
The Length Fatigue Levels Of Time Undergoing Hemodialysis In Chronic Kidney Disease Patients

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ABSTRACT

Background: Chronic Kidney Disease (CKD) is a progressive condition that often requires long-term hemodialysis (HD) to sustain life. However, HD is associated with fatigue, which affects approximately 60–97% of patients and significantly impacts their quality of life.

Purpose: This study aimed to determine the correlation between the length of time undergoing hemodialysis and fatigue levels in CKD patients.

Methods: A cross-sectional study was conducted at the Hypertension Kidney Clinic Lestari Semarang, involving 68 CKD patients undergoing HD. Fatigue levels were measured using the Fatigue Assessment Scale (FAS). Data were analyzed using the Gamma correlation test.

Results: The results showed a statistically significant positive correlation between the length of time undergoing hemodialysis and fatigue levels ($p < 0.001$; correlation coefficient = 0.798), indicating that longer treatment duration is associated with higher fatigue.

Conclusion: These findings suggest that the longer a patient undergoes hemodialysis, the more severe the fatigue experienced. It is recommended that healthcare providers implement targeted educational and rehabilitative interventions to reduce fatigue in long-term HD patients and improve their quality of life.

Keywords: chronic kidney disease; fatigue; hemodialysis; hemodialysis duration.

BACKGROUND

Chronic Kidney Disease (CKD) represents a critical and expanding global public health challenge characterized by a steadily escalating epidemiological burden. Global estimates indicate that approximately 697.5 million individuals lived with a CKD diagnosis worldwide, reflecting a global prevalence of 9.1% (Bikbov & Purcell, 2020). Within the Indonesian context, national health data reveals that the prevalence of CKD among populations aged 15 years and older stands at 0.18%, with Central Java Province exhibiting a slightly higher localized prevalence of 0.19% (SKI, 2023). This growing patient cohort has concurrently driven a surge in the demand for renal replacement therapies, particularly hemodialysis (HD), which is utilized by 21.1% of the CKD population. Despite its life-sustaining benefits, maintenance HD is inherently burdensome and frequently triggers debilitating secondary symptoms. Chief among these is fatigue, a pervasive clinical manifestation that profoundly disrupts patients' daily functioning and overall quality of life (Sondergaard, 2020; Sajidah et al., 2021). While empirical evidence generally suggests that fatigue exacerbates in tandem with prolonged exposure to hemodialysis therapy, contemporary literature regarding the exact relationship between dialysis duration and fatigue severity remains conspicuously divided (Darmawan et al., 2019). Certain investigators have documented a statistically significant positive correlation between the length of time on treatment and fatigue levels. Conversely, other studies have failed to establish any such significant association. These conflicting outcomes likely stem from methodological variances, including disparate sample demographics, varying severities of baseline comorbidities, and differences in the psychometric sensitivities of the measurement tools employed across studies (Hasballah et al., 2023). This prominent empirical inconsistency underscores a critical knowledge gap, particularly within regional Indonesian clinical settings where unique socioeconomic and healthcare delivery factors may influence symptom presentation. Supported by preliminary patient interviews indicating a high burden of unmanaged exhaustion at the Lestari Kidney Disease and Hypertension Clinic in Semarang, this study sought to systematically evaluate the correlation between hemodialysis duration and fatigue levels. Based on the progressive physiological strain of long-term renal replacement therapy, it is hypothesized that a statistically significant positive correlation exists between the length of time undergoing hemodialysis and the severity of fatigue in patients with CKD, indicating that a longer treatment history predicts higher fatigue level.

OBJECTIVE

This study aims to evaluate the correlation between hemodialysis duration and fatigue severity in chronic kidney disease (CKD) patients

METHODS

This study utilized a quantitative correlational design with a cross-sectional approach to evaluate the relationship between hemodialysis (HD) duration and fatigue severity in patients diagnosed with chronic kidney disease (CKD). The investigation was conducted at the Lestari Kidney Disease and Hypertension Clinic in Semarang, Indonesia, spanning from February 17 to 22, 2025.

From an accessible target population of 162 patients, a sample size of 68 participants was determined utilizing Slovin's formula, which incorporated a 10% safety margin to

account for potential incomplete data or attrition. Subjects were selected via non-probability purposive sampling based on predefined eligibility criteria.

The inclusion criteria comprised CKD patients who were fully conscious, exhibited effective verbal communication capabilities, and were undergoing regular maintenance hemodialysis at the study site. Conversely, patients requiring concurrent acute oxygen therapy (e.g., via nasal cannula or rebreathing masks) were excluded from participation. Data were gathered using a dual-part instrument comprising a structured demographic and clinical data sheet alongside the standardized Fatigue Assessment Scale (FAS). The demographic component captured clinical parameters—including hemoglobin levels, pre-dialytic blood pressure, interdialytic weight gain (IDWG), and gender—compiled via structured interviews and validated through electronic medical record reviews. The primary independent variable, length of time undergoing hemodialysis, was segmented ordinally into three therapeutic epochs: new (< 12 months), moderate (12–24 months), and long-term (> 24 months)

The dependent variable, multidimensional fatigue, was quantified using the FAS. This 10-item instrument evaluates both physical and mental fatigue domains using a 5-point Likert scale. Total cumulative scores were stratified into three distinct severity brackets: mild fatigue (< 22), moderate fatigue (22–34), and severe fatigue (> 35). This study adopted the cross-culturally translated and validated version by Suseno, Wibowo, and Suandika (2020), which demonstrates high psychometric stability with Cronbach's alpha reliability coefficients ranging between 0.823 and 0.940

Statistical processing was executed using IBM SPSS Statistics version 25.0. Univariate analysis was applied to calculate descriptive statistics, expressing categorical and ordinal data as absolute frequencies and percentages. Given that both the independent variable (hemodialysis duration) and the dependent variable (fatigue level) were operationalized on ordinal scales, bivariate analysis was conducted using the non-parametric Gamma correlation test to measure the direction and strength of the relationship. Statistical significance was established a priori at $p < 0.05$.

The study adhered to the Declaration of Helsinki, with mandatory written informed consent from all participants. Ethical approval was granted by the Ethics Committee of Poltekkes Kemenkes Semarang (No. 1410/EA/F.XXIII.38/2024). Participant anonymity, data confidentiality, beneficence, and non-maleficence were rigorously safeguarded throughout the research process.

RESULTS

Table 1. Frequency Distribution Based on Respondents Characteristics (n=68)

Characteristic	Frequency (f)	Percentage (%)
Hemoglobin Level		
High	1	1.5
Low	46	67.6
Normal	21	30.9
Gender		
Male	30	44.1
Female	38	55.9
Blood Pressure		
Normal	36	52.9
Prehypertension	18	26.5

Characteristic	Frequency (f)	Percentage (%)
Hypertension Grade 1	10	14.7
Hypertension Grade 2	4	5.9
IDWG		
Mild	48	70.6
Moderate	16	23.5
Severe	4	5.9

Based on Table 1, the frequency distribution of respondents' characteristics shows that the majority had low hemoglobin levels, defined as <14.0 g/dL for males and <12.0 g/dL for females, with a total of 50 respondents (73.5%). Most respondents were female, totaling 38 (55.9%). In terms of blood pressure, the majority had normal readings, with systolic blood pressure between 120–129 mmHg and diastolic between 80–84 mmHg, totaling 36 respondents (52.9%). Additionally, most respondents experienced a weight gain of less than 4% and were categorized as having mild interdialytic weight gain (IDWG), accounting for 48 respondents (70.6%).

Table 2. Distribution of Respondent Characteristics According to Duration of Hemodialysis and Fatigue Level (n = 68)

Characteristic	Category	Duration of Hemodialysis n (%)			Fatigue Level n (%)		
		New	Moderate	Long	Mild	Moderate	Severe
Hemoglobin Level	High	1 (5.9)	1 (5.9)	1 (5.9)	1 (14.3)	1 (14.3)	1 (14.3)
	Low	7 (41.2)	7 (41.2)	7 (41.2)	0 (0.0)	13 (48.1)	33 (97.1)
	Normal	9 (52.9)	9 (52.9)	9 (52.9)	6 (85.7)	6 (85.7)	6 (85.7)
Gender	Male	11 (64.7)	11 (64.7)	11 (64.7)	4 (57.1)	4 (57.1)	4 (57.1)
	Female	6 (35.3)	6 (35.3)	6 (35.3)	3 (42.9)	3 (42.9)	3 (42.9)
Blood pressure	Normal	11 (64.7)	11 (64.7)	11 (64.7)	4 (57.1)	4 (57.1)	4 (57.1)
	Pre hypertension	3 (17.6)	3 (17.6)	3 (17.6)	2 (28.6)	2 (28.6)	2 (28.6)
	Hypertension Grade 1	1 (5.9)	1 (5.9)	1 (5.9)	0 (0.00)	2 (7.4)	8 (23.5)
	Hypertension Grade 2	2 (11.8)	2 (11.8)	2 (11.8)	1 (14.3)	1 (3.7)	2 (5.9)
IDWG	Mild	14 (82.4)	14 (82.4)	14 (82.4)	7 (100.0)	24 (88.9)	17 (50.0)
	Moderate	2 (11.8)	2 (11.8)	2 (11.8)	0 (0.0)	3 (11.1)	13 (38.2)
	Severe	1 (5.9)	1 (5.9)	1 (5.9)	0 (0.0)	0 (0.0)	4 (11.8)

Table 2 the distribution of respondent characteristics according to the duration of hemodialysis and fatigue level. Respondents who had undergone hemodialysis for a longer duration (>24 months) were predominantly characterized by low hemoglobin levels (86.7%), female gender (60.0%), normal blood pressure (50.0%), and mild interdialytic weight gain (IDWG) (56.7%). Similarly, severe fatigue was most frequently observed among respondents with low hemoglobin levels (97.1%), females (61.8%), normal blood pressure (50.0%), and mild to moderate IDWG. Overall, the findings

suggest that prolonged hemodialysis treatment is associated with a higher prevalence of low hemoglobin levels and severe fatigue, highlighting the potential role of anemia and fluid management in influencing fatigue severity among patients undergoing maintenance hemodialysis.

Table 3. Characteristics of Respondents Based on Duration of Hemodialysis and Fatigue Level (n=68)

Length of Time Undergoing Hemodialysis	Frequency (f)	Percentage (%)
New (< 12 Months)	17	25.0
Moderate (12–24 Months)	21	30.9
Long (> 24 Months)	30	44.1
Level Fatigue		
Mild (Score < 22)	7	10.3
Moderate (Score 22–34)	27	39.7
Severe (Score $\geq$ 35)	34	50.0

Table 3 summarizes the characteristics of respondents according to the duration of hemodialysis and fatigue level. Nearly half of the respondents had been receiving hemodialysis for more than 24 months (44.1%), while 30.9% had undergone treatment for 12–24 months and 25.0% for less than 12 months. Regarding fatigue status, severe fatigue was the most prevalent category, reported by 50.0% of respondents, followed by moderate fatigue (39.7%) and mild fatigue (10.3%). These findings indicate that prolonged hemodialysis treatment and high fatigue burden were common among the study population.

Table 4. Gamma Correlation Test Between Length of Time Undergoing Hemodialysis and Level Fatigue

Length of Time Undergoing Hemodialysis	Level Fatigue			Total	Contingency Coefficient (C)	p-value
	Mild	Moderate	Severe			
New	7	7	3	17	0.798	0.000
Moderate	0	14	7	21		
Long	0	6	24	30		
Total	7	27	34	68		

The Gamma correlation test revealed a statistically significant association between the duration of hemodialysis and fatigue level ($C = 0.798$, $p < .001$) (Table 4). Patients with a longer history of hemodialysis were more likely to experience severe fatigue. Among respondents undergoing long-term hemodialysis, 34% reported severe fatigue, compared with 21% of those in the moderate-duration group and 17% of newly treated patients. These findings indicate a strong positive relationship, suggesting that fatigue severity increases with prolonged exposure to hemodialysis treatment.

Table 5. Logistic Regression of Respondent Characteristics on Level Fatigue

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	32.776 ^a	.000	0	.
Hemoglobin Level	62.211	29.435	4	.000

Gender	32.883 ^b	.107	2	.948
Blood Pressure	40.306 ^b	7.530	6	.275
IDWG	39.995 ^b	7.219	4	.125

The multinomial logistic regression analysis identified hemoglobin level as the only significant predictor of fatigue level among patients undergoing hemodialysis ($\chi^2 = 29.435$, $df = 4$, $p < .001$) (Table 5). In contrast, gender ($\chi^2 = 0.107$, $df = 2$, $p = .948$), blood pressure ($\chi^2 = 7.530$, $df = 6$, $p = .275$), and IDWG ($\chi^2 = 7.219$, $df = 4$, $p = .125$) were not significantly associated with fatigue level. These findings indicate that hemoglobin level was the most influential factor contributing to fatigue severity, highlighting the importance of anemia-related conditions in the occurrence of fatigue among hemodialysis patients.

DISCUSSION

The strong, statistically significant positive relationship between the length of time undergoing hemodialysis and the severity of patient fatigue ($\gamma = 0.798$, $p < 0.001$) establishes that an expanding dialysis vintage directly correlates with an accumulating fatigue burden. While this finding appears to clash with certain literature suggesting that longer treatment histories allow for psychological adaptation and a better subjective quality of life over time (Devi & Rahman, 2022; Likewise, et al. 2024), it strongly aligns with contemporary studies reporting a significant positive correlation between treatment duration and fatigue scores ($p = 0.001$). This consistency across cohorts underscores the progressive nature of end-stage renal disease; when patients face permanent kidney failure and lack immediate or viable access to renal transplantation, they remain completely dependent on long-term mechanical dialysis to sustain life. This structural commonality across cohorts indicates that while patients may psychologically adapt to their treatment routine, the cumulative physiological toll of long-term uremic exposure, chronic inflammation, and repeated dialysis-induced cardiovascular stress causes an unavoidable accumulation of physical and mental exhaustion over time.

The univariate breakdown from this study further establishes the pervasiveness of this symptom burden, revealing that exactly 50.0% of the sampled chronic kidney disease (CKD) patients met the criteria for clinical severe fatigue. This high prevalence matches international documentation of high-level exhaustion in dialysis cohorts (Nurdina & Anggraini, 2021) and stands in contrast to studies reporting predominantly mild fatigue levels (Wahyudi & Rantung, 2024). When severe exhaustion persists unmanaged, it acts as a debilitating barrier to recovery, inducing a loss of motivation for activities of daily living while triggering secondary psychological complications like depression and impaired concentration (Maulidiyah & Murtaqib, 2024). To counteract this debilitating trajectory, clinical literature increasingly advocates for the integration of low-intensity physical conditioning, such as scheduled walking regimens, which have been shown to successfully reduce fatigue perceptions and facilitate systemic relaxation (Maesaroh & Waluyo, 2020).

Our multivariate modeling clarified these relationships by identifying baseline hemoglobin level as the single most critical and statistically significant direct predictor of fatigue severity ($\chi^2 = 29.43$, $p < 0.001$). This finding is heavily supported by regional

studies that identified a significant correlation between hemoglobin levels and fatigue in CKD patients (Maisyaroh et al., 2024; Patimah et al., 2024; Santoso et al., 2022). Mechanistically, hemoglobin functions as the primary vehicle for systemic oxygen transport, and when its circulating concentration is depressed, downstream musculoskeletal and visceral organs suffer from impaired aerobic metabolism. This structural oxygen deficiency in the muscles and the central nervous system forces cells into anaerobic pathways that cause rapid exhaustion, triggering a faster onset of both physical and mental fatigue even during minimal physical exertion.

Crucially, the descriptive data demonstrate that a significant majority of the studied respondents (67.6%) presented with subnormal hemoglobin levels. A deeper sub-analysis revealed that patients with an extended hemodialysis vintage exceeding 24 months who suffered from severe fatigue were overwhelmingly anemic. This clinical reality aligns with established evidence stating that the longer patients undergo hemodialysis, the more likely their hemoglobin levels remain low, or even worsen if not properly managed (Cahyani et al., 2024; Patimah et al., 2024). However, the therapeutic relationship between these two variables is complex, as medical literature cautions that isolated increases in hemoglobin concentrations do not always translate into a linear or complete resolution of fatigue (Guedes et al., 2020). This limitation highlights that fatigue in CKD is inherently multifactorial and heavily driven by concurrent systemic microinflammation, poor sleep architecture, and underlying depressive disorders that must be addressed alongside basic hematological targets.

Beyond hematological predictors, demographic and behavioral variations also play a role in modulating patient outcomes. In this study, the majority of the current sample cohort was female (55.9%), a finding that mirrors some regional data (Wahyudi & Rantung, 2024), but contrasts with other studies identifying a higher prevalence among male patients (Natashia, 2020). These epidemiological variations across different literatures are frequently attributable to distinct sociodemographic shifts and lifestyle trends. As documented in contemporary literature, variations in behavioral habits, dietary patterns, and physical activity levels differ substantially between genders, which can cause distinct risk profiles and metabolic variations; this potentially explains why men in certain populations exhibit accelerated renal decline that necessitates earlier, more intensive, and prolonged hemodialysis regimens (Riehl-Tonn et al., 2024).

Finally, the study revealed notable trends in hemodynamic regulation and fluid volume compliance, with over half of the respondents (52.9%) maintaining normal pre-dialytic blood pressure levels and a vast majority (70.6%) successfully limiting fluid retention to the mild interdialytic weight gain (IDWG) tier. The high rate of mild IDWG indicates a behavioral adaptation over time, wherein experienced patients develop superior self-management strategies, tighter dietary discipline, and stricter fluid restriction compliance compared to patients new to hemodialysis (Santoso et al., 2022). Conversely, the controlled blood pressure observed among those undergoing long-term hemodialysis contrasts with findings stating that blood pressure typically remains chronically elevated or difficult to manage in long-term care (Santoso et al., 2022). Because chronic hemodialysis patients frequently exhibit complex blood pressure regulatory disorders induced by vascular stiffness, fluid shifts, electrolyte imbalances, and sustained activation of the renin-angiotensin-aldosterone system, the controlled readings observed in this

long-term cohort likely reflect aggressive, optimized pharmacological interventions rather than a native return to hemodynamic stability (Nugraha et al., 2021).

CONCLUSION

The maintenance hemodialysis cohort presented a female predominance, low hemoglobin, controlled blood pressure, mild interdialytic weight gain, and high fatigue levels tied to an extended dialysis vintage. Hemodialysis duration strongly correlates with severe fatigue. Recommendations include bi-weekly hemoglobin tracking, structured patient education, and future large-scale, disease-specific longitudinal research.

ACKNOWLEDGMENTS

The author thanks the Health Polytechnic of the Ministry of Health in Semarang, the Lestari Kidney Disease and Hypertension Clinic Semarang for research permission, and the nursing students who actively contributed throughout the research process, including data collection and field assistance.

REFERENCES

- Alshammari, B., Alkubati, S. A., Alrasheeday, A., Pasay-An, E., Edison, J. S., Madkhali, N., Al-Sadi, A. K., Altamimi, M. S., Alshammari, S. O., Alshammari, A. A., & Alshammari, F. (2024). Factors Influencing Fatigue Among Patients Undergoing Hemodialysis: A Multi-Center Cross-Sectional Study. *Libyan Journal of Medicine*, 19(1), 1–10. <https://doi.org/10.1080/19932820.2023.2301142>
- Amelia, F., Safitri, K. H., & Suwanto, S. (2021). Determinant Fatigue Pada Pasien Esrd Yang Menjalani Hemodialisis. *Jurnal Keperawatan Wiyata*, 2(1), 41. <https://doi.org/10.35728/jkw.v2i1.495>
- Bikbov, B., & Purcell, C. (2020). Global, Regional, And National Burden Of Chronic Kidney Disease, 1990–2017: A Systematic Analysis For The Global Burden Of Disease Study 2017. *The Lancet*, 395(10225), 709–733. [https://doi.org/10.1016/S0140-6736\(20\)30045-3](https://doi.org/10.1016/S0140-6736(20)30045-3)
- Cahyani, A. A. A. E., Parwati, P. A., Asdiwinata, I. N., Subhaktiyasa, P. G., & Rahayu, L. (2024). Hubungan kadar hemoglobin dengan kualitas hidup pasien gagal ginjal kronik di Prodia Indramayu. *Tropis: Jurnal Riset Teknologi Laboratorium Medis*, 1(2), 79–84. <https://doi.org/10.37304/tropis.v1i2.14287>
- Darmawan, I. P. E., Nurhesti, P. O., & Suardana, I. K. (2019). Hubungan Lamanya Menjalani Hemodialisis dengan Fatigue pada Pasien Chronic Kidney Disease. *Community of Publishin in Nursing (COPING)*, 7(3), 139–146.
- Devi, S., & Rahman, S. (2022). Hubungan Lama Menjalani Terapi Hemodialisis Dengan Kualitas Hidup Pasien Penyakit Ginjal Kronik Di Rumah Sakit Khusus Ginjal Rasyida. *Jurnal Ilmiah Kohesi*, 4(1), 124–128.
- Diniyatul Maulidiyah, D., & Murtaqib. (2024). Hubungan Fatigue dengan Kualitas Hidup pada Pasien Gagal Ginjal Kronik yang Menjalani Hemodialisis di RSD dr . Soebandi Jember PENDAHULUAN Gagal ginjal kronik adalah suatu penyakit yang terjadi karena adanya masalah pada fungsi ginjal yang sifatnya progresif. *Jurnal Ilmiah Ners Indonesia*, 5(2), 81–89.
- Gina Nurdina, & Dian Anggraini. (2021). Hubungan Fatigue Terhadap Kualitas Hidup Pasien Hemodialisa. *Jurnal Ilmiah Keperawatan (Scientific Journal of Nursing)*, 7(3), 33–39. <https://doi.org/10.33023/jikep.v7i3.813>

- Hasballah, H., Bayhakki, B., & Erika, E. (2023). Relationship Between Hemodialysis Duration and Fatigue in Chronic Kidney Disease (CKD) Patients During Hemodialysis. *JETISH: Journal of Education Technology Information Social Sciences and Health*, 2(2), 1642–1648. <https://doi.org/10.57235/jetish.v2i2.891>
- Maesaroh, & Waluyo, A. (2020). Faktor-Faktor Yang Berhubungan Dengan Terjadinya Fatigue Pada Pasien Hemodialisis. *Jurnal Ilmiah Indonesia*, 5(4), 110–120.
- Nugraha, I. K. A., Tedjamartono, T. D., & Sunaka, W. (2021). Factors Associated With Blood Pressure In End Stage Renal Disease Patients Receiving Regular Hemodialysis At Wangaya General Hospital, Denpasar. *International Journal of Advances in Medicine*, 8(8), 1201. <https://doi.org/10.18203/2349-3933.ijam20212867>
- Patimah, S., Kusumajaya, H., & Faizal, K. M. (2024). Faktor - Faktor Yang Berhubungan Dengan Fatigue Pada Pasien Gagal Ginjal Kronis Yang Menjalani Hemodialisis Di Rumah Sakit Umum Daerah Depati Bahrin Sungailiat Tahun 2024. *Jurnal Kesehatan Tambusai*, 5(4), 11003–11012.
- Pramesti Hariyadi, A. A., & Kadek, D. P. (2024). Hubungan Lama Menjalani Hemodialisis Dengan Indeks Massa Tubuh, Aktivitas Fisik, dan Kualitas Tidur Pada Pasien Penyakit Ginjal Tahap Akhir di Rumah Sakit Umum Daerah Bangli. *Jurnal Ilmiah Wahana Pendidikan*, 10(September), 78–93.
- Santoso, D., Sawiji, S., Oktantri, H., & Septiwi, C. (2022). Faktor-Faktor Yang Berhubungan Dengan Fatigue Pada Pasien Gagal Ginjal Kronik Yang Menjalani Hemodialisa Di Rsud Dr. Soedirman Kebumen. *Jurnal Ilmiah Kesehatan Keperawatan*, 18(1), 60. <https://doi.org/10.26753/jikk.v18i1.799>.
- Shadrina, D., Susanto, A. D., & Sartika, I. (2024). Hubungan Lama Menjalani Hemodialisis Dengan Kualitas Hidup Pasien Gagal Ginjal Kronik Di Unit Hemodialisa RSUD Balaraja Tahun 2024. *Gudang Jurnal Ilmu Kesehatan*, 2(2), 404–410.
- SKI. (2023). Survei Kesehatan Indonesia (SKI). *SKI*, 1–68.
- Sondergaard, H. (2020). Fatigue While Undergoing Long-Term Hemodialysis. *Clinical Journal of the American Society of Nephrology*, 15(11), 1539–1540. <https://doi.org/10.2215/CJN.14870920>.
- Suseno, S., Wibowo, T. H., & Suandika, M. (2020). Gambaran Skor Index Of Nausea, Vomiting And Recthing (INVR) Dan Fatigue Pada Pasien Pasca General Anestesi. *Jurnal Penelitian Perawat Profesional*, 2(5474), 1333–1336
- Wahyudi, F. F. N., & Rantung, J. (2024). Hubungan Fatigue Dengan Kualitas Hidup Pasien Gagal Ginjal Kronik Yang Menjalani Terapi Hemodialisa Di Rumah Sakit Swasta Bandar Lampung. *Klabat Journal of Nursing*, 6(1), 50. <https://doi.org/10.37771/kjn.v6i1067>