Sains Medika: Jurnal Kedokteran dan Kesehatan

journal homepage: http://jurnal.unissula.ac.id/index.php/sainsmedika/

RESEARCH ARTICLE

Factors affecting quality of life in patients undergoing hemodialysis in Semarang, Indonesia

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ARTICLE INFO

Hemoglobin
Quality of Life
Hemodialysis

ABSTRACT

The quality of life in patients with chronic kidney disease (CKD) reflects how well an individual's needs are met across three physical, psychological, and social dimensions. Measuring a patient's quality of life (QoL) helps evaluate the effectiveness of CKD therapies. This study compares patients' clinical conditions categorised by their quality of life while undergoing hemodialysis therapy for chronic kidney failure. This study compares the clinical conditions of CKD patients undergoing hemodialysis based on their QoL, using a cross-sectional design involving 82 patients from Sultan Agung Islamic Hospital, Semarang. QoL was assessed with the WHOQOL-BREF questionnaire, and demographic data were collected through interviews. Clinical data was sourced from electronic medical records. Logistic regression analysis identified influencing variables on QoL. The sample was predominantly female (62.2%), with most patients over 45 years old, meeting minimum education standards (61%), and 67.1% unemployed. Most identified as Muslim and married, with 98.8% reporting strong family support. While bivariate analysis showed no significant impact of demographic or clinical variables on QoL, multivariate analysis indicated a significant relationship with haemoglobin levels. While other factors like family support and knowledge contribute to well-being, further research with larger, more varied samples is needed to better understand the quality-of-life influences for CKD patients on hemodialysis.

1. Introduction

Assessing the quality of life (QoL) in patients with chronic kidney disease (CKD) undergoing hemodialysis is essential, as it reflects not only the effectiveness of therapy but also correlates with patient morbidity and mortality. Furthermore, it offers valuable insights into how patients manage their daily lives while coping with the disease (Nemati *et al.,* 2017). QoL encompasses the degree to which an individual's needs are met across various life domains, typically evaluated through three interrelated dimensions: physical, psychological, and social (Estoque *et al.,* 2019). A change in one domain can significantly influence the others, underscoring the holistic nature of QoL assessments in chronic disease management. According to the World Health

https://doi.org/10.30659/sainsmed.v16i1.39560
Received 26 August 2024; Received in revised form 31 August 2024; Accepted 13 March 2025

Organization (WHO), QoL is defined as an individual's perception of their position in life within the context of their culture and value systems, and to their goals, expectations, standards, and concerns (Ravindran *et al.,* 2020).

CKD is characterized by structural or functional abnormalities of the kidneys leading to a persistent reduction in glomerular filtration rate for at least three months (Lim & Kwon, 2023). Globally, CKD affects approximately 850 million individuals, with a disproportionate burden in low- and lower-middle-income countries (LICs and LMICs). By 2040, CKD is projected to become the fifth leading cause of years of life lost (YLL) worldwide. In Indonesia, the prevalence of CKD increased from 2.0% in 2013 to 3.8% in 2018, marking a significant rise within five years (Hustrini *et al.,* 2022; Indonesian Ministry of Health, 2022). The continuous increase in CKD cases highlights the urgent need for appropriate and effective therapies.

End-stage renal disease, resulting from irreversible kidney damage, may stem from conditions such as progressive nephritis, obstructive uropathy, vascular complications of diabetes mellitus, and chronic hypertension. These contribute to renal fibrosis and the gradual loss of kidney function (Baroleh *et al.,* 2022). As kidney function declines, patients require renal replacement therapy—most commonly hemodialysis in the Indonesian context—to eliminate toxins and maintain metabolic stability (Kemenkes, 2023). While kidney transplantation remains an option, hemodialysis is the most widely accessible and utilised intervention in Indonesia due to its relative feasibility (Hustrini *et al.,* 2022).

Hemodialysis typically involves 10–15 hours of weekly treatment, divided into multiple sessions, to ensure physiological stability and maintain QoL (Bello *et al.,* 2022). Inadequate dialysis can result in severe complications and decreased QoL (Dembowska *et al.,* 2022). Patients often face a range of adverse effects, including uremia, peripheral neuropathy, pericarditis, bone disease, lethargy, worsening anaemia, anorexia, hypertension, oedema, dyspnea, fever, chest pain, muscle cramps, and bleeding at the vascular access site (Rammang *et al.,* 2020). While hemodialysis offers life-sustaining benefits such as uremic toxin removal and fluid-electrolyte balance, it can also negatively impact patient well-being (Liakopoulos *et al.,* 2017; Ikizler & Hakim, 1996). These impacts extend beyond physical health, affecting patients' social roles, mental health, employment status, sexual functioning, and overall outlook (Marianna & Astutik, 2018; Yuwono *et al.,* 2022).

Numerous studies have explored QoL in CKD patients undergoing hemodialysis, identifying various influencing factors. Rustandi et al. (2018) found that age, gender, income, depression, and family support significantly influence Qol in this population. Similarly, Rammang (2023) dentified age, occupation, duration of dialysis, and hemoglobin levels as key determinants. Given the multifaceted nature of QoL and its clinical significance, this study aims to assess the quality of life and the contributing factors among CKD patients undergoing hemodialysis therapy.

2. Materials and Methods

2.1. Study Design and Ethical Considerations Setting

This study employed a cross-sectional design and was conducted at Sultan Agung Islamic Hospital, Semarang, Indonesia, from February to September 2023. It received ethical approval from the Bioethics Commission of Sultan Agung Islamic Hospital, Semarang, Indonesia (Approval No. 113/KEPK-RSISA/V/2023). All participants provided written informed consent before data collection.

2.2. Population and Sample

A total sampling technique was used to recruit 79 patients undergoing hemodialysis at the study site. The inclusion criteria were ages between 18 and 60, undergoing hemodialysis at least twice a week for a minimum of three months, conscious and mentally capable of participating in interviews, and willing to provide informed consent. The exclusion criteria were non-compliance with scheduled hemodialysis, presence of dialysis disequilibrium syndrome, chronic heart failure (CHF) grade 3 or 4, diagnosed sepsis or malignancy, uncontrolled diabetes mellitus, and worsening clinical condition during data collection.

2.3. Quality of Life Assessment

Data were collected using structured interviews and medical record reviews. Demographic data included: age, gender, occupation, income, marital status, education, religion, and family support. Clinical characteristics include hemodialysis adequacy, duration of hemodialysis, type of vascular access, and haemoglobin levels.

The World Health Organisation Quality of Life – BREF (WHOQOL-BREF) assessed patients' quality of life (Qol). The WHOQOL-BREF questionnaire contains 26 items divided into four domains: physical health (7 items), psychological well-being (6 items), social relationships (3 items), and environment (8 items). It also includes two general questions on overall QoL and health. Items were scored using a 5-point Likert scale. Scores were transformed to a 0–100 scale using

the formula:

$$Final\ score = \frac{(Total\ Item\ Score - 24)}{96} \times 100$$

A domain score >50 indicated a good health-related quality of life.

2.4. Hemodialysis Adequacy

Hemodialysis adequacy was assessed using the formula:

$$Hemodialysis\ adequacy = \frac{Kt}{V},$$

where: K is urea clearance, t is duration of dialysis, and V is the distribution volume of urea in the body. According to the National Kidney Foundation (2015) for patients receiving hemodialysis three times per week, the recommended $\frac{Kt}{V}$ value is ≥1.2 (URR ≥65%), value ≥1.8 for those receiving hemodialysis twice per week.

2.5. Data Analysis

All data were analysed using SPSS version 25.00. Logistic regression analysis was performed to determine the associations between haemoglobin levels, dialysis adequacy, duration of hemodialysis, and patients' quality of life. A p-value <0.05 was considered statistically significant.

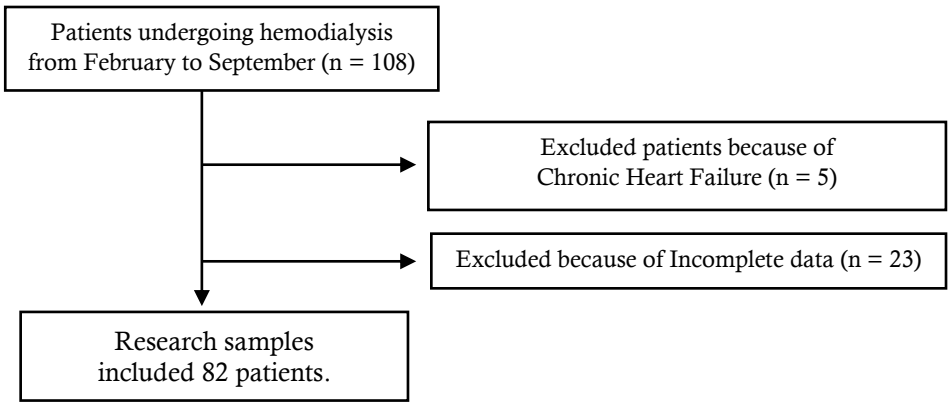

Figure 1. Diagram of participant selection in the study

Table 1. Demographic characteristics of hemodialysis patients (n = 82)

Variable	n (%)			*p* value of statistical analysis	
	Fair	Good	Total	Bivariate	Multivariate
Gender				0.065	0.910 (step 4)
• Man	21 (36.2)	14 (58.3)	35 (42.7)		
• Woman	37 (63.8)	10 (41.7)	47 (57.3)		
Age				0.971	0.548 (step 6)
• ≤ 45 years	22 (37.9)	9 (37.5)	31 (37.8)		
• > 45 years	36 (62.1)	15 (62.5)	51 (62.2)		
Education				0.094	0.050 (step 9)
• Below standard	26 (44.8)	6 (25)	32 (39.0)		
• Meets standard	32 (55.2)	18 (75)	50 (61.0)		
Occupation				0.279	0.419 (step 7)
• Unemployed	17 (29.3)	10 (41.7)	27 (32.9)		
• Employed	41 (70.7)	14 (58.3)	55 (67.1)		
Income				0.024*	0.056 (step 9)
• Below minimum standard	57 (98.3)	20 (83.3)	77 (93.9)		
• Above minimum standard	1 (1.7)	4 (16.7)	5 (6.1)		
Marital Status				0.502*	0.999 (step 3)
• Single	1 (1.7)	1 (4.2)	2 (2.4)		
• Married	57 (98.3)	23 (95.8)	80 (97.6)		
Religion				0.083	1 (step 2)
• Catholic	0	2 (8.3)	2 (2.4)		
• Muslim	58 (100)	22 (91.7)	80 (97.6)		
Family Support				0.707*	1 (step 1 and 2)
• Negative	1 (1.7)	0	1 (1.2)		
• Positive	57 (98.3)	24 (100)	81 (98.8)		

*Value was obtained from Fisher Exact Test

3. Results

3.1. Participant Characteristics

108 patients with chronic kidney disease (CKD) undergoing hemodialysis were initially enrolled in this study. After applying the inclusion and exclusion criteria, the final sample comprised 82 patients (Figure 1).

3.2. Demographic characteristics and their relationship with the quality of life (QoL) of hemodialysis patients

Table 1 shows that of 82 patients undergoing hemodialysis who participated in this study, the majority were female (57.3%), over 45 years of age (62.2%), and had an education level meeting the national standard (61.0%). Most patients were employed (67.1%) but earned below the minimum wage (93.9%). Nearly all were married (97.6%) and identified as Muslim (97.6%). Positive family support was reported by almost all participants (98.8%). Bivariate analysis showed that income (p = 0.024) was associated with QoL. However, in the multivariate logistic regression model, only education level showed a statistically significant association with QoL (p = 0.050 in step 9). Patients with education meeting the national standard were more likely to have good QoL.

3.3. Hemodialysis treatment characteristics and their relationship with the quality of life (QoL) of hemodialysis patients

Table 2 depicts that most patients (72.0%) had been undergoing hemodialysis for one year or less, with 59.8% using temporary vascular access. Adequate hemodialysis was reported in 67.1% of patients, and 64.6% had haemoglobin levels ≥ 8 mg/dL. From the bivariate analysis, none of the treatment-related variables showed a statistically significant association with QoL. However, in the multivariate model, haemoglobin level emerged as a significant predictor of QoL (p = 0.024 in step 9), with patients having haemoglobin levels ≥ 8 mg/dL being more likely to report good QoL.

3.4. Quality of Life (QoL) Overview

Table 3 shows that in terms of QoL domains, most patients had fair QoL in the physical (76.8%),

Table 2. Hemodialysis treatment characteristics of patients (n = 82)

Variable	n (%)			*p* value of statistical analysis	
	Fair	Good	Total	Bivariate	Multivariate
Duration of Hemodialysis				0.693	0.639 (step 5)
• ≤ 1 year	41 (70.7)	18 (75)	59 (72.0)		
• > 1 year	17 (29.3)	6 (25)	23 (28.0)		
Access Type				0.744	0.137 (step 9)
• Permanent	24 (41.4)	9 (37.5)	33 (40.2)		
• Temporary	34 (58.6)	15 (62.5)	49 (59.8)		
Hemoglobin Level				0.207	0.024 (step 9)
• < 8 mg/dL	23 (39.7)	6 (25)	29 (35.4)		
• ≥ 8 mg/dL	35 (60.3)	18 (75)	53 (64.6)		
Hemodialysis Adequacy				0.279	0.135 (step 9)
• Adequate	41 (70.7)	14 (58.3)	55 (67.1)		
• Not Adequate	17 (29.3)	10 (41.7)	27 32.9)		

Table 3. Quality of life (QoL) domain overview of hemodialysis patients (n = 82)

QoL Domain	n (%)			*p* value of statistical analysis	
	Fair	Good	Total	Bivariate	Multivariate
Physical				0.000	0.994 (step 9)
• Fair	56 (96.6)	7 (29.2)	63 (76.8)		
• Good	2 (3.4)	17 (70.8)	19 (23.2)		
Psychological				0.023	0.999 (step 8)
• Fair	58 (100)	21 (87.5)	79 (96.3)		
• Good	0	3 (12.5)	3 (3.7)		
Social				0.040	0.134 (step 9)
• Fair	47 (81.0)	12 (50.0)	59 (72.0)		
• Good	11 (19.0)	12 (50.0)	23 (28.0)		
Environmental				0.000	0.994 (step 9)
• Fair	28 (48.3)	1 (4.2)	29 (35.4)		
• Good	30 (51.7)	23 (95.8)	53 (64.6)		

psychological (96.3%), and social (72.0%) domains. However, in the environmental domain, 64.6% of patients reported good QoL. Bivariate analysis showed significant associations between overall QoL and the physical ($p < 0.001$), psychological ($p = 0.023$), social ($p = 0.040$), and environmental ($p < 0.001$) domains. However, in the final multivariate model (step 9), none of the QoL domains remained statistically significant predictors of overall QoL, likely due to the influence of confounding variables such as education and haemoglobin levels.

4. Disscussion

The research findings indicated that most respondents were female. This contrasts with previous studies conducted in Semarang, which generally report a higher prevalence of chronic kidney disease (CKD) among men (Prihatiningtias & Arifianto, 2017; Wahyuni *et al.,* 2020). However, this study aligns with global (García *et al.,* 2022; Um-E-kalsoom, 2020) and national survey data (Hustrini *et al.,* 2022), suggesting that CKD is more prevalent among women, although men are more likely to receive kidney transplant therapy. The discrepancy may stem from sampling techniques facilitating greater female participation, as women were more willing to engage in interviews and complete questionnaires. This is further supported by data from the Semarang Health Department, showing a greater prevalence of hypertension and diabetes among women—two major risk factors for CKD—with 161,877 (56%) female hypertension cases and 23,777 (59%) female diabetes cases, contributing to an estimated 1,449 new CKD cases in 2022 (Dinas Kesehatan Kota Semarang, 2023). Additionally, Kovesdy (2022) reported that globally, CKD prevalence in women is 11.8% higher than in men. Lewandowski et al. (2023) further noted higher rates of emergency room visits and outpatient appointments among women, indicating more frequent diagnosis and recording of pathological conditions. Despite these findings, gender was not a significant factor influencing quality of life (QoL) in either bivariate or multivariate analyses, although men reported a higher QoL. This could be attributed to socio-cultural factors in Indonesia, where men often receive greater familial support as heads of the household, contributing positively to their QoL (García *et al.,* 2022; Um-E-kalsoom, 2020).

Age-wise, most respondents were over 45 years old, with an average age of 47.48 years. This is consistent with the 2023 Indonesian Health Survey, which reported that most CKD patients are above 45 (Kementerian Kesehatan Republik Indonesia Badan Kebijakan Pembangunan Kesehatan, 2023). The 2018 National Basic Health Survey also indicated that 83.1% of adult patients under 60 required hemodialysis (Hustrini, 2023; Hustrini *et al.,* 2022). Notably, this study included a 24-year-old participant, reflecting an alarming trend of younger individuals experiencing CKD.

Educational attainment among respondents generally met or exceeded national minimum standards, with most having completed high school or equivalent education. This trend aligns with the education profile of Semarang City, Indonesia, where better access to facilities and the implementation of a 12-year compulsory education policy have supported higher educational outcomes. A significant relationship was observed between education level and QoL ($p=0.039$), indicating that higher education may improve patients' health literacy, adherence to treatment, and coping strategies.

Many respondents were unemployed and earned below the minimum income threshold. While most were covered by the national health insurance (BPJS), which facilitates hemodialysis access, employment status did not significantly affect QoL. The absence of a significant association between income and QoL ($p=0.063$) may be due to the strong familial support for non-medical needs such as food and transportation. Nevertheless, low income can still pose logistical challenges, especially for those far from treatment centres. Contrary to this study, Aisyah et al. (2022) found a positive correlation between economic status, hemodialysis adequacy, and QoL.

Most respondents were married, which is consistent with Indonesia's average marriage age of 21. Marital status was found to influence the social dimensions of QoL, as unmarried individuals may face emotional isolation and lack of support (Susanty *et al.,* 2022). Marriage, particularly at the early elderly stage, is common among CKD patients and offers emotional and practical support that can enhance coping and QoL.

Religious affiliation was predominantly Muslim (97.6%), reflecting the patient population served by Sultan Agung Islamic Hospital, a Sharia-compliant facility. While religion did not significantly influence QoL ($p=0.820$), spirituality was critical in shaping patients' health perspectives. Many patients viewed their illness as a divine test, fostering resilience and positive coping mechanisms (Puchalski, 2004; Silva *et al.,* 2023). Spiritual beliefs thus supported psychological well-being, even without a statistically significant relationship.

A commendable finding was the overwhelmingly high rate of family support reported (98.8%). This reflects cultural and religious norms in Semarang and Central Java, where caring for ill family members is a

deeply rooted value. In Islamic teachings, as emphasised in hadiths, filial piety is obligatory, encouraging family members to provide emotional and logistical support. This aligns with national studies indicating that family support for chronic illness patients is generally robust (Farzi *et al.,* 2018; Hulu *et al.,* 2021; Luthfa *et al.,* 2019; Yumni, 2023; Ulfah *et al.,* 2022).

Regarding clinical characteristics, while many patients had been on hemodialysis for over a year, most had received hemodialysis for less than one year (72%), and most used temporary access (59.8%). Despite the relatively short treatment duration, patients experienced significant lifestyle changes, including adaptation and stress. Haemoglobin levels averaged 8.45 mg/dl, with 72% having levels above 8 mg/dl, and 67.1% showed adequate hemodialysis effectiveness. Hemodialysis can initially lead to increased haemoglobin levels by removing excess fluids and toxins, concentrating haemoglobin. Hb, along with albumin, lymphocytes, and platelets, is a general marker of nutritional and inflammatory status (Garini, 2018). This study found that Hb levels significantly influenced QoL (p=0.001), consistent with findings that anaemia, common in CKD, impacts energy levels and overall health. Treatment with erythropoietin (EPO) and iron supplements can improve Hb levels and thus patients' well-being (Santoso *et al.,* 2022).

Despite these medical and social supports, the overall QoL among CKD patients undergoing hemodialysis remained poor, with an average score of 69.52. The psychological domain was the most negatively impacted, followed by physical, social, and environmental domains. Psychological challenges such as anxiety, depression, and feelings of burden are prevalent due to chronic dependence on hemodialysis. Physically, limited mobility and fatigue are compounded by frequent medical visits, especially for those living in remote areas. Social engagement also declines due to the time commitment required for treatment. These findings align with Aljawadi et al. (2024), who reported that CKD patients often suffer from fatigue, muscle weakness, sleep disturbances, and pain—factors that severely diminish functional capacity and QoL. Furthermore, cognitive issues such as poor memory and limited problem-solving abilities may impair social interaction. The high burden of medications increases the risk of adverse effects and errors, signalling complex comorbidities.

This study highlights that only haemoglobin levels significantly influence the quality of life in patients with chronic kidney disease (CKD) undergoing hemodialysis therapy. Patients with lower haemoglobin levels generally had a reduced QoL. Anaemia, characterised by decreased haemoglobin concentrations in red blood cells, is a common complication of CKD and is associated with a range of debilitating symptoms, including fatigue, weakness, shortness of breath, dizziness, headaches, and depression. These symptoms contribute to a marked decline in the overall well-being of CKD patients, and the presence of anaemia further exacerbates this deterioration. Notably, the severity of anaemia tends to increase as kidney function declines, intensifying CKD-related complications (Hoshino *et al.,* 2020). This finding is in line with the study by Wu et al. (2019), which reported that anaemia adversely affects QoL due to the disruptive impact of its symptoms on daily activities. In CKD, anaemia can result from multiple causes, such as erythropoietin deficiency, iron deficiency, gastrointestinal bleeding, hematuria, shortened red blood cell lifespan due to hemolysis, folate deficiency, bone marrow suppression, and ongoing inflammation (Wua *et al.,* 2019). Similar findings have been reported in a study conducted in Bandung, which demonstrated a significant relationship between haemoglobin levels and quality of life (Hasibuan, 2024). However, some studies have noted that haemoglobin levels primarily affect the physical domain of QoL, often using a higher anaemia threshold—typically below 10 g/dL—whereas the present study used a threshold of 8 g/dL (Hoshino *et al.,* 2020; Van Haalen *et al.,* 2020). This study's other demographic and clinical variables did not show a statistically significant effect, likely due to an unequal distribution of variable categories and a limited sample size, which may have influenced the p-values in hypothesis testing (Bearden *et al.,* 1982).

5. Conclusions

This study highlights haemoglobin levels as the most significant factor influencing the quality of life (QoL) among chronic kidney disease (CKD) patients undergoing hemodialysis. Although other demographic and clinical variables did not show a direct statistical association, they remain relevant in shaping patients' overall well-being. In particular, strong family support and adequate health literacy can enhance patients' coping mechanisms and treatment adherence, indirectly contributing to improved QoL. Future studies involving larger and more diverse patient populations and more comprehensive clinical data are recommended to gain a deeper understanding of the multifactorial determinants of QoL in CKD patients receiving hemodialysis therapy.

Acknowledgment

The authors would like to express their sincere gratitude to the staff of the Hemodialysis Unit at Sultan Agung Islamic Hospital for their cooperation and

support throughout this study. Special thanks are also extended to all respondents who generously provided valuable data. The authors gratefully acknowledge the financial support from the Lembaga Penelitian dan Pengabdian Masyarakat (LPPM) of Universitas Islam Sultan Agung, Semarang, Indonesia.

Conflict of interest

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

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