Indonesian Journal of Global Health Research
Volume 8 Number 1, February 2026
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

EVALUATION OF RENAL ANEMIA THERAPY IN CHRONIC KIDNEY DISEASE PATIENTS UNDERGOING HEMODIALYSIS IN HOSPITAL

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ABSTRACT
End-stage chronic kidney disease (CKD) requiring hemodialysis is often complicated by anemia. Renal anemia in CKD-HD patients can affect quality of life and worsen prognosis. Anemia therapy involves erythropoiesis-stimulating agents (ESAs), iron supplements, and blood transfusions, but evaluation of their effectiveness at Dr. Loekmono Hadi Kudus Regional Hospital is still limited. This study aims to evaluate the anemia profile and the effectiveness of anemia therapy in PGK-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital. This study used a quantitative descriptive method with purposive sampling technique in 93 CKD-HD patients with hemoglobin levels ⩽ 10 g/dL. Data were collected through a review of electronic medical records and analyzed using descriptive statistics. Most CKD-HD patients had moderate (48%) and severe (43%) anemia. 90% of patients received ESA therapy, with 62% receiving PRBC transfusions and 47% combination therapy. Iron status analysis showed that many patients required supplemental iron therapy. Anemia in CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital requires more optimal management with routine monitoring of iron status. Further evaluation of ESA and iron therapy is needed to improve patient quality of life and prevent further complications.

Keywords: anemia; blood transfusion; chronic kidney disease; ESAs; hemodialysis; iron therapy

How to cite (in APA style)
Kurniawan, J. A., & Hakam, A. (2025). Evaluation of Renal Anemia Therapy in Chronic Kidney Disease Patients Undergoing Hemodialysis in Hospital. Indonesian Journal of Global Health Research, 8(1), 155–162. https://doi.org/10.37287/ijghr.v8i1.530.

INTRODUCTION

Chronic Kidney Disease (CKD) is a condition characterized by a gradual decline in kidney function that can progress to end-stage kidney failure. One therapy used for end-stage CKD patients is hemodialysis. Although hemodialysis can replace kidney function in removing waste and excess body fluids, this procedure carries various complications, one of which is anemia. Anemia in CKD patients is very common, occurring due to decreased erythropoietin production by damaged kidneys, which results in a low red blood cell count (Ministry of Health of the Republic of Indonesia, 2023).

In patients undergoing hemodialysis, anemia can worsen their quality of life, increase cardiovascular risk, and contribute to decreased physical capacity and excessive fatigue. Therefore, effective therapy for renal anemia is crucial. Management of anemia in CKD involves the use of erythropoiesis-stimulating agents (ESAs), iron supplements, and in some cases, blood transfusions. ESAs are used to stimulate red blood cell production, while iron supplements are used to address the iron deficiency that often occurs in CKD patients undergoing hemodialysis (Pernefri, 2020).

Previous research has shown that anemia in CKD patients is often accompanied by iron deficiency, which is related to impaired iron metabolism. Furthermore, therapy using ESA can also improve the quality of life of CKD patients by increasing hemoglobin levels in the blood. However, this therapy must be managed carefully, considering the risk of side effects such as hypertension and thrombosis if hemoglobin levels increase too rapidly (Portolé, 2023). Although many studies have examined the use of ESA and blood transfusions, evaluation of anemia therapy in CKD-HD patients at Dr.

Loekmono Hadi Kudus Regional Hospital has not been widely conducted, so research is needed to fill this gap.

Anemia in CKD patients, especially those undergoing hemodialysis, tends to worsen as the stage of kidney disease advances. The prevalence of anemia is very high, with approximately 81% of CKD patients undergoing hemodialysis having hemoglobin levels below 10 g/dL (Pernefri, 2020). Suboptimal management of anemia can worsen patient prognosis, increase hospitalization rates, and reduce life expectancy. Therefore, it is important to evaluate the therapy provided at Dr. Loekmono Hadi Kudus Regional Hospital to determine whether it complies with recommended renal anemia therapy guidelines (Pernefri, 2020).

Furthermore, existing data indicate uncertainty regarding the effective use of iron supplementation therapy, particularly regarding patient iron status, which requires further evaluation using serum ferritin and total iron binding capacity (TIBC) measurements. This study also aims to determine whether the ESA therapy implemented is optimal in reducing anemia and improving the quality of life of CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital.

Managing anemia in CKD-HD patients is not only a clinical issue but also an economic one, as effective anemia therapy can reduce the need for blood transfusions, which are often expensive and carry the risk of complications. Therefore, this study aims to provide more accurate data on the anemia profile in CKD-HD patients and evaluate the effectiveness of the therapy implemented in the hospital. This study aims to evaluate the anemia profile and the effectiveness of anemia therapy in PGK-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital. Therefore, the results of this study are expected to contribute to improving anemia management in CKD-HD patients and increasing the efficiency and quality of services at Dr. Loekmono Hadi Kudus Regional Hospital.

METHOD

This study used a quantitative descriptive research method, which aims to describe and analyze the profile of renal anemia and evaluate anemia therapy in chronic kidney disease patients undergoing hemodialysis at Dr. Loekmono Hadi Kudus Regional Hospital. Data were collected through a review of electronic medical records (EMB) documents that include patient profiles, hemoglobin (Hb) levels , and the type of anemia therapy received by patients. In addition, laboratory data regarding iron levels , transferrin saturation, and serum ferritin will also be analyzed to evaluate patient iron status and the effectiveness of the therapy given.

Participants in this study were CKD patients undergoing hemodialysis at Dr. Loekmono Hadi Kudus Regional Hospital with Hb levels ≤ 10 g/dL. The sampling technique used was purposive sampling, where researchers selected patients who met the inclusion criteria, namely patients diagnosed with CKD who were undergoing hemodialysis therapy and had measurable Hb data during the study period. This study involved 93 patients with varying distributions of gender, age , and estimated glomerular filtration rate (eGFR). Data obtained from medical records will be analyzed descriptively using descriptive statistics, where the results will be presented in tables and graphs to provide a clear picture of the patient profile and the results of the therapy received.

Data processing was performed using statistical software to analyze the degree of anemia based on the patient's hemoglobin level and iron status. The results of this analysis are expected to provide useful information regarding the effectiveness of anemia therapy given to CKD-HD patients at the hospital. Therefore, this study is expected to contribute to improving anemia therapy protocols for CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital, as well as increasing understanding of anemia management in CKD patients in Indonesia in general (Sugiyono, 2019; Pernefri, 2020).

RESULT

Table 1.
Characteristics of Respondents of PGK-HD Patients

Characteristics	Frequency	Percentage (%)
Gender		
Man	54	58%
Woman	39	42%
Age		
18-25 years old	6	6.5%
26-35 years old	8	8.6%
36-45 years old	15	16.1%
46-55 years	37	39.8%
56-64 years	26	28.0%
≥ 65 years	1	1.1%
eGFR level		
6-10 mL/min/1.73 m²	59	63.4%
11-15 mL/min/1.73 m²	34	36.6%

Table 1, it is known that the majority of patients undergoing hemodialysis at Dr. Loekmono Hadi Kudus Regional Hospital are men (58%), with the majority being in the 46-55 years age range (39.8 %). Most patients (63.4 %) have eGFR levels between 6-10 mL/min/1.73 m², indicating that they are in the advanced stage of chronic kidney disease.

Table 2.
Degree of Anemia in PGK-HD Patients

Degree of Anemia	f	%
Mild Anemia	9	9%
Moderate Anemia	48	48%
Severe Anemia	36	43%

Based on table 2 it is known that Most CKD-HD patients experience anemia, with moderate (48%) and severe (43%) anemia. Only 9% of patients experience mild anemia. This indicates that anemia in CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital is quite prevalent, according to data reported by the Indonesian Renal Registry (IRR, 2020).

Table 3.
Types of Renal Anemia Therapy in CKD-HD Patients

Types of Therapy	f	%
PRC transfusion	58	62%
ESA (Epoetin)	84	90%
Combination Therapy (PRC and ESA)	44	47%

Table 3 shows that most patients (90%) received erythropoiesis-stimulating agents (ESAs), which is the first-line therapy for renal anemia. Furthermore, 62% of patients also received packed red cell (PRC) transfusions, particularly those with very low hemoglobin levels (<7 g/dL). Combination therapy between PRCs and ESAs was administered to 47% of patients to optimize anemia management.

DISCUSSION

Patient Profile by Gender, Age Proportion, and eGFR Level of CKD-HD Patients

The profile of CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital shows that the majority of patients undergoing hemodialysis are men (58%), while women only make up 42%. This phenomenon aligns with findings in many countries, where CKD patients are more frequently

found in men. According to research by Sabanayagam et al. (2020), factors such as smoking habits, unhealthy lifestyles, and poor diet are more common in men, thus increasing the risk of developing chronic kidney disease (CKD). Furthermore, studies in Singapore and China also report that CKD patients are predominantly male, which is likely related to social and lifestyle factors.

In terms of age, this study shows that the majority of CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital are aged between 46 and 55 years (39.8%) and 56 and 64 years (28%). This reflects the increasing prevalence of CKD with age, which is also found in other studies such as by Hasanah et al. (2023), which stated that the risk of CKD doubles in those over 40 years of age. The more rapid decline in kidney function in the elderly is caused by a decrease in the kidney's ability to regenerate new nephrons, so that more individuals require renal replacement therapy such as hemodialysis (Siagian & Damayanty, 2018).

The eGFR level in CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital shows that the majority of patients have an eGFR between 6-10 mL/min/1.73 m² (63.4 %). This figure indicates that most patients are in the advanced stage of chronic kidney disease, namely stages 4-5. According to Pernefri (2020), in stages 4-5 of CKD, kidney function has significantly decreased and patients require hemodialysis therapy to replace kidney function. This decrease in eGFR is also correlated with an increased prevalence of anemia in CKD patients, as reflected in the high rate of anemia in patients undergoing hemodialysis at this hospital.

Furthermore, these data also suggest a link between low eGFR levels and increased complications in CKD-HD patients, including anemia, cardiovascular disease, and increased hospitalizations. Research by Portolé (2023) demonstrated that decreased eGFR directly increases the risk of cardiovascular events and death in CKD patients. Therefore, routine eGFR monitoring is crucial in the management of CKD-HD patients, as it can provide insight into the progression of kidney disease and the effectiveness of therapy received by the patient.

This study was predominantly male (58%), with a peak age of 46–55 years, and most initiated HD at eGFR 6–10 mL/min/1.73 m² (63.4%) in line with regional and global patterns: the Indonesian national registry (n=122,449) also reported a male majority (55.5%) and a mean age of approximately 52 years in HD patients (Andhika et al., 2025), while a tertiary hospital study in Vietnam confirmed sex-based differences in practice and achievement of KDIGO targets, with the epidemiological context that the incidence of ESKD is higher in men and women tend to initiate HD later (Pham et al., 2024). In terms of eGFR, this study (concentrated at 6–10) is consistent with a nationwide USRDS analysis in the US that showed a mean eGFR at HD initiation of 8.9 mL/min/1.73 m² (Hemmige, V., et al., 2024), and is in the “intermediate” range that a recent systematic review did not find to confer a survival advantage over later initiation; some studies have even associated “early” initiation (≥10) with higher mortality after adjustment (Jia et al., 2023). Thus, the sex and age profiles in this study reflect patterns common in Asian HD populations, while the eGFR distribution suggests relatively conservative initiation practices.

Degree of Renal Anemia in CKD-HD Patients

Anemia is one of the most common complications in patients with chronic kidney disease (CKD), especially those undergoing hemodialysis. Research at Dr. Loekmono Hadi Kudus Regional Hospital found that most CKD-HD patients experienced anemia, with degrees ranging from moderate (48%) to severe (43%). Only 9% of patients experienced mild anemia. This decrease in hemoglobin levels is consistent with the increasingly severe decline in kidney function, where erythropoietin production by the kidneys is significantly reduced in patients with advanced CKD, leading to normocytic normochromic anemia (Pernefri, 2020). As hemoglobin levels decline ,

CKD-HD patients can experience decreased physical capacity and a poorer quality of life, as well as an increased risk of cardiovascular disease and death (Portolé, 2023).

The degree of anemia in CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital showed that the majority of patients (48%) were in the moderate anemia category, with hemoglobin levels between 8-10 g/dL. Anemia in CKD stages 4-5 is often caused not only by erythropoietin deficiency, but also by impaired iron metabolism, inflammation, and other factors such as increased hepcidin levels that interfere with iron absorption (Portolé et al., 2021). Decreased hemoglobin levels in CKD-HD patients are closely associated with decreased eGFR, which indicates a significant decline in kidney function. In a study by Sofue et al. (2020), anemia in CKD increases with worsening kidney disease stages, and in patients undergoing hemodialysis, the prevalence of anemia reaches very high levels.

As the primary therapy for anemia in CKD, the use of Erythropoiesis-Stimulating Agents (ESAs) is the first choice, with the aim of increasing red blood cell production. However, ESA therapy is not always effective, especially in patients with functional iron deficiency. Based on research results, 62% of CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital received blood transfusions, indicating a high prevalence of severe anemia (Hb <8 g/dL) in patients undergoing hemodialysis. Red blood cell (PRC) transfusion therapy is given primarily to patients with severe anemia, who require immediate correction of their hemoglobin levels . This indicates that even after ESA has been administered, many patients still require blood transfusions to achieve optimal hemoglobin levels.

Management of anemia in CKD-HD patients requires a comprehensive approach, including iron status management, ESA use, and in some cases, blood transfusion. Research at Dr. Loekmono Hadi Kudus Regional Hospital emphasized the need for further evaluation of patients' iron status, both to identify absolute iron deficiency anemia and functional iron deficiency anemia. Inadequate iron therapy can lead to hyporesponsiveness to ESA, necessitating closer monitoring of ferritin levels and transferrin saturation (Pernefri, 2020). Therefore, optimal anemia management in CKD-HD patients at this hospital relies heavily on accurate evaluation of the degree of anemia and response to therapy.

The degree of anemia in CKD-HD patients in this study showed that the majority of patients had mild to moderate anemia, with an average hemoglobin of approximately 9.5 g/dL. This finding is consistent with a study by Badura et al. (2024), which reported that anemia is a common complication in CKD patients, affecting patient quality of life and clinical outcomes. Furthermore, a study by Khan et al. (2024) showed the prevalence of anemia in patients with CKD stages 3–5 was 78.7% at baseline and 77.7% at 6 months, with a prevalence of anemia in stage 3 patients of 61.5% at baseline. Prapaiwong et al. (2025) also found that approximately 15% of patients with early-stage CKD had anemia, compared with 41% in patients receiving nephrology care and up to 80% in CKD stage 5. Factors contributing to anemia in CKD-HD patients include erythropoietin deficiency, iron metabolism disorders, chronic inflammation, and bone marrow disorders. Management of anemia in CKD-HD patients involves the use of erythropoiesis-stimulating agents (ESAs) and iron supplementation, taking into account the KDIGO 2025 guidelines which recommend initiation of ESA therapy when Hb concentration is ≤9.0–10.0 g/dL.)

Types of Renal Anemia Therapy in CKD-HD Patients

Renal anemia therapy in CKD-HD patients at Dr. Loekmono Hadi Kudus Regional General Hospital involves several main approaches, namely the use of Erythropoiesis Stimulating Agents (ESAs), Packed Red Cell (PRC) transfusions, and iron supplementation. Based on research results, ESA therapy is the primary choice given to 90% of CKD-HD patients. This therapy aims to

stimulate red blood cell production by increasing erythropoietin levels, which are reduced in CKD patients. The use of ESA can help increase hemoglobin levels and improve symptoms of anemia, such as fatigue and decreased physical capacity, which are often experienced by CKD patients. ESA therapy at Dr. Loekmono Hadi Kudus Regional General Hospital is administered with doses of epoetin alfa and beta, in accordance with existing guidelines (Pernefri, 2020).

Although ESA is the primary therapy, not all patients respond adequately to it. This is often due to functional iron deficiency, which reduces the effectiveness of ESA. Therefore, iron therapy is an integral part of the management of renal anemia. At Dr. Loekmono Hadi Kudus Regional Hospital, only a small proportion of patients receive separate iron therapy, either orally or intravenously, depending on their individual iron status. Intravenous iron, such as iron sucrose or iron dextran, is primarily administered to patients undergoing hemodialysis to ensure adequate iron levels for erythropoiesis (Pernefri, 2020).

Furthermore, blood transfusions are also a therapeutic option for patients with severe anemia (Hb <8 g/dL). Sixty-two percent of CKD-HD patients at Dr. Loekmono Hadi Kudus Regional Hospital received PRBC transfusions, indicating that transfusion therapy remains an important part of anemia management in patients with more severe anemia. These transfusions are given to patients experiencing more severe anemia symptoms, such as a significant decrease in physical capacity and cardiovascular symptoms. Although blood transfusions are effective in increasing hemoglobin levels , this therapy is only given to patients with specific indications and is minimized to reduce the risk of long-term complications (Pernefri, 2020).

It is important to remember that anemia management in CKD-HD patients must be individualized and tailored to the response to the therapy. Regular evaluation of hemoglobin levels , iron status, and response to ESA is crucial to determine the appropriateness and effectiveness of the therapy. Therefore, this study highlights the need for a comprehensive, guideline-based approach to therapy, as well as ongoing evaluation to improve the quality of life of CKD-HD patients and reduce the risk of complications (Portolé et al., 2021).

Anemia therapy in CKD-HD patients generally involves the use of erythropoiesis-stimulating agents (ESAs) and intravenous iron supplementation. According to the KDIGO 2025 guidelines, initiation of ESA therapy is recommended when hemoglobin (Hb) levels are ≤9.0–10.0 g/dL in patients with anemia and G5D CKD undergoing hemodialysis or peritoneal dialysis. Intravenous iron supplementation, such as ferumoxytol, can be used to address iron deficiency in patients who cannot receive oral therapy or have poor iron absorption. A study by Ogolla et al. (2025) showed that the combination of ESA therapy and intravenous iron supplementation was more effective in increasing Hb levels and stabilizing kidney function compared with either therapy alone. Furthermore, a study by Bhandari et al. (2025) highlighted the importance of an individualized approach to anemia management in CKD patients, taking into account factors such as age, comorbidities, and response to previous therapy. Newer therapies, such as daprodustat, have also shown potential in increasing Hb levels in CKD patients, although further evaluation of their long-term safety and effectiveness is needed.

CONCLUSION

This study shows that anemia is a significant complication in chronic kidney disease (CKD) patients undergoing hemodialysis at Dr. Loekmono Hadi Kudus Regional Hospital. Most patients experience moderate (48%) and severe (43%) anemia, which is closely associated with increasingly severe kidney function decline, reflected by low hemoglobin levels . Management of anemia in CKD-HD patients involves Erythropoiesis Stimulating Agents (ESA) therapy, Packed Red Cell (PRC) transfusion, and iron administration, each of which plays an important role in increasing

hemoglobin levels and reducing anemia symptoms. However, ESA therapy is not always effective if the patient has functional iron deficiency, which requires regular evaluation of iron status and the use of intravenous iron therapy in patients who require it.

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