









Prevalence, prescription patterns, and quality of life of anaemia in adults with chronic renal disease

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ABSTRACT

Introduction and aim. Anaemia is a chronic kidney disease (CKD) condition characterised by a decline in glomerular filtration rate (GFR) and impaired kidney function. The aim of this study was to assess the prevalence, prescribing patterns, and quality of life of anaemia in patients with chronic renal disease who were adults (>18 years of age) at a tertiary care hospital.

Material and methods. Data on demographic characteristics, laboratory results, medication prescriptions, and quality of life assessments were collected. Statistical tests were performed to determine associations between anaemia prevalence and factors like age, gender, and CKD stage. The study included 132 patients, with a gender distribution of 89 men and 43 women.

Results. The most frequently prescribed drugs are epoetin (15.06%), multivitamins (14.82%), iron (10.65%), folic acid (10.22%), calcium carbonate (8.17%), calcitriol (5.6%), and omeprazole (4.22%). The cardiovascular system, blood disorders, and blood-producing organs come after the gastrointestinal tract and metabolism in the first anatomical level of the ATC classification.

Conclusion. It suggests hospital audits and recommendations for improved prescription practices. Further investigation into anaemia causes and drug class appropriateness is needed, and implementing improvements could potentially improve health outcomes.

Keywords. anaemia, chronic kidney disease, prescribing pattern, quality of life

Introduction

Chronic kidney disease (CKD) is a condition characterised by a decline in glomerular filtration rate (GFR) and impaired kidney function. The National Kidney Foundation's Kidney Disease Outcomes Quality Initiative divides CKD into five stages: stage 1, stage 2, stage 3, and stage 4. Anaemia is a common complication of CKD, affecting a significant number of individuals.^{1,2} Manage-

ment of anaemia in CKD often involves drug classes like erythropoiesis-stimulating agents and iron supplements. However, further investigation into the underlying causes of anaemia in CKD and the appropriateness of prescribed drug classes is needed. Anaemia is often associated with poor quality of life, decreased physical activity, and cognitive impairment in CKD patients.³ It is also closely related to the development of heart failure

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and stroke, as well as the progression of CKD. Normocytic, normochromic, and hyperproliferative anaemias are frequently associated with CKD. A decline in kidney function is the cause of anaemia, as the kidneys can create erythropoietin, a signaling protein that increases red blood cell production in response to a drop in blood oxygen levels.⁴ When kidney function declines, the production of erythropoietin is reduced, leading to a decrease in red blood cell production. This can cause fatigue and other symptoms associated with anaemia and further worsen kidney function by reducing oxygen supply to the kidneys and promoting tissue damage.⁵ Since recombinant human erythropoietin was made, erythropoiesis-stimulating agents (ESA) have been the main treatment for CKD anaemia. They improve the quality of life for patients and reduce morbidity, mortality, and left ventricular hypertrophy. International recommendations recommend considering ESA treatment for patients with a hemoglobin (Hb) level of 11 g/dL in pre-dialysis and 10 g/dL in dialysis patients.⁶ However, it is crucial to carefully monitor Hb levels and adjust ESA dosage to avoid potential risks such as cardiovascular events or thromboembolic complications.

Aim

The current study was to evaluate the prevalence, prescription trends, and quality of life of anaemia in adult (patients older than 18 years of age) chronic renal disease patients at a tertiary care hospital.

Material and methods

A study of 132 adults aged 18 and older with chronic renal disease and confirmed anaemia participated. Data were collected from their medical records, including Hb levels, ESA prescriptions, and cardiovascular events or complications. A quality-of-life questionnaire was completed to assess anaemia's impact on daily functioning and well-being. The data was analysed to determine anaemia prevalence, ESA prescription patterns, and overall patient quality of life.

Study design, population, and approval

The Raghavendra Institute of Pharmaceutical Education and Research Institution Review Board approved a cross-sectional observational study involving 132 prescriptions from CKD patients aged over 18 (October 22, 2022, RIPER/IRB/2022/045). The study collected demographic and clinical data from medical records, including patient age, comorbidities, and laboratory results. Patient quality of life was assessed using validated questionnaires like the EQ-5D and SF-36.^{7,8} The findings will provide valuable insights into anaemia management in CKD patients and contribute to improving patient care and outcomes. The study's demographic and clinical data will help establish a comprehensive understand-

ing of the characteristics and health status of CKD patients. By examining factors such as age, comorbidities, and laboratory results, researchers can identify potential risk factors and determine the most effective strategies for anaemia management in this population. The assessment of patient quality of life using validated questionnaires will provide important information on the impact of anaemia on overall well-being and functioning.^{9,10} These insights will be crucial in developing targeted interventions and improving care and outcomes for patients with anaemia in this population. If older patients with comorbidities and low Hb levels are at higher risk for anaemia-related complications, healthcare providers can prioritise regular monitoring and early intervention strategies. However, some counterarguments may arise, such as the potential for regular monitoring and early intervention strategies to not be feasible or cost-effective for all individuals at higher risk for anaemia-related complications.

Inclusion criteria

The CKD patients in stages 3a–5 who are not on dialysis and have an eGFR of 60 mL/min/1.73 m² and an Hgb level of 10 g/dL can get ESA therapy. However, these interventions may be challenging due to diverse needs and comorbidities, and their efficacy may vary depending on the severity and underlying cause of the anaemia.¹¹ Some potential interventions for individuals with anaemia include dietary modifications, iron supplementation, blood transfusions, and medication management. Dietary modifications may involve increasing the intake of iron-rich foods, while iron supplementation may be prescribed to replenish iron stores. Blood transfusions may be necessary in severe cases or when other interventions have been ineffective. Medication management may involve treating underlying conditions that contribute to anaemia, such as chronic kidney disease or certain types of cancer. If these interventions prove ineffective, blood transfusions may be required to replenish red blood cells and improve overall health.¹² If an underlying condition like chronic kidney disease or cancer is the cause of anaemia, managing the medication may involve first treating these conditions rather than concentrating solely on iron intake. Additionally, certain individuals may have a genetic condition called hemochromatosis, where their body absorbs too much iron, which can be harmful and exacerbate the condition.^{13–16}

Exclusion criteria

The study aimed to evaluate the safety and appropriateness of blood transfusions for patients with chronic renal replacement therapy, active cancer, bleeding episodes, and documented iron-deficiency anaemia. Patients with a history of severe allergic reactions to blood products, infectious diseases like HIV or hepatitis, or

heart or lung conditions that may worsen the procedure are excluded.¹⁷ Healthcare professionals must evaluate each individual's medical history and overall health status before determining if a blood transfusion is necessary and appropriate. Informed consent from the patient or their legal guardian is typically required before proceeding with the procedure. Blood transfusions are not without risks and potential complications, including transfusion reactions ranging from mild allergic reactions to more severe immune reactions.¹⁸ These reactions can occur due to incompatibility between the donor's blood and the recipient's blood type or the presence of antibodies in the recipient's blood. Healthcare professionals must carefully match the blood type and perform compatibility tests to minimise these risks.

Data collection

The researcher collected information using a questionnaire after obtaining written informed consent from participants. Patients were interviewed to collect demographic data and medical histories to establish a context for current symptoms. Laboratory results, such as Hb, serum creatinine, eGFR, BUN, blood urine, and pharmaceutical information, were collected using the Anatomy Therapeutic Chemical Classification System (ATC).¹⁹ The Form 12 Health Survey (SF-12) was used to measure well-being. The SF-12 questionnaire is a widely used instrument for evaluating self-reported health and well-being. The questionnaire evaluates physical functioning, roles incongruous due to physical and emotional health issues, physical discomfort, general health, vitality, social functioning, and mental health. The SF-12 questionnaire uses a scoring algorithm that takes an average of 50 and uses it to figure out an eight-dimensional summary of physical and mental health. This score is inversely related to the subjective health functions that were reported.²⁰ The SF-12 questionnaire is widely used in research and clinical settings to assess an individual's subjective perception of their overall health and well-being, providing a comprehensive evaluation of various aspects of physical and mental health. The scoring algorithm takes into account the responses provided by the individual across different dimensions, providing a reliable summary score that reflects their subjective health functioning.

Statistical analysis

The study used the student's T-test to compare the average of independent category variables and dependent continuous variables. Using Graph Pad software version 8.0, GraphPad Software (Boston, MA 02110, USA). Statistical analysis was conducted on the SF-12 questionnaire data to determine correlations and patterns between subjective health functioning and other variables.²¹ This analysis helps researchers and clini-

cians gain insights into factors influencing an individual's overall health and well-being. Statistical analysis can also be used to compare the subjective health functioning of different populations or track changes in an individual's health over time. Overall, statistical analysis is crucial for interpreting the data from the SF-12 questionnaire and drawing meaningful conclusions about an individual's health status.¹⁸

Results

The study included 132 prescriptions written by CKD patients aged 40 to 50, with a gender split of 89 men (67.34%) and 43 women (32.57%), and Hb levels ranging from 7-9.9 g/dL. When questioned, every patient admitted to strictly adhering to the dietary changes advised by nephrologists. Overall, 765 different drugs were prescribed. Statistical analysis can provide valuable information about an individual's health status. By examining the data, researchers can identify patterns, trends, and correlations that may be indicative of certain health conditions or risk factors. This information can then be used to develop targeted interventions or treatments to improve the individual's overall well-being. Additionally, statistical analysis allows for the identification of potential confounding factors that may influence the relationship between health functioning and other variables. This helps ensure that any conclusions drawn are accurate and reliable. Out of the 132 prescriptions that were looked at, the average number of medications per prescription was 7.21. According to the first anatomical level of the ATC classification, drugs for the gastrointestinal tract and metabolism were most frequently prescribed (44.86%), followed by drugs for the cardiovascular system (21.85%), drugs for blood disorders and drugs for blood-forming organs (20.12%), and vitamin and mineral supplements (18.42%) (Table 1). The seven drugs that were most frequently prescribed were epoetin (15.06%), multivitamins (14.82%), iron (10.65%), folic acid (10.22%), calcium carbonate (8.17%), calcitriol (5.60%), and omeprazole (4.22%). According to the stages of chronic renal illness listed in Table 2, the patients were classified based on their eGFR values. Chronic renal disease was diagnosed in 61 cases (46.2%) at stage 1, 37 cases (28.1%) at stage 2, 26 cases (19.6%) at stage 3, and 8 cases (6.1%) at stage 4. Eight patients in stage 1 CKD had Hb values as high as 10-10.9 g/dL, whereas a maximum of 21 patients had values as low as 7-7.9 g/dL. The Hb levels in the 15 patients with stage 2 CKD were as low as 7-7.9 g/dL, while in 5 patients, they were as high as 10-10.9 g/dL. Hb levels in 12 individuals with stage 3 illness ranged from 7 to 7.9 g/dL to 10 to 10.9 g/dL in 2 cases. Finally, stage 4 patients have extremely low Hb levels of 7-7.9 g/dL. No patients exhibited Hb levels of 10-10.9 g/dL (Table 3).

Table 1. Analysis of drugs class based on ATC classification*

Class No.	Drugs class (Abbreviation of ATC class)	Total no. of drugs prescribed (%)
A	alimentary tract and metabolism	452 (43.67)
B	blood disorders and blood forming organs	218 (20.12)
C	cardiovascular system	226 (21.85)
D	dermatological drugs	3 (0.21)
G	genitourinary system and sex hormones.	2 (0.14)
J	ant infectious drugs for systemic use	9 (1.02)
L	immunomodulating agents	1 (0.09)
M	drugs for musculoskeletal system	10 (1.09)
N	drugs acting on nervous system	5 (0.56)
P	drugs against parasites and insecticides	0
R	drugs for respiratory system	2 (0.26)
S	drugs for eye, ear	0
V	vitamin and mineral supplements	209 (18.42)

* ATC – Anatomic therapeutic chemical

Table 2. CKD stage wise distribution based on eGFR values

S. No.	Stages	n=132	%
1.	1 (90 mL/min)	61	46.2
2.	2 (60–89 mL/min)	37	28.1
3.	3 (30–59 mL/min)	26	19.6
4.	4 (15–29 mL/min)	8	6.1
5.	5 (15 mL/min)	0	0

Table 3 Association between hemoglobin and stages of CKD (n=132)

S. No.	Hb levels (g/dL)	1	2	3	4
1.	7–7.9	21	15	12	4
2.	8–8.9	17	11	7	3
3.	9–9.9	15	6	3	1
4.	10–10.9	8	5	2	0

Hypertension was the most common risk factor, occurring in 41.6% of men and 37.2% of women. Following this was age: 20.2% of men and 32.6% of women; diabetes: 10.1% of men and 4.6% of women; a family history of the condition: 11.3% of men and 9.3% of women; drug abuse: 14.6% of men and 16.4% of women; and trauma: 2.2% and 0% of women. The mean and standard deviation for all patients in the study are shown in Table 4, which illustrates how the SF-12 health survey correlates with patients' Hb levels. The treatment period for darbepoetin alfa (40 mcg per kg) and epoetin beta-methoxy polyethylene glycol (0.6 mcg per kg) is used to treat anaemia. The study found that mental health (MCS) was significantly better than physical health (PCS) in both groups. Women had higher mean scores on the SF-12 mental health survey compared to men, suggesting they may have better overall mental well-being despite higher drug abuse rates. Men showed slightly higher mean scores on the SF-12 physical health survey, suggesting they may have better physical health outcomes. These findings highlight the complex relationship between gender, health, and risk factors associated

with the condition. However, some cultural contexts, where gender roles and expectations heavily influence health outcomes, may result in lower scores for women compared to men. Individual choices and behaviours, as well as genetics and socioeconomic status, also play a significant role in health outcomes.

Prevalence

A study of 150 patients with CKD found that 88% had anaemia, while 12% did not. The study included 89 males and 43 females, with 128 individuals with Hb values between 7 and 9.9 g/dL. Age-related loss of renal function increases the number of CKD patients experiencing anaemia. Men have higher prevalence rates of the condition, possibly due to occupational hazards, lifestyle choices, and biological differences. Cultural norms and expectations may also contribute to underreporting or delayed diagnosis among women. Understanding the prevalence of the condition across different genders is crucial for addressing the specific needs and challenges faced by each group.

Health-related quality of life (HRQoL)

The mean and standard deviation (SD) were calculated using the SF-12 Questionnaire form. In contrast to feeling depressed, which had a high mean of 4.588 and a low SD of 0.8314, performing many tasks (such as moving a table or lifting any weight) had low mean and SD values of 1.039 and 0.2260, respectively, and had a significant impact on anaemia in CKD patients (Tables 5 and 6). Anaemia in CKD patients, particularly among different genders, leads to decreased energy levels, fatigue, and poor well-being, affecting daily activities and overall health. Addressing anaemia is crucial for improving HRQoL and overall health outcomes.

Table 4. Distribution based on risk factors among patients

S. No.	Risk factors	Male (n=89)	%	Female (n=43)	%
1.	Hypertension	37	41.6%	16	37.2
2.	Age	18	20.2%	14	32.6
3.	Diabetes	9	10.1%	02	4.6
4.	Family history	10	11.3%	04	9.3
5.	Drug abuse	13	14.6%	07	16.3
6.	Trauma/Accident	2	2.2%	0	0

Table 5. Health-related quality of life by SF-12 survey

S. No	Characteristics	Mean	Standard deviation
1.	Physical functioning	2.83	0.4102
2.	Role physical	1.516	0.6188
3.	Role emotional	1.039	0.226
4.	Mental health	1.052	0.4102
5.	Bodily pain	1.156	0.5515
6.	General health	1.13	0.4959
7.	Vitality	1.196	0.3983
8.	Social functioning	2.869	0.6948

Table 6. The association of SF-12 health survey with Hb levels

Overall Survey Questions	Hb 7–9.9 g/dL	Hb 10–10.9g/dL	p
Physical functioning	49.07±37.92	51.89±37.08	0.603
Role physical	47.22±29.5	47.35±32.31	0.977
Role emotional	51.62±30.52	53.01±33.32	0.772
Mental health	65.74±25.14	57.72±26.97	0.04
Bodily pain	50.46±34.16	58.46±37.24	0.137
General health	37.50±26.93	29.12±25.6	0.026
Vitality	53.70±30.48	50.06±34.5	0.464
Social functioning	44.90±31.98	45.79±37.71	0.869
PCS score	36.79±10.72	38.05±10.49	0.412
MCS score	40.25±11.06	39.53±10.45	0.213

* PCS – physical component summary; MCS – mental component summary

Discussion

The study analysed the gender distribution and mean age of CKD patients, who received an average of 7.21 prescriptions. Anaemia in CKD patients significantly impacts their daily activities and overall health, leading to decreased energy levels and fatigue.^{19–21} This condition negatively affects well-being, emphasising the need for effective management and treatment to improve HRQoL and overall health outcomes. Darbepoetin Alfa, administered weekly, has been found to effectively raise blood sugar levels in CKD patients with anaemia.²² This treatment leads to improved energy levels, reduced fatigue, and overall well-being. It also reduces the need for costly blood transfusions, which can be risky and costly. Darbepoetin Alfa not only increases Hb levels but also improves the quality of life for CKD patients, reducing symptoms like shortness of breath, dizziness, and difficulty concentrating. Additionally, studies have shown that Darbepoetin Alfa can help improve cardiovascular health in CKD patients by reducing the risk of heart failure and improving exercise capacity.²³ Furthermore, this treatment has been found to be well tolerated with minimal side effects, making it a viable option for long-term management of anaemia in CKD patients. This improvement in symptom management enhances daily functioning and productivity while minimising complications like infections and transfusion reactions, improving patient safety and healthcare costs.²⁴

Epoetin beta-methoxy polyethylene glycol is a medication that has been shown to increase blood sugar levels in CKD patients with anaemia. Studies show that it stimulates red blood cell production, leading to improved blood sugar levels and alleviating anaemia symptoms. This medication is well-tolerated and safe, making it a viable treatment option for CKD patients.²⁵ It also improves exercise capacity and reduces the need for blood transfusions in CKD patients. Epoetin beta-methoxy polyethylene glycol mimics the action of erythropoietin, a hormone responsible for regulating red blood

cell production. This leads to improved oxygen delivery to tissues and organs, improved energy levels, and reduced fatigue.²⁶ Polypharmacy is defined as the simultaneous use of five or more prescriptions for the same patient. The study found a significant correlation between the severity of anaemia and the degree of physical limitations experienced by CKD patients. Patients with more severe anaemia reported greater difficulty performing daily tasks, such as climbing stairs or walking short distances.²⁷ This underscores the need for effective management and treatment of anaemia to enhance the quality of life and overall functioning of these patients. Interventions aimed at improving haemoglobin levels and addressing anaemia-related symptoms may have a profound impact on the well-being and functional abilities of CKD patients.²⁸ The study included only prescribed drugs, but over-the-counter pharmaceutical use is common in the country, resulting in drug interactions and negative drug responses. Encouraging the use of generic medications can help reduce healthcare costs and promote better patient outcomes.²⁹ Healthcare providers should educate CKD patients about potential drug interactions and the importance of discussing all medications, including over-the-counter drugs, with their healthcare team.³⁰ Additionally, healthcare providers should also emphasise the importance of regular medication reviews to identify and address any potential drug interactions or adverse reactions. This proactive approach can further enhance patient safety and optimise treatment outcomes.³¹ The study discovered that hypertension was the most frequent risk factor, followed by age, diabetes, family history, drug use, and trauma.³² This finding is comparable to a study by Lori et al., which found that coronary artery disease, diabetes, and anaemia were the most common risk factors. However, 84% of CKD patients had hypertension, compared to 80% who had anaemia in the Strauss et al. study.³³ The study showed a correlation between Hb levels and the SF-12 health survey, with those with levels between 7 and 9.9 g/dL and 10 to 10.9 g/dL having significantly higher MCS scores than PCS scores. The majority of studies demonstrate that chronic illnesses – not just renal disease – hurt poor physical and mental health. Nephrologists should pay special attention to reducing the disease's progression, as the condition has a major impact on HRQoL.³⁴ The study highlights the need for comprehensive interventions that address both physical and mental well-being to improve overall HRQoL in CKD patients. These interventions could include a combination of medical treatments, lifestyle modifications, and psychological support. By addressing both the physical and mental aspects of CKD, patients may experience improved quality of life and better overall health outcomes.³⁵ Healthcare providers should consider implementing multidisciplinary care teams to

provide holistic care for CKD patients. These care teams could consist of nephrologists, dietitians, mental health professionals, and social workers who work together to address the various needs of CKD patients. By taking a multidisciplinary approach, healthcare providers can ensure that patients receive comprehensive and coordinated care, leading to better management of their condition and improved HRQoL.³⁶ Furthermore, patient education and empowerment are crucial in promoting self-management and adherence to treatment plans, which can positively impact both physical and mental well-being in CKD patients. Collaboration between healthcare professionals and social workers plays a vital role in supporting CKD patients.³⁷ They provide essential resources and support services to help patients navigate the challenges of living with a chronic illness. Social workers can assist with financial counselling, connecting patients with community resources, and addressing any psychosocial issues that may arise.³⁸ Their involvement in the multidisciplinary team ensures that patients receive holistic care that addresses all aspects of their well-being. Moreover, patient education and empowerment are key components of improving the overall quality of life for CKD patients. By providing patients with knowledge about their condition, treatment.³⁹

Study limitations

The study's cross-sectional design, lack of follow-up, and quantitative data may have hindered the identification of patients' poor quality of life and its underlying causes. In-depth interviews or focus groups could have better highlighted the causes of poor quality of life. The study's small sample size and self-reported HRQoL measures may introduce bias, and it did not consider potential confounding factors like socioeconomic status or comorbidities. Further research with larger sample sizes and more comprehensive assessments is needed to fully understand the impact of CKD on HRQoL.

Conclusion

In conclusion, while this study provided valuable insights into the relationship between chronic kidney disease and quality of life, there are limitations that need to be addressed in future research. By conducting in-depth interviews or focus groups, researchers can gain a more nuanced understanding of the underlying causes of the poor quality of life associated with CKD. Epoetin beta-methoxy polyethylene glycol and Darbepoetin Alfa are the drugs of choice for the treatment of anaemia in CKD patients. Additionally, it is crucial to consider potential confounding factors such as socioeconomic status and comorbidities to obtain a more accurate picture of the impact of CKD on HRQoL. To ensure a comprehensive understanding, future studies should aim for larger sample sizes and utilise more comprehensive

assessments to provide a clearer understanding of the complex relationship between CKD and quality of life.

Declarations

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Author contributions

Conceptualization, A.S. and K.E.; Methodology, H.W.; Software, S.S.; Validation, S.A., S.S. and A.S.; Formal Analysis, H.W.; Investigation, A.S.; Resources, S.A.; Data Curation, S.S.; Writing – Original Draft Preparation, S.S.; Writing – Review & Editing, S.A.; Visualization, K.E.; Supervision, H.W.; Project Administration, K.E.; Funding Acquisition, S.A.

Conflicts of interest

The authors declare no conflict of interest.

Data availability

Data available on request from the authors.

Ethical approval

The Raghavendra Institute of Pharmaceutical Education and Research Institution Review Board gave its approval for this study, and it also obtained data usage permission. The study period was November 2022 to April 2023 (date of approval: October 22, 2022, RIPER/IRB/2022/045).

References

1. Kwon HY, Kim E, You KH. Health-Related Quality of Life for Patients with Chronic Obstructive Pulmonary Disease in South Korea. *Val in Heal.* 2014;17:A780. doi: 10.1016/j.jval.2014.08.370
2. Hussien H, Apetrii M, Covic A. Health-related quality of life in patients with chronic kidney disease. *Exp Rev of Pharm & Outcome Res.* 2020;21:43-54. doi: 10.1080/14737167.2021.1854091
3. Ahmed R, Ahmed T, Ud Din N, et al. Health Related Quality of Life Among Chronic Kidney Disease Patients Undergoing Hemodialysis in Pakistan. *Pak J Kidney Dis.* 2021;5:100-104. doi: 10.53778/pjkd54182
4. Kim S-H, Oh YM, Jo M-W. Health-related quality of life in chronic obstructive pulmonary disease patients in Korea. *Health Qual Life Outcomes.* 2014;12:57. doi: 10.1186/1477-7525-12-57
5. Malik M, Nisha IU, Hussain A. Assessment of Health Related Quality of Life among Chronic Kidney Disease Patients: Challenges for Nephrologists in Pakistan. *Journal of Advances in Medical and Pharmaceutical Sciences.* 2020;22(11):42-48. doi: 10.9734/jamps/2020/v22i1130204

6. Lee SJ, Son H. Comparison of health-related quality of life between patients with stage 3 and 4 chronic kidney disease and patients undergoing continuous ambulatory peritoneal dialysis. *Jpn J Nurs Sci*. 2015;13:166-173. doi: 10.1111/jjns.12101
7. Akca N, Saygili M, Ture AK. The relationship between the perception of chronic disease care and health-related quality of life in adults with chronic kidney disease. *Chronic Illn*. 2021;18:874-888. doi: 10.1177/17423953211039792
8. Zhang Y, Li J, Yang L. Health-related quality of life of Chinese patients with chronic kidney disease: a study based on four EQ-5D-3L value sets. *Sci Rep*. 2023;13:7863. doi: 10.1038/s41598-023-35002-0
9. Taptagaporn S, Mongkolsomlit S, Rakkapao N, Kaewdok T, Wattanasoei S. Quality of Life among Patients Suffering from Chronic Kidney Disease in Chronic Kidney Disease Clinic of Thailand. *The Open Public Health Journal*. 2021;14:417-424. doi: 10.2174/1874944502114010417
10. Johnston S. Prescribing in patients with chronic kidney disease. *Nurse Prescribing*. 2017;15:192-197. doi: 10.12968/npre.2017.15.4.192
11. Al-Rajhi W, Al Salmi I. Quality of life and health related quality of life among end-stage kidney disease patients: Methodology. *Journal of Nephrology & Renal Therapy* 2021;21. 10.24966/NRT-7313/100039
12. Bashar MA, Haque ME, Islam MZ. Nutritional Status and Health Related Quality of Life Of Chronic Kidney Disease Patients. *JOPSOM*. 2022;40:44-51. doi: 10.3329/jopsom.v40i2.61796
13. Horvat N, Locatelli I, Kos M, Janežič A. Medication adherence and health-related quality of life among patients with chronic obstructive pulmonary disease. *Acta Pharmaceutica* 2018;68:117-125. <https://doi.org/10.2478/acph-2018-0006>.
14. McAdams-DeMarco MA, Ying H, Olorundare I, et al. Frailty and Health-Related Quality of Life in End Stage Renal Disease Patients of All Ages. *J Frailty Aging*. 2016;5(3):174-179.
15. Unruh ML, Hess R. Assessment of Health-Related Quality of Life Among Patients With Chronic Kidney Disease. *Adv Chronic Kidney Dis*. 2007;14:345-352. doi: 10.1053/j.ackd.2007.07.011
16. Parekh AJ. Systematic Review on Quality of Life of Patients with Chronic Kidney Disease. *Inter J Psych Rehab*. 2020;24:7432-7444. doi: 10.37200/ijpr/v24i5/pr2020777
17. Chen L, Wang J, Huang X, et al. Association between diabetes mellitus and health-related quality of life among patients with chronic kidney disease: results from the Chinese Cohort Study of Chronic Kidney Disease (C-STRIDE). *Health Qual Life Outcomes*. 2020;18. doi: 10.1186/s12955-020-01519-5
18. Aly A, Kharshid A, Syed Sulaiman S. Evaluation of Health-Related Quality of Life among Malaysian non Dialysis dependent Chronic Kidney Disease Patients. *Value in Health*. 2017;20: A896-A897. doi: 10.1016/j.jval.2017.08.2736
19. Jyotsna B. A Descriptive Analysis of Prescribing Patterns of Drugs in Chronic Kidney Disease Patients on Maintenance Hemodialysis. *JMSCR*. 2019;7:126. doi: 10.18535/jmscr/v7i5.126
20. Alrajhi W. SAT-220 Quality Of Life and Health Related Quality of Life in Patients with End Stage Kidney Disease. *Kidney Int Rep*. 2020;5:94. doi: 10.1016/j.ekir.2020.02.235
21. Krishnan A, Lim W, Teixeira-Pinto A, Craig J, Wong G. SUN-098 Health Related Quality Of Life In Patients With Chronic Kidney Disease. *Kidney Int Rep*. 2019;4:197. doi: 10.1016/j.ekir.2019.05.495
22. Andayani T, Puspitasari C. The Association Hemoglobin Levels with Health-Related Quality of Life of Patients with Chronic Kidney Disease. *Value in Health*. 2017;20:A492. doi: 10.1016/j.jval.2017.08.3026
23. Senanayake S, Gunawardena N, Palihawadana P, et al. Health related quality of life in chronic kidney disease; a descriptive study in a rural Sri Lankan community affected by chronic kidney disease. *Health Qual Life Outcomes*. 2020;18(1):106. doi: 10.1186/s12955-020-01369-1
24. Morga A, Alexandre AF, Koochaki P, Georgiadis A, Desvignes-Gleizes C. MO555 Assessment of Health-Related Quality of Life (Hrql) Measures for Paediatric Patients with Anaemia of Chronic Kidney Disease (CKD). *Nephrology Dialysis Transplantation*. 2021;36:gfab085.0018. doi: 10.1093/ndt/gfab085.0018
25. Finkelstein FO, Finkelstein SH. The Impact of Anemia Treatment on Health-Related Quality of Life in Patients with Chronic Kidney Disease in the Contemporary Era. *Adv Chronic Kidney Dis*. 2019;26:250-252. doi: 10.1053/j.ackd.2019.04.003
26. Hsu Y-C, Lee P-H, Lei C-C, Shih Y-H, Lin C-L. Analgesic use, parents' clan, and coffee intake are three independent risk factors of chronic kidney disease in middle and elderly-aged population: a community-based study. *Renal Fail*. 2014;36:361-366. doi: 10.3109/0886022x.2013.866017
27. Moon J. Perfluoroalkyl substances (PFASs) exposure and kidney damage: Causal interpretation using the US 2003-2018 National Health and Nutrition Examination Survey (NHANES) datasets. *Environ Poll*. 2021;288:117707. doi: 10.1016/j.envpol.2021.117707
28. Rao MV, Qiu Y, Wang C, Bakris G. Hypertension and CKD: Kidney Early Evaluation Program (KEEP) and National Health and Nutrition Examination Survey (NHANES), 1999-2004. *Am J Kidney Dis*. 2008; 51: 30-37. doi: 10.1053/j.ajkd.2007.12.012
29. Fehr T, Ammann P, Garzoni D, et al. Interpretation of erythropoietin levels in patients with various degrees of renal insufficiency and anemia. *Kidney Inter*. 2004; 66:1206-1211. doi: 10.1111/j.1523-1755.2004.00880.x
30. Al Salmi I. Quality of Life and Health-Related Quality of Life among end-stage Kidney Disease Patients: Testing the concepts and assessing the Measures. *Nep Ren Therap*. 2020;6:1-24. doi: 10.24966/nrt-7313/100041

31. Fidan C, Ağırbaş İ. The Effect of Renal Replacement Therapy on Quality of Life in Chronic Renal Failure: A Meta-Analysis. *Clin Exp Nephrol.* 2023;27(10):829-846. doi: 10.1007/s10157-023-02377-3
32. Han T-C, Lin H-S, Chen C-M. Association between Chronic Disease Self-Management, Health Status, and Quality of Life in Older Taiwanese Adults with Chronic Illnesses. *Health.* 2022;10:609. doi: 10.3390/healthcare10040609
33. Barile JP, Thompson WW, Zack MM, Krahn GL, Horner-Johnson W, Bowen SE. Multiple Chronic Medical Conditions and Health-Related Quality of Life in Older Adults, 2004–2006. *Prev Chronic Dis.* 2013;10:E162. doi: 10.5888/pcd10.120282
34. Bennett L. Patient independence in chronic kidney disease and anaemia: implications of the 2012 kdigo guideline. *J Ren Care.* 2013;39:108-117. doi: 10.1111/j.1755-6686.2013.12010.x
35. Chamney M, Pugh-Clarke K, Kafkia T, Wittwer I. CE: Continuing Education Article Management of anaemia in chronic kidney disease. *J Ren Care.* 2010;36:102-111. doi: 10.1111/j.1755-6686.2010.00149.x
36. Jenkins K. Measuring quality of life in anaemia management. *J Renal Nurs.* 2012;4:26-27. doi: 10.12968/jorn.2012.4.1.26
37. D'Souza MS, Rathinasamy EL. Education and Exercise on the Quality of Life among Adults with Chronic Renal Disease. *Endocrinology and Disorders.* 2018;2:1-7. doi: 10.31579/2640-1045/037
38. Stevens PE. Anaemia, diabetes and chronic kidney disease: where are we now. *J Ren Care.* 2012;38:67-77. doi: 10.1111/j.1755-6686.2012.00281.x
39. Wittwer I. Iron deficiency anaemia in chronic kidney disease. *J Ren Care.* 2013;39:182-188. doi: 10.1111/j.1755-6686.2013.12026.x