non-adherence as 0 [19]. This sensitivity analysis used the four observed family-support/adherence cell counts and profile penalized-likelihood CIs. It evaluated small-sample bias in the unadjusted association and was distinct from the multivariable model. Sparse outcome cells were not, by themselves, taken as evidence of complete or quasi-complete separation [20].

Research Ethics

Participation was voluntary and required written informed consent. Participants were informed that their responses would remain confidential and would be used for research purposes. Institutional permission to conduct the study was obtained from Murni Teguh Memorial Hospital.

Results and Discussion

Research Results

The analysis included 172 participants, of whom 115 were classified as adherent (66.9%; 95% Wilson CI, 59.5–73.5%) and 57 as non-adherent (33.1%). Most participants were female, had received hemodialysis for ≤4 years, and were classified as having high treatment knowledge and good family support (Table 1).

Table 1. Participant characteristics and self-reported hemodialysis adherence (N = 172).

Characteristic	Category	n	%
Age	>65 years	95	55.2
	≤65 years	77	44.8
Sex	Male	73	42.4
	Female	99	57.6
Education	Higher	35	20.3
	Secondary (senior high school)	91	52.9
	Low (primary/junior high school)	46	26.7
Dialysis duration	≤4 years	149	86.6
	>4 years	23	13.4
Knowledge	High	102	59.3
	Low	70	40.7
Family support	Good	121	70.3
	Poor	51	29.7
Adherence	Adherent	115	66.9
	Non-adherent	57	33.1

Percentages use the total sample as the denominator and may not sum to 100.0% because of rounding. The reported mean monthly unit caseload was 309 patients; the study sample comprised 172 purposively enrolled participants.

Educational attainment, treatment knowledge, and family support were associated with adherence in bivariate analysis (all $p < 0.001$; Table 2). Adherence was 91.4% in the higher-education group, 73.6% in the secondary-education group, and 34.8% in the low-education group. It was also higher among participants with high rather than low knowledge (87.3% versus 37.1%) and good rather than poor family support (92.6% versus 5.9%). Age, sex, and dialysis duration did not show statistically significant associations ($p = 0.866$, 0.357, and 0.212, respectively).

Table 2. Bivariate associations between participant characteristics and hemodialysis adherence (N = 172).

Factor/category	Adherent, n (%)	Non-adherent, n (%)	Total, n	p-value
Age >65 years	63 (66.3)	32 (33.7)	95	0.866
Age ≤65 years	52 (67.5)	25 (32.5)	77	
Male	46 (63.0)	27 (37.0)	73	0.357
Female	69 (69.7)	30 (30.3)	99	
Higher education	32 (91.4)	3 (8.6)	35	<0.001
Secondary education	67 (73.6)	24 (26.4)	91	
Low education	16 (34.8)	30 (65.2)	46	
High knowledge	89 (87.3)	13 (12.7)	102	<0.001
Low knowledge	26 (37.1)	44 (62.9)	70	
Dialysis ≤4 years	97 (65.1)	52 (34.9)	149	0.212
Dialysis >4 years	18 (78.3)	5 (21.7)	23	
Good family support	112 (92.6)	9 (7.4)	121	<0.001
Poor family support	3 (5.9)	48 (94.1)	51	

Percentages are calculated within each category. Each p-value is from a two-sided Pearson chi-square test for the complete factor, not a separate test for each category. Knowledge: high, score ≥6; low, score <6. Family support: good, score ≥34; poor, score <34.

Figure 1 displays the corresponding adherence proportions with 95% Wilson CIs. The poor-support group had the lowest observed adherence, although its CI was relatively wide because only three participants in that group were adherent.

In the multivariable model, family support was the only term with a coefficient significantly different from zero ($B = 6.032$; $p < 0.001$; $\text{Exp}[B] = 416.364$; 95% CI, 43.078–4024.308). Education, knowledge, and dialysis duration were not statistically significant after joint adjustment (Table 3). The family-support estimate was large but imprecise and should not be interpreted as a probability ratio or a causal effect.

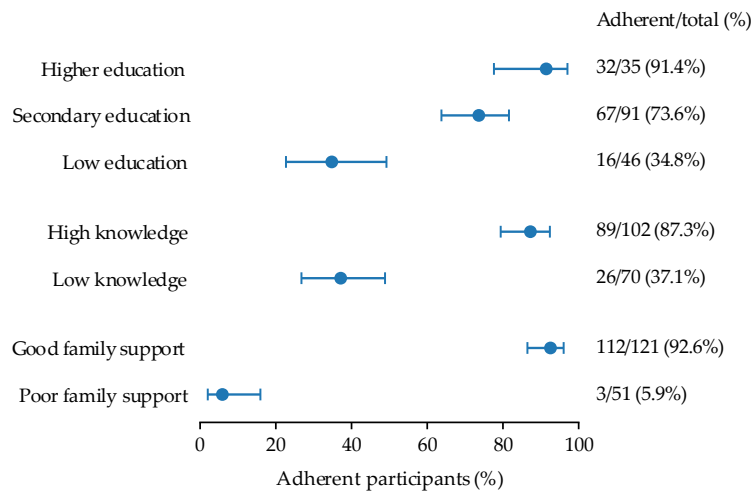


Figure 1. Self-reported hemodialysis adherence by educational attainment, treatment knowledge, and family support. Points indicate percentages; horizontal error bars indicate 95% Wilson confidence intervals. Counts show adherent participants divided by the category total. Estimates were calculated from the cross-tabulated counts in Table 2.

Table 3. Multivariable logistic regression for non-adherence to hemodialysis (N = 172).

Term	B	SE	p-value	Exp(B)	95% CI
Education	0.309	0.555	0.577	1.362	0.459–4.041
Knowledge	-1.192	1.144	0.297	0.304	0.032–2.856
Dialysis duration	-1.019	1.023	0.319	0.361	0.049–2.678
Family support	6.032	1.157	<0.001	416.364	43.078–4024.308
Intercept	-2.501	0.571	<0.001	0.082	—

The modeled event was non-adherence (1), with adherence coded as 0. Terms are presented on the original predictor-coding scale; education was fitted as one ordered-category term. B, regression coefficient; SE, standard error; Exp(B), exponentiated coefficient; CI, confidence interval. The intercept is included; its CI was not reported.

The unadjusted odds ratio for adherence with good versus poor family support was 199.11, based on 112 adherent and nine non-adherent participants with good support, compared with three adherent and 48 non-adherent participants with poor support. The corresponding Firth-penalized estimate was 164.10 (95% profile penalized-likelihood CI, 51.86–694.10). Thus, bias reduction attenuated the unadjusted estimate without removing the marked association. This comparison does not establish the stability of the adjusted coefficient in Table 3.

Discussion

Approximately one-third of participants were classified as non-adherent to the composite hemodialysis regimen. This finding is relevant to clinical practice because attendance, session completion, medication-taking, and fluid and dietary behaviors represent related but distinct treatment demands. Studies from other settings likewise document variation across adherence domains and clinically important consequences of non-adherence [8–10]. Direct comparisons of prevalence nevertheless require similar instruments, recall periods, and thresholds; the present estimate is specific to the operational definition used in this study.

The observed educational gradient was substantial, but educational attainment should not be treated as equivalent to health literacy. Schooling may facilitate access to health information, whereas health literacy also involves understanding, appraisal, and application. Indonesian studies have linked these competencies to medication adherence and described how patients seek and use information during maintenance hemodialysis [13,14]. A review of nutrition-related adherence similarly identified an association with health literacy, while emphasizing variation in its measurement [15]. Education was not statistically significant in the multivariable model here, but that finding neither excludes a clinically relevant association nor demonstrates mediation through knowledge or family support. The study did not establish a temporal pathway between these factors.

High treatment knowledge was associated with greater adherence in the bivariate analysis. However, factual understanding does not ensure that patients can implement recommendations when practical or psychosocial barriers persist. This distinction helps contextualize the weak, non-significant health-literacy/medication-adherence correlation reported by Hamza and colleagues in a Pakistani sample [16]. Their study assessed broader health literacy and medication-taking, whereas the present study used ten treatment-specific knowledge statements and a composite adherence outcome. Differences in the constructs, instruments, clinical eligibility, and care settings make the findings complementary rather than directly contradictory. Education should therefore connect understanding with feasible daily routines instead of relying on information provision alone.

Family support showed the clearest contrast in observed adherence. Assistance with transportation, reminders, dietary routines, and communication with clinicians offers plausible explanations for this association, consistent with evidence on perceived social support and self-care management [11,12]. Indonesian studies have also reported associations involving family support or caregiver burden [17,18]. The present findings do not show that any particular support activity caused better adherence, because support was measured as a composite perception at the same time as the outcome.

The relationship may also be bidirectional. Patients who maintain treatment routines may perceive family relationships more positively, while relatives may adjust their involvement in response to illness severity, functional dependence, or previous treatment difficulties. Household resources, travel distance, depressive symptoms, and the quality of patient–clinician communication could influence both support and adherence. A 2025 multicenter dyadic study linked coping and mutuality to quality of life in patients receiving hemodialysis and their caregivers, reinforcing the relevance of shared relational processes without establishing an adherence mechanism in this sample [21]. These considerations argue against interpreting family support as an isolated or exclusively causal determinant.

The very large adjusted family-support coefficient warrants caution. Although the two-by-two table contains no zero cells, only three adherent participants reported poor support and nine non-adherent participants reported good support. This imbalance can contribute to sparse-data bias and wide intervals; formal separation depends on the joint configuration of all model covariates, not on the size of a single odds ratio [20]. The unadjusted Firth analysis provides a useful sensitivity check, but its CI still spans a broad range. Penalization reduces one source of estimation bias; it does not correct selection bias, measurement error, or unmeasured confounding [19]. The observed category-specific proportions are therefore more clinically transparent than treating the adjusted odds ratio as a precise measure of benefit.

The non-significant findings for age, sex, and dialysis duration should not be interpreted as evidence of equivalence or clinical irrelevance. Only 23 participants had received dialysis for >4 years, limiting precision for that subgroup, and dichotomization may obscure gradients within age and treatment duration. A multicenter study reported associations involving male sex and shorter dialysis duration [8], whereas more recent work on dietary adherence considered demographic factors alongside knowledge, support, and self-care ability [22]. Research in Qassim also described practical and health-related barriers to attendance [23]. Differences in outcome definitions, subgroup sizes, and service organization may account for divergent findings. Small or moderate associations could remain undetected in this sample.

The findings support evaluating a patient- and family-centered approach that respects patient autonomy. With the patient's agreement, a designated family member could join brief counseling sessions on the dialysis schedule, prescribed session duration, medication routines, and individualized fluid and dietary advice. Teach-back can be used to check understanding, followed by a written plan identifying transport arrangements, reminders, and whom to contact when attendance is threatened. Medication review is also relevant: a 2024 systematic review documented a substantial medication burden in dialysis-dependent CKD [24]. Such measures address the practical implementation of treatment rather than attributing non-adherence solely to patient motivation.

Family involvement should include assessment of caregiver well-being using a locally validated instrument, such as the Zarit Burden Interview, followed by discussion of workload and support needs. In a randomized trial of 80 patient–caregiver dyads, psychoeducation improved psychosocial outcomes and reduced Zarit-measured caregiver burden, but did not establish an effect on the composite adherence outcome studied here [25]. A 2026 review identified stress management, peer support, and structured self-management as potential burden-reduction strategies [26]. Digital education, including a recent trial of a story-based game [27], also warrants context-specific evaluation rather than assuming that benefits transfer unchanged between services.

Strengths and limitations

A strength of this study is its joint consideration of demographic, knowledge, and family-support factors in a clinically defined hemodialysis population. Its cross-sectional design, however, precludes determination of temporal order and causal effects. Purposive recruitment among patients attending treatment, together with the exclusion of non-routine attendees, may underrepresent those with the greatest attendance barriers. Literacy and hemodynamic-stability requirements further restrict generalizability. The results should therefore not be extrapolated directly to all patients with CKD or to dialysis services with different patient populations and access conditions.

Adherence and family support were assessed by self-report, creating potential recall and social-desirability bias. Shared reporting methods may also strengthen apparent associations between perceived support and favorable treatment behavior. The measurement properties of the locally modified instruments were not established in this analysis, and the support threshold of 34 out of 35 represents a particularly stringent operational cutoff. Objective attendance and session-duration records, alongside appropriately interpreted clinical measures, would provide complementary evidence. Dichotomized scores also discard information about gradations in knowledge and support.

Residual confounding remains possible because income, travel distance, depressive symptoms, comorbidity, functional status, treatment fatigue, and dialysis adequacy were not included. The imprecise family-support estimate and absence of internal validation preclude using this model for clinical prediction. The unadjusted sensitivity analysis does not resolve these limitations. Multicenter prospective studies with explicit coding, validated measurements, and internal validation are needed.

Conclusions

Among 172 patients receiving maintenance hemodialysis at Murni Teguh Memorial Hospital, 66.9% met the study's adherence criterion. Education, knowledge, and family support were associated with adherence in bivariate analysis; only family support remained statistically significant after adjustment. An unadjusted bias-reduced analysis supported this association, although estimates remained imprecise. These findings support evaluating family-centered counseling and practical assistance, but do not establish causality, a precise intervention effect, or generalizability beyond this single-center sample.

Conflict of Interest

The authors declare no conflict of interest related to this study.

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