Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Anaemia and health-related quality of life in patients on maintenance haemodialysis in Douala, Cameroon: a cross-sectional study

Vincent Ebenezer Ngamby
vincentngamby@gmail.com
University of Douala
Géraldine Nguea Ndjamen
University of Douala
Nadine Dion Ebah
University of Douala
Jean-Yves Balepna
Laquintinie Hospital of Douala
Marie Solange Ndom Ebongue
University of Douala
Hermine Fouda
University of Yaounde I
Marie Patrice Halle
University of Douala

Research Article

Keywords: Anaemia, Haemodialysis, Health-related quality of life, KDQOL-SF, Erythropoiesis-stimulating agents, Cameroon

Posted Date: November 10th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11678260/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Anaemia is a frequent complication of kidney failure and may impair health-related quality of life (HRQoL), but data from sub-Saharan Africa, where access to erythropoiesis-stimulating agents (ESA) is limited, are scarce. We assessed the prevalence of anaemia, its association with HRQoL, and the factors associated with poor HRQoL among anaemic patients on maintenance haemodialysis in Douala, Cameroon.

Methods

We conducted a cross-sectional analytical study from January to May 2026 in the haemodialysis units of the Douala General Hospital and the Laquintinie Hospital of Douala. Consenting adults on maintenance haemodialysis were enrolled consecutively. Anaemia was defined as a mean haemoglobin (Hb) of the last three monthly measurements < 10 g/dL. HRQoL was assessed with the Kidney Disease Quality of Life Short Form (KDQOL-SF); an overall score < 50 defined poor HRQoL.

Results

Of 253 patients analysed (median age 50 years [IQR 42–60]; 41.1% women), 199 had anaemia (78.7%; 95% CI 73.2–83.3). Only 52.3% (n = 104) of anaemic patients were receiving an ESA, whereas 54.8% (n = 109) had been transfused. Anaemic patients had lower overall KDQOL-SF scores (median 51.6 vs 56.9; p = 0.003) and SF-36 composite scores (45.0 vs 56.2; p < 0.001), mainly in physical, general health and social domains. Poor HRQoL was more frequent among anaemic patients (41.7% vs 24.1%; adjusted odds ratio [aOR] 2.22, 95% CI 1.09–4.51), and each 1 g/dL decrease in Hb was associated with 38% higher odds of poor HRQoL (aOR 1.38, 1.17–1.63). Among anaemic patients, poor HRQoL was independently associated with pallor (aOR 3.41, 1.16–10.06), pre-dialysis blood pressure ≥ 140/90 mmHg (aOR 2.41, 1.10–5.26) and inversely associated with serum phosphate > 45 mg/L (aOR 0.43, 0.22–0.86). ESA use was associated with lower odds of poor HRQoL in bivariable analysis (OR 0.50, 0.28–0.88) but not after adjustment.

Conclusions

Anaemia affected about four in five patients on haemodialysis in Douala and was associated, in a graded manner, with poorer HRQoL, mainly in its physical dimensions. Improving access to ESA and iron therapy, together with better blood pressure control and regular HRQoL assessment, should be priorities for haemodialysis care in Cameroon.

Background

Chronic kidney disease (CKD) is a growing global health problem and one of the leading causes of death worldwide, with a disproportionate and rising burden in low- and middle-income countries [1]. In sub-Saharan Africa (SSA), maintenance haemodialysis is the main available kidney replacement therapy, often at high out-of-pocket cost for patients and families [2–4].

Anaemia is one of the most common complications of CKD. It results mainly from relative erythropoietin deficiency and disordered iron homeostasis, compounded in patients on haemodialysis by blood losses, inflammation, shortened red cell survival and nutritional deficiencies [5, 6]. Its prevalence rises as kidney function declines, and a meta-analysis from SSA reported a pooled prevalence of 59%, rising to 71% among patients on dialysis [7]. Anaemia contributes to fatigue, reduced exercise capacity, cognitive impairment, cardiovascular morbidity and transfusion dependence [5, 8]. Current guidelines recommend treating anaemia in patients on dialysis with iron and erythropoiesis-stimulating agents (ESA), with a maintenance haemoglobin (Hb) target below 11.5 g/dL, because higher targets have not improved outcomes and may cause harm [6, 9, 10].

Health-related quality of life (HRQoL) is a patient-centred outcome that independently predicts hospitalisation and mortality in patients on haemodialysis [11]. Several studies from Europe, the United States, the Middle East, Asia and Nigeria have shown that lower Hb is associated with poorer HRQoL, particularly in its physical dimensions [12–18], although this relationship has not been found in all populations [19]. In Cameroon, studies have documented a high prevalence of anaemia among patients on haemodialysis [20, 21], frequent reliance on blood transfusion with its financial toxicity [4, 22] and poor HRQoL among patients on maintenance haemodialysis [3, 23], but the relationship between anaemia and HRQoL has not been specifically examined. High cost of ESA are largely paid by patients as part of the in-pocket total cost of care. Blood transfusion is still widely used as a substitute, which may influence both anaemia control and quality of life.

We therefore aimed to determine the prevalence of anaemia among patients on maintenance haemodialysis in Douala, to compare HRQoL between patients with and without anaemia, and to identify the factors associated with poor HRQoL among anaemic patients.

Methods

Study design and setting

We conducted a cross-sectional analytical study from January to May 2026 in the two public haemodialysis units of Douala, the economic capital of Cameroon: the Douala General Hospital (DGH), a first-category university teaching hospital with 32 dialysis posts and approximately 300 patients, and the Laquintinie Hospital of Douala (LHD), a second-category referral hospital with 15 dialysis posts and approximately 140 patients. Majority of patients receive two sessions of 4hours duration per week. The study is reported in accordance with the STROBE statement [24].

Participants

All patients aged ≥ 21 years on maintenance haemodialysis for at least three months who gave written informed consent were eligible and were enrolled consecutively during their dialysis sessions. Patients with sickle cell disease and those without a full blood count were excluded.

The minimum sample size was calculated using the single-proportion formula $n = z^2p(1 - p)/e^2$, with $z = 1.96$, an expected anaemia prevalence of 82.9% reported among patients on haemodialysis in Yaoundé [21] and a margin of error of 5%, giving 218 patients. Recruitment was planned proportionally to the size of each unit (152 at DGH and 66 at LHD).

Data collection

Trained investigators administered a structured questionnaire face-to-face in a private setting during dialysis sessions (approximately 25 minutes per patient). Sociodemographic data (age, sex, marital status, education, occupation, monthly income and religion), clinical data (primary kidney disease, comorbidities, dialysis vintage, vascular access, current treatments, symptoms) and pre-dialysis blood pressure, heart rate, height and dry weight were recorded and completed from the medical records. Body mass index (BMI) was calculated from dry weight. Pre-dialysis blood pressure ≥ 140/90 mmHg was considered uncontrolled. Anaemia treatment (ESA, iron and blood transfusion) was recorded as reported by the patient and in the medical records.

Hb, haematocrit, serum calcium and serum phosphate were obtained from the routine monthly laboratory tests. For each patient, the mean of the last three monthly values including the month of enrolment was used (results from November and December 2025 were used for patients enrolled in January 2026); when fewer than three values were available, the mean of the available values was used. Anaemia was defined as a mean Hb < 10 g/dL, the upper bound of the range (9–10 g/dL) at which current guidelines suggest initiating ESA therapy in patients on dialysis [6]. Hypocalcaemia was defined as serum calcium < 84 mg/L and hyperphosphataemia as serum phosphate > 45 mg/L.

Assessment of health-related quality of life

HRQoL was assessed using the French version of the Kidney Disease Quality of Life Short Form (KDQOL-SF) [25, 26], whose kidney-specific scales have shown acceptable psychometric properties in SSA patients on haemodialysis [27]. The instrument combines the generic SF-36 core, which explores eight dimensions (physical functioning, role limitations due to physical health, pain, general health, emotional well-being, role limitations due to emotional problems, social functioning and energy/fatigue), with kidney disease-targeted scales (symptoms/problems, effects of kidney disease, burden of kidney disease, work status, cognitive function, quality of social interaction, sexual function, sleep, social support and dialysis staff encouragement). The patient satisfaction item was not administered. Each scale was scored from 0 to 100, with higher scores indicating better HRQoL. We computed an SF-36

composite (mean of the eight SF-36 scales), a kidney disease-targeted composite (mean of the ten kidney-targeted scales) and an overall KDQOL-SF score (mean of the 18 available scales). Poor HRQoL was defined as an overall score < 50.

Statistical analysis

Data were entered in CSPro 7.5 and analysed with SPSS 29.0; the analyses reported here were reproduced in Python 3 (pandas, SciPy and statsmodels) from the study database. Categorical variables are presented as counts and percentages and were compared with the chi-squared or Fisher's exact test. Continuous variables are presented as medians and interquartile ranges (IQR), or means ± standard deviation (SD), and were compared with the Mann–Whitney U test. The prevalence of anaemia is reported with its Wilson 95% confidence interval (CI).

The association between anaemia and poor HRQoL was assessed with logistic regression, both unadjusted and adjusted for age, sex, hospital, type 2 diabetes, dialysis vintage and employment, chosen a priori as potential confounders. Hb was also analysed as a continuous variable (per 1 g/dL decrease). Linear regression with the same covariates was used to estimate differences in overall and composite scores. Among anaemic patients, factors associated with poor HRQoL were first explored in bivariable analysis; variables with $p < 0.10$, together with age and sex, were entered into a multivariable logistic regression model. Results are expressed as odds ratios (OR) or adjusted OR (aOR) with 95% CI. Multicollinearity was checked with variance inflation factors, calibration with the Hosmer–Lemeshow test, and discrimination with the area under the receiver operating characteristic curve (AUC). Analyses were complete-case. In a sensitivity analysis, the main model was restricted to patients with three Hb values available. A two-sided $p < 0.05$ was considered statistically significant.

Results

Study population

Of the 308 patients on maintenance haemodialysis assessed, 54 were excluded (31 declined, two had sickle cell disease and 21 had no full blood count), and 254 were enrolled. One participant had no recorded Hb value, leaving 253 patients for analysis (176 at DGH and 77 at LHD) (Fig. 1). The mean age was 49.9 ± 13.3 years (range 22–84) and 104 (41.1%) were women. Hypertension (96%, n = 191) and type 2 diabetes (17.7%, n = 35) were the main comorbidities. The median dialysis vintage was 24 months (IQR 12–48) and 90.1% of patients were dialysed through an arteriovenous fistula (Table 1).

Table 1
Characteristics of the study population according to anaemia status (N = 253)

Characteristic	Total (N = 253)	Anaemia (n = 199)	No anaemia (n = 54)	p value
Sociodemographic characteristics				
Age, years	50.0 (42.0–60.0)	49.0 (41.5–59.0)	53.0 (45.0–60.0)	0.412
Female sex	104 (41.1)	86 (43.2)	18 (33.3)	0.191
Laquintinie Hospital of Douala (vs DGH)	77 (30.4)	67 (33.7)	10 (18.5)	0.032
Married	160 (63.2)	119 (59.8)	41 (75.9)	0.029
Education level				0.645
None	6 (2.4)	5 (2.5)	1 (1.9)	
Primary	27 (10.7)	19 (9.5)	8 (14.8)	
Secondary	155 (61.3)	125 (62.8)	30 (55.6)	
University	65 (25.7)	50 (25.1)	15 (27.8)	
Currently employed	134 (53.0)	96 (48.2)	38 (70.4)	0.004
Monthly income, FCFA				0.001
< 43,969	36 (14.2)	35 (17.6)	1 (1.9)	
43,969–99,999	99 (39.1)	83 (41.7)	16 (29.6)	
100,000–300,000	111 (43.9)	76 (38.2)	35 (64.8)	
> 300,000	7 (2.8)	5 (2.5)	2 (3.7)	
Clinical characteristics				
Primary kidney disease				0.716
Vascular	56 (22.1)	46 (23.1)	10 (18.5)	
Tubulointerstitial	18 (7.1)	15 (7.5)	3 (5.6)	
Glomerular	69 (27.3)	55 (27.6)	14 (25.9)	

Values are n (%) or median (interquartile range). Percentages are calculated on non-missing values. p values from the chi-squared test, Fisher's exact test (□) or Mann–Whitney U test.

□ Calculated from dry weight. BP, blood pressure; DGH, Douala General Hospital; ESA, erythropoiesis-stimulating agent; FCFA, Central African CFA franc. Calcium < 84 mg/L corresponds to < 8.4 mg/dL; phosphate > 45 mg/L corresponds to > 4.5 mg/dL.

Characteristic	Total (N = 253)	Anaemia (n = 199)	No anaemia (n = 54)	p value
Sociodemographic characteristics				
Undetermined	110 (43.5)	83 (41.7)	27 (50.0)	
Hypertension	241 (95.3)	191 (96.0)	50 (92.6)	0.291□
Type 2 diabetes	47 (18.7)	35 (17.7)	12 (22.2)	0.447
HIV infection	15 (6.0)	13 (6.6)	2 (3.7)	0.745□
Heart failure	9 (3.6)	7 (3.5)	2 (3.7)	1.000□
Dialysis vintage, months	24.0 (12.0–48.0)	24.0 (12.0–48.0)	36.0 (20.0–48.0)	0.524
Arteriovenous fistula	228 (90.1)	180 (90.5)	48 (88.9)	0.733
Body mass index, kg/m²□	23.4 (21.0–25.8)	23.2 (20.8–25.3)	24.2 (21.2–27.1)	0.045
Pre-dialysis BP ≥ 140/90 mmHg	174 (68.8)	142 (71.4)	32 (59.3)	0.089
Fatigue (asthenia)	163 (64.7)	147 (74.2)	16 (29.6)	< 0.001
Cramps	60 (23.7)	52 (26.1)	8 (14.8)	0.083
Headache	44 (17.6)	40 (20.3)	4 (7.5)	0.030
Pallor	24 (9.5)	23 (11.6)	1 (1.9)	0.031
Anaemia treatment				
ESA	155 (61.3)	104 (52.3)	51 (94.4)	< 0.001
Iron	159 (63.6)	107 (54.6)	52 (96.3)	< 0.001
Blood transfusion	111 (44.0)	109 (55.1)	2 (3.7)	< 0.001
Laboratory values (3-month mean)				
Haemoglobin, g/dL	8.6 (7.5–9.7)	8.1 (7.2–8.9)	10.9 (10.4–11.8)	< 0.001
Serum calcium, mg/L	86.0 (80.8–90.1)	84.8 (79.5–89.6)	89.4 (84.9–93.9)	< 0.001

Values are n (%) or median (interquartile range). Percentages are calculated on non-missing values. p values from the chi-squared test, Fisher's exact test (□) or Mann–Whitney U test.

□ Calculated from dry weight. BP, blood pressure; DGH, Douala General Hospital; ESA, erythropoiesis-stimulating agent; FCFA, Central African CFA franc. Calcium < 84 mg/L corresponds to < 8.4 mg/dL; phosphate > 45 mg/L corresponds to > 4.5 mg/dL.

Characteristic	Total (N = 253)	Anaemia (n = 199)	No anaemia (n = 54)	p value
Sociodemographic characteristics				
Serum phosphate, mg/L	45.3 (33.1–57.6)	44.7 (33.0–57.5)	49.1 (33.1–60.8)	0.617
Calcium < 84 mg/L	99 (39.9)	87 (44.8)	12 (22.2)	0.003
Phosphate > 45 mg/L	126 (51.0)	95 (49.2)	31 (57.4)	0.288

Values are n (%) or median (interquartile range). Percentages are calculated on non-missing values. p values from the chi-squared test, Fisher's exact test (□) or Mann–Whitney U test.

□ Calculated from dry weight. BP, blood pressure; DGH, Douala General Hospital; ESA, erythropoiesis-stimulating agent; FCFA, Central African CFA franc. Calcium < 84 mg/L corresponds to < 8.4 mg/dL; phosphate > 45 mg/L corresponds to > 4.5 mg/dL.

Prevalence and characteristics of anaemia

The mean Hb was 8.6 ± 1.8 g/dL. Anaemia was present in 199 patients, a prevalence of 78.7% (95% CI 73.2–83.3); it was more frequent among patients at LHD than DGH (87.0% vs 75.0%; p = 0.032). Anaemia was normocytic normochromic in 173 (86.9%), microcytic hypochromic in 17 (8.5%) and macrocytic in 9 (4.5%) anaemic patients. Compared with non-anaemic patients, anaemic patients were less often married and employed, and more often in the lowest income category. Patients reported fatigue (74.2% vs 29.6%), headache and pallor (Table 1). Only 104 anaemic patients (52.3%) were receiving an ESA and 107 (54.6%) iron, whereas 109 (55.1%) of them had received a blood transfusion;.

Health-related quality of life according to anaemia status

The median overall KDQOL-SF score was 52.8 (IQR 46.1–59.4), and 96 patients (37.9%) had poor HRQoL. The lowest scores were observed for role limitations due to physical health, burden of kidney disease, general health and energy/fatigue (Table 2). Anaemic patients had a lower overall score than non-anaemic patients (51.6 vs 56.9; p = 0.003) and a lower SF-36 composite (45.0 vs 56.2; p < 0.001), whereas the kidney disease-targeted composite did not differ significantly (56.8 vs 57.3; p = 0.152). Anaemic patients scored lower for physical functioning, role limitations due to physical health, general health, role limitations due to emotional problems, social functioning, symptoms/problems and burden of kidney disease (Table 2, Fig. 2).

Table 2
KDQOL-SF scale scores according to anaemia status

Scale	Total (N = 253)	Anaemia (n = 199)	No anaemia (n = 54)	p value
Kidney disease-targeted scales				
Symptoms/problems	72.9 (62.5–81.2)	70.8 (62.5–79.2)	76.0 (68.8–84.9)	0.002
Effects of kidney disease	46.9 (39.3–59.4)	46.9 (37.5–59.4)	51.2 (40.6–61.7)	0.156
Burden of kidney disease	25.0 (18.8–37.5)	25.0 (12.5–34.4)	25.0 (18.8–37.5)	0.039
Work status	50.0 (0.0–50.0)	50.0 (0.0–50.0)	50.0 (0.0–50.0)	0.661
Cognitive function	66.7 (60.0–73.3)	66.7 (60.0–80.0)	66.7 (60.0–73.3)	0.713
Quality of social interaction	73.3 (60.0–80.0)	73.3 (63.3–80.0)	70.0 (60.0–80.0)	0.685
Sexual function [1]	50.0 (25.0–75.0)	50.0 (25.0–75.0)	50.0 (25.0–75.0)	0.717
Sleep	57.5 (50.0–70.0)	57.5 (47.5–70.0)	58.8 (50.0–70.0)	0.757
Social support	66.7 (50.0–100.0)	66.7 (50.0–100.0)	83.3 (66.7–100.0)	0.473
Dialysis staff encouragement	75.0 (75.0–100.0)	75.0 (75.0–100.0)	87.5 (75.0–100.0)	0.122
SF-36 scales				
Physical functioning	50.0 (40.0–65.0)	45.0 (35.0–60.0)	55.0 (45.0–70.0)	0.020
Role limitations – physical	0.0 (0.0–50.0)	0.0 (0.0–41.7)	12.5 (0.0–50.0)	0.014
Pain	67.5 (45.0–80.0)	67.5 (45.0–80.0)	63.8 (46.2–90.0)	0.326
General health	35.0 (25.0–45.0)	30.0 (25.0–40.0)	35.0 (30.0–50.0)	0.009

Values are median (interquartile range) unless otherwise indicated; scores range from 0 to 100, higher scores indicating better HRQoL. p values from the Mann–Whitney U test (chi-squared test for poor HRQoL). [1] Sexual function was not answered by 34 patients. The composites are unweighted means of the corresponding scales; the overall score is the mean of the 18 available scales.

Scale	Total (N = 253)	Anaemia (n = 199)	No anaemia (n = 54)	p value
Kidney disease-targeted scales				
Emotional well-being	60.0 (52.0–68.0)	60.0 (52.0–68.0)	60.0 (56.0–68.0)	0.260
Role limitations – emotional	33.3 (0.0–100.0)	33.3 (0.0–100.0)	66.7 (8.3–100.0)	0.044
Social functioning	62.5 (50.0–75.0)	62.5 (50.0–75.0)	62.5 (62.5–75.0)	0.007
Energy/fatigue	40.0 (35.0–55.0)	40.0 (30.0–50.0)	45.0 (35.0–55.0)	0.118
Composite scores				
Kidney disease-targeted composite	57.0 (51.3–62.9)	56.8 (50.3–62.9)	57.3 (53.7–62.1)	0.152
SF-36 composite	46.2 (36.7–58.1)	45.0 (36.3–56.2)	56.2 (44.8–67.2)	< 0.001
Overall KDQOL-SF score	52.8 (46.1–59.4)	51.6 (45.0–58.5)	56.9 (50.9–62.5)	0.003
Poor HRQoL (overall score < 50), n (%)	96 (37.9)	83 (41.7)	13 (24.1)	0.018

Values are median (interquartile range) unless otherwise indicated; scores range from 0 to 100, higher scores indicating better HRQoL. p values from the Mann–Whitney U test (chi-squared test for poor HRQoL). ‡ Sexual function was not answered by 34 patients. The composites are unweighted means of the corresponding scales; the overall score is the mean of the 18 available scales.

Poor HRQoL was observed in 83 of 199 anaemic patients (41.7%) and 13 of 54 non-anaemic patients (24.1%; p = 0.018). After adjustment, anaemia remained associated with poor HRQoL (aOR 2.22, 95% CI 1.09–4.51), and each 1 g/dL decrease in Hb was associated with higher odds of poor HRQoL (aOR 1.38, 1.17–1.63). Anaemia was associated with a 4.3-point lower overall score and a 6.7-point lower SF-36 composite after adjustment, and each 1 g/dL increase in Hb with a 1.4-point higher overall score (Table 3). The association was stronger when the analysis was restricted to the 206 patients with three Hb values available (aOR 3.13, 1.42–6.92).

Table 3
Association of anaemia and haemoglobin level with health-related quality of life (N = 253)

Outcome / exposure	Crude estimate	p value	Adjusted estimate	p value
Poor HRQoL (overall score < 50); OR (95% CI)				
Anaemia (Hb < 10 vs ≥ 10 g/dL)	2.26 (1.14–4.47)	0.020	2.22 (1.09–4.51)	0.028
Haemoglobin, per 1 g/dL decrease	1.36 (1.17–1.60)	< 0.001	1.38 (1.17–1.63)	< 0.001
Score difference, anaemia vs no anaemia; β (95% CI)				
Overall KDQOL-SF score	-4.46 (-7.61 to -1.31)	0.006	-4.25 (-7.52 to -0.98)	0.011
SF-36 composite	-7.53 (-11.76 to -3.29)	< 0.001	-6.68 (-11.09 to -2.27)	0.003
Kidney disease-targeted composite	-1.92 (-4.85 to 1.01)	0.197	-2.26 (-5.29 to 0.77)	0.143
Overall score, per 1 g/dL higher Hb	1.34 (0.65 to 2.04)	< 0.001	1.44 (0.70 to 2.18)	< 0.001

 Adjusted for age, sex, hospital, type 2 diabetes, dialysis vintage and employment. Odds ratios from logistic regression; β coefficients (score points) from linear regression. In a sensitivity analysis restricted to the 206 patients with three Hb values available, the adjusted OR for anaemia was 3.13 (95% CI 1.42–6.92).

Factors associated with poor HRQoL among anaemic patients

In bivariable analysis among the 199 anaemic patients, poor HRQoL was associated with pallor and pre-dialysis blood pressure ≥ 140/90 mmHg, and inversely associated with ESA use (OR 0.50, 0.28–0.88), iron therapy (OR 0.50, 0.28–0.88) and serum phosphate > 45 mg/L (Table 4).

Table 4
Factors associated with poor health-related quality of life among anaemic patients (n = 199)

Variable	Poor HRQoL (n = 83)	Good HRQoL (n = 116)	Crude OR (95% CI)	p	aOR (95% CI)[a]	p
Age, per year	49.0 (43.0–60.0)	48.5 (40.8–58.2)	1.00 (0.98–1.03)	0.694	1.02 (1.00–1.05)	0.101
Female sex	41 (49.4)	45 (38.8)	1.54 (0.87–2.72)	0.137	1.74 (0.89–3.41)	0.105
Religion						
Catholic	32 (39.0)	67 (58.3)	1 (reference)		1 (reference)	
Evangelical	39 (47.6)	32 (27.8)	2.55 (1.36–4.79)	0.004	3.91 (1.83–8.34)	< 0.001
Other (Pentecostal, Jehovah's Witness, Muslim)	11 (13.4)	16 (13.9)	1.44 (0.60–3.46)	0.415	1.33 (0.48–3.74)	0.584
ESA use	35 (42.2)	69 (59.5)	0.50 (0.28–0.88)	0.016	0.49 (0.14–1.71)	0.261
Iron therapy	36 (44.4)	71 (61.7)	0.50 (0.28–0.88)	0.017	0.46 (0.18–1.16)	0.101
Blood transfusion	52 (62.7)	57 (49.6)	1.71 (0.96–3.04)	0.069	0.60 (0.19–1.92)	0.388
Pallor	15 (18.1)	8 (6.9)	2.98 (1.20–7.40)	0.019	3.41 (1.16–10.06)	0.026
Pre-dialysis BP ≥ 140/90 mmHg	66 (79.5)	76 (65.5)	2.04 (1.06–3.94)	0.033	2.41 (1.10–5.26)	0.027
Phosphate > 45 mg/L	33 (40.7)	62 (55.4)	0.55 (0.31–0.99)	0.046	0.43 (0.22–0.86)	0.017
Type 2 diabetes	11 (13.4)	24 (20.7)	0.59 (0.27–1.29)	0.189	–	
Haemoglobin < 8 g/dL	43 (51.8)	51 (44.0)	1.37 (0.78–2.41)	0.275	–	
Fatigue (asthenia)	62 (74.7)	85 (73.9)	1.04 (0.55–1.99)	0.901	–	

Values are n (%) or median (interquartile range). Percentages are calculated on non-missing values; religion was missing for two patients. [a] Multivariable logistic regression including all variables with an aOR shown (n = 188 with complete data, 78 events); Hosmer–Lemeshow p = 0.32; AUC = 0.77. Variables without an aOR were not retained (bivariable p ≥ 0.10). aOR, adjusted odds ratio; BP, blood pressure; ESA, erythropoiesis-stimulating agent; HRQoL, health-related quality of life; OR, odds ratio.

Variable	Poor HRQoL (n = 83)	Good HRQoL (n = 116)	Crude OR (95% CI)	p	aOR (95% CI)□	p
Dialysis vintage > 60 months	17 (20.5)	20 (17.2)	1.24 (0.60–2.54)	0.563	–	

Values are n (%) or median (interquartile range). Percentages are calculated on non-missing values; religion was missing for two patients. □ Multivariable logistic regression including all variables with an aOR shown (n = 188 with complete data, 78 events); Hosmer–Lemeshow p = 0.32; AUC = 0.77. Variables without an aOR were not retained (bivariable p ≥ 0.10). aOR, adjusted odds ratio; BP, blood pressure; ESA, erythropoiesis-stimulating agent; HRQoL, health-related quality of life; OR, odds ratio.

In the multivariable model (n = 188, 78 events), poor HRQoL remained independently associated with pallor (aOR 3.41, 1.16–10.06), pre-dialysis blood pressure ≥ 140/90 mmHg (aOR 2.41, 1.10–5.26), and inversely associated with serum phosphate > 45 mg/L (aOR 0.43, 0.22–0.86). The associations with ESA (aOR 0.49, 0.14–1.71) and iron therapy (aOR 0.46, 0.18–1.16) were no longer statistically significant. No important multicollinearity was found (all variance inflation factors < 4); the model was well calibrated (Hosmer–Lemeshow p = 0.32) and had acceptable discrimination (AUC 0.77).

Discussion

In this two-centre study of patients on maintenance haemodialysis in Douala, almost four in five patients had a mean Hb < 10 g/dL, and only half of them were receiving an ESA. Anaemia was associated with poorer HRQoL, in a graded manner with decreasing Hb, and mainly through its physical dimensions. Among anaemic patients, pallor and uncontrolled pre-dialysis blood pressure were associated with poor HRQoL, while higher serum phosphate was associated with better HRQoL.

The prevalence of anaemia observed (78.7%) is close to the 82.9% reported among patients on haemodialysis in Yaoundé [21] and consistent with the 79% reported among patients on haemodialysis in Cameroon a decade ago [20] and with the pooled prevalence of 71% among patients on dialysis in SSA [7]. The persistence of such a high prevalence over ten years is concerning. It is higher than the 56% reported in Mexico with the same Hb threshold [28], and much higher than in settings where ESA and intravenous iron are routinely available [12, 13]. The pattern of treatment observed here points to limited access to anaemia therapy as a major explanation: ESA and iron are largely paid for out of pocket with their tremendous cost on patients without medical insurance coverage, and transfusion was used as a substitute in most anaemic patients not receiving an ESA. Transfusion exposes patients to sensitisation, infections and iron overload, and offers only transient correction of anaemia [6]; in Douala, it has been associated with hyperferritinaemia, adverse outcomes, high costs and missed dialysis sessions [4, 22]. The predominantly normocytic normochromic pattern is in keeping with anaemia driven mainly by erythropoietin deficiency, although we could not assess iron status or inflammation.

HRQoL was globally low in our population, with the poorest scores for role limitations due to physical health, burden of kidney disease and general health. The proportion with poor HRQoL (37.9%) was lower

than the 76.2% reported in four government-funded Cameroonian units using the KDQOL-36 [23], a difference that probably reflects differences in instrument, scoring and populations rather than a true difference in HRQoL. Anaemic patients had significantly lower scores in most physical and social domains, and the association with poor HRQoL persisted after adjustment for sociodemographic and clinical factors. The dose-response relationship with Hb, observed for both poor HRQoL and continuous scores, strengthens the plausibility of the association. These findings are consistent with observational data from Europe and the United States, where lower Hb was associated with worse physical functioning, fatigue and work productivity [12, 13], and with studies from Jordan, Palestine, Russia and Nigeria [15–18]. In contrast, no significant correlation between Hb and KDQOL scores was found in an Indonesian haemodialysis cohort [19], possibly because of a narrower Hb range or a smaller sample. Reduced oxygen delivery leads to fatigue [8], impaired exercise tolerance and cognitive slowing, which may explain why the SF-36 physical domains were most affected, while the kidney disease-targeted composite, which mainly reflects the burden of dialysis shared by all patients, did not differ significantly.

ESA use was associated with lower odds of poor HRQoL in bivariable analysis, but this association was attenuated after adjustment. This is probably explained by the strong overlap between ESA use, iron therapy and the absence of transfusion, which limited our ability to separate their effects, as well as by limited statistical power. In randomised trials, targeting Hb levels of 13 g/dL or higher with ESA brought at most modest improvements in fatigue and no clinically meaningful HRQoL gain over lower targets, while increasing cardiovascular risk [9, 10, 29]. These trials, however, compared high with moderate Hb targets and did not address the severe, untreated anaemia observed in our setting. In our setting, where most anaemic patients have Hb far below the recommended range, ensuring affordable and continuous access to ESA and iron, rather than repeated transfusions, is likely to yield clinically meaningful benefits.

Pallor was independently associated with poor HRQoL among anaemic patients. Clinically detectable pallor reflects more severe or long-standing anaemia, although its sensitivity is limited [30], and it may also be a visible marker that patients and their families associate with illness. Uncontrolled pre-dialysis blood pressure was also associated with poor HRQoL; it may reflect volume overload, high interdialytic weight gain or insufficient dialysis dose, which are associated with symptoms such as dyspnoea, headache and fatigue; we could not explore these mechanisms because interdialytic weight gain and dialysis adequacy were not recorded. The inverse association between serum phosphate and poor HRQoL was unexpected. In patients on haemodialysis, serum phosphate partly reflects dietary protein intake, and lower phosphate may indicate poor appetite, malnutrition or inflammation, which are themselves associated with poor quality of life and mortality [31]. This finding should be interpreted with caution and does not question phosphate control recommendations.

This study has several strengths: it included patients from both public haemodialysis units of Douala, exceeded the calculated sample size, used a kidney disease-specific HRQoL instrument administered face-to-face, and used the mean of up to three monthly Hb values rather than a single measurement. Some limitations must be considered. First, the cross-sectional design does not allow causal inference, and reverse causation cannot be excluded. Second, several important determinants of anaemia and

HRQoL were not available, including iron indices, dialysis adequacy (Kt/V). Third, the definition of poor HRQoL relied on an unweighted mean of the KDQOL-SF scales with a cut-off of 50, which is pragmatic but not formally validated; the consistency of the results with continuous scores is, however, reassuring.

Conclusions

Anaemia affected about four in five patients on maintenance haemodialysis in Douala and was independently and progressively associated with poorer HRQoL, particularly in its physical dimensions. Among anaemic patients, pallor and uncontrolled pre-dialysis blood pressure identified those with the poorest HRQoL. Improving access to ESA and iron therapy, reducing reliance on blood transfusion, optimising blood pressure and volume control, and integrating routine HRQoL assessment into haemodialysis care should be priorities in Cameroon. Longitudinal and interventional studies are needed to determine whether better anaemia correction improves the quality of life of these patients.

Abbreviations

aOR
Adjusted odds ratio
AUC
Area under the receiver operating characteristic curve
BMI
Body mass index
BP
Blood pressure
CI
Confidence interval
CKD
Chronic kidney disease
DGH
Douala General Hospital
ESA
Erythropoiesis-stimulating agent
Hb
Haemoglobin
HRQoL
Health-related quality of life
IQR
Interquartile range
KDQOL-SF
Kidney Disease Quality of Life Short Form
LHD

Laquintinie Hospital of Douala
OR
Odds ratio
SD
Standard deviation
SF-36
36-item Short Form Health Survey
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. It was approved by the Institutional Ethics Committee of the University of Douala (approval N°5476CEI-Udo/03/2026/T), and administrative authorisations were obtained from the Directors of the Douala General Hospital and the Laquintinie Hospital of Douala. All participants gave written informed consent before inclusion.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Clinical trial number

Not applicable.

Funding

This study received no specific funding from any funding agency in the public, commercial or not-for-profit sectors.

Author Contribution

VEN, GNN and MPH conceived and designed the study. (initial idea, methodology, litterature review)NDE collected the data under the supervision of VEN, GNN in the two hemodialysis centers.NDE analysed and

interpreted the data.NDE and VEN wrote the first manuscript and made the necessary traduction.GNN, JYB, MSNE, HF, and MPH critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Acknowledgements

We thank the patients who participated in this study and the medical and nursing staff of the haemodialysis units of the Douala General Hospital and the Laquintinie Hospital of Douala.

Data Availability

The dataset used and analysed during the current study is available from the corresponding author on reasonable request.

References

1. GBD 2023 Chronic Kidney Disease Collaborators. Global, regional, and national burden of chronic kidney disease in adults, 1990–2023, and its attributable risk factors: a systematic analysis for the Global Burden of Disease Study 2023. Lancet. 2025;406(10518):2461–82. https://doi.org/10.1016/S0140-6736(25)01853-7.
2. Halle MP, Ashuntantang G, Kaze FF, Takongue C, Kengne AP. Fatal outcomes among patients on maintenance haemodialysis in sub-Saharan Africa: a 10-year audit from the Douala General Hospital in Cameroon. BMC Nephrol. 2016;17(1):165. https://doi.org/10.1186/s12882-016-0377-5.
3. Fouda HDEEM, Mouaffo FNM, Nzana VB, Tumchou P, Elimby L, Teuwafeu D, et al. Household wealth and its association with non-adherence, quality of life, anxiety and depression amongst hemodialysis patients in two centers in Cameroon. BMC Nephrol. 2025;26(1):447. https://doi.org/10.1186/s12882-025-04380-0.
4. Fouda Mepse, Ebana HD, Balepna JY, Elimby L, Nguéa AG, Ngamby V, Simo Kiegaing R, et al. The financial toxicity of anemia management among patients on chronic hemodialysis: a cross-sectional study on blood transfusion costs and care disruption in Douala, Cameroon. Open J Nephrol. 2026;16(3):439–55. https://doi.org/10.4236/ojneph.2026.163038.
5. Fishbane S, Spinowitz B. Update on anemia in ESRD and earlier stages of CKD: core curriculum 2018. Am J Kidney Dis. 2018;71(3):423–35. https://doi.org/10.1053/j.ajkd.2017.09.026.
6. Babitt JL, Berns JS, Bozkurt B, Cheung Khedairy RS, Cuevas Y, Effa EE, et al. Executive summary of the KDIGO 2026 Clinical Practice Guideline for the Management of Anemia in Chronic Kidney Disease (CKD). Kidney Int. 2026;109(1):44–56. https://doi.org/10.1016/j.kint.2025.06.005.
7. Taderegew MM, Wondie A, Terefe TF, Tarekegn TT, GebreEyesus FA, Mengist ST, et al. Anemia and its predictors among chronic kidney disease patients in Sub-Saharan African countries: a systematic

review and meta-analysis. PLoS ONE. 2023;18(2):e0280817. https://doi.org/10.1371/journal.pone.0280817.

8. Jhamb M, Weisbord SD, Steel JL, Unruh M. Fatigue in patients receiving maintenance dialysis: a review of definitions, measures, and contributing factors. Am J Kidney Dis. 2008;52(2):353–65. https://doi.org/10.1053/j.ajkd.2008.05.005.
9. Pfeffer MA, Burdmann EA, Chen CY, Cooper ME, de Zeeuw D, Eckardt KU, et al. A trial of darbepoetin alfa in type 2 diabetes and chronic kidney disease. N Engl J Med. 2009;361(21):2019–32. https://doi.org/10.1056/NEJMoa0907845.
10. Singh AK, Szczech L, Tang KL, Barnhart H, Sapp S, Wolfson M, et al. Correction of anemia with epoetin alfa in chronic kidney disease. N Engl J Med. 2006;355(20):2085–98. https://doi.org/10.1056/NEJMoa065485.
11. Mapes DL, Lopes AA, Satayathum S, McCullough KP, Goodkin DA, Locatelli F, et al. Health-related quality of life as a predictor of mortality and hospitalization: the Dialysis Outcomes and Practice Patterns Study (DOPPS). Kidney Int. 2003;64(1):339–49. https://doi.org/10.1046/j.1523-1755.2003.00072.x.
12. Eriksson D, Goldsmith D, Teitsson S, Jackson J, van Nooten F. Cross-sectional survey in CKD patients across Europe describing the association between quality of life and anaemia. BMC Nephrol. 2016;17(1):97. https://doi.org/10.1186/s12882-016-0312-9.
13. van Haalen H, Jackson J, Spinowitz B, Milligan G, Moon R. Impact of chronic kidney disease and anemia on health-related quality of life and work productivity: analysis of multinational real-world data. BMC Nephrol. 2020;21(1):88. https://doi.org/10.1186/s12882-020-01746-4.
14. Mujais SK, Story K, Brouillette J, Takano T, Soroka S, Franek C, et al. Health-related quality of life in CKD patients: correlates and evolution over time. Clin J Am Soc Nephrol. 2009;4(8):1293–301. https://doi.org/10.2215/CJN.05541008.
15. Alshogran OY, Shatnawi EA, Altawalbeh SM, Jarab AS, Farah RI. Predictors of poor health-related quality of life among hemodialysis patients with anemia in Jordan. Health Qual Life Outcomes. 2021;19(1):272. https://doi.org/10.1186/s12955-021-01905-7.
16. Al-Jabi SW, Rajabi NS, Koni AA, Zyoud SH. A multicenter descriptive analysis of anemia management in hemodialysis patients and its association with quality of life. BMC Nephrol. 2023;24(1):197. https://doi.org/10.1186/s12882-023-03254-7.
17. Kotenko ON, Abolyan LV, Kuteinikov VI, Vinogradov VE, Fomin VV. Anemia and quality of life of chronic kidney disease patients on renal replacement therapy by programmed hemodialysis. Ter Arkh. 2023;95(1):32–7. https://doi.org/10.26442/00403660.2023.01.202050.
18. Odeyemi A, Oladimeji OM, Ajibare AO, Iyayi AA, Oladimeji AB, Ojo OT, et al. Impact of anemia on the quality of life of chronic kidney disease patients: a single institution experience. West Afr J Med. 2023;40(11):1253–61. https://pubmed.ncbi.nlm.nih.gov/38099515/.
19. Hasibuan SF, Makmum A, Sukesi L. Profile of anemia and the relationship between hemoglobin levels and quality of life in end-stage chronic kidney disease patients undergoing chronic

hemodialysis at Hasan Sadikin Hospital 2021–2022. Indones J Kidney Hypertens. 2024;1(1):17–23. https://doi.org/10.32867/inakidney.v1i1.120.

20. Kaze FF, Kengne AP, Mambap AT, Halle MP, Mbanya D, Ashuntantang G. Anemia in patients on chronic hemodialysis in Cameroon: prevalence, characteristics and management in low resources setting. Afr Health Sci. 2015;15(1):253–60. https://doi.org/10.4314/ahs.v15i1.33.
21. Mahamat M, Sidje Gahaki F, Nzana VB, Teuwafeu DG, Mambap TA, Fouda H, et al. Profil, coût et déterminants de la prise en charge de l'anémie chez les patients en hémodialyse chronique à Yaoundé. Health Sci Dis. 2025;26(8):3–9. https://doi.org/10.5281/hsd.v26i8.6885.
22. Fouda Mepse, Ebana HD, De Ngaha TSD, Nda Mefo'o JP, Nasser A, Kingue epse Tatnou PD, et al. Prevalence, factors associated and outcome of anaemia with hyperferritinemia among hemodialysis patients in Cameroon at the Douala General Hospital. J Clin Nephrol Res. 2024;11(2):1124. https://www.jscimedcentral.com/public/assets/articles/nephrology-11-1124.pdf.
23. Teuwafeu DG, Sehbing M, Halle MP, Mahamat M, Fouda H, Ashuntantang G. Quality of life and social reinsertion of patients on maintenance haemodialysis in four government funded hospitals in Cameroon. BMC Nephrol. 2024;25(1):335. https://doi.org/10.1186/s12882-024-03778-6.
24. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370(9596):1453–7. https://doi.org/10.1016/S0140-6736(07)61602-X.
25. Hays RD, Kallich JD, Mapes DL, Coons SJ, Carter WB. Development of the kidney disease quality of life (KDQOL) instrument. Qual Life Res. 1994;3(5):329–38. https://doi.org/10.1007/BF00451725.
26. Boini S, Leplège A, Loos Ayav C, Français P, Ecosse E, Briançon S. Mesure de la qualité de vie dans l'insuffisance rénale chronique terminale. Adaptation transculturelle et validation du questionnaire spécifique Kidney Disease Quality of Life. Nephrol Ther. 2007;3(6):372–83. https://doi.org/10.1016/j.nephro.2007.05.005.
27. Gebrie MH, Asfaw HM, Bilchut WH, Lindgren H, Wettergren L. Psychometric properties of the kidney disease quality of life-36 (KDQOL-36) in Ethiopian patients undergoing hemodialysis. Health Qual Life Outcomes. 2022;20(1):24. https://doi.org/10.1186/s12955-022-01932-y.
28. Lizardi Gómez LF, Reyes Sánchez I, Guerrero Soto J, Rivera Antolín J, Muñoz Menjivar C, Venegas Vera A. Factors related to the presence of anemia in patients with chronic kidney disease in hemodialysis. Ann Hematol Oncol. 2021;8(1):1326.
29. Collister D, Komenda P, Hiebert B, Gunasekara R, Xu Y, Eng F, et al. The effect of erythropoietin-stimulating agents on health-related quality of life in anemia of chronic kidney disease: a systematic review and meta-analysis. Ann Intern Med. 2016;164(7):472–8. https://doi.org/10.7326/M15-1839.
30. Kalantri A, Karambelkar M, Joshi R, Kalantri S, Jajoo U. Accuracy and reliability of pallor for detecting anaemia: a hospital-based diagnostic accuracy study. PLoS ONE. 2010;5(1):e8545. https://doi.org/10.1371/journal.pone.0008545.

31. Shinaberger CS, Greenland S, Kopple JD, Van Wyck D, Mehrotra R, Kovesdy CP, et al. Is controlling phosphorus by decreasing dietary protein intake beneficial or harmful in persons with chronic kidney disease? Am J Clin Nutr. 2008;88(6):1511–8. https://doi.org/10.3945/ajcn.2008.26665.
32. Burlacu A, Artene B, Nistor I, Buju S, Jugrin D, Mavrichi I, et al. Religiosity, spirituality and quality of life of dialysis patients: a systematic review. Int Urol Nephrol. 2019;51(5):839–50. https://doi.org/10.1007/s11255-019-02129-x.
33. Bravin AM, Trettene ADS, Andrade LGM, Popim RC. Benefits of spirituality and/or religiosity in patients with chronic kidney disease: an integrative review. Rev Bras Enferm. 2019;72(2):541–51. https://doi.org/10.1590/0034-7167-2018-0051.

Figures

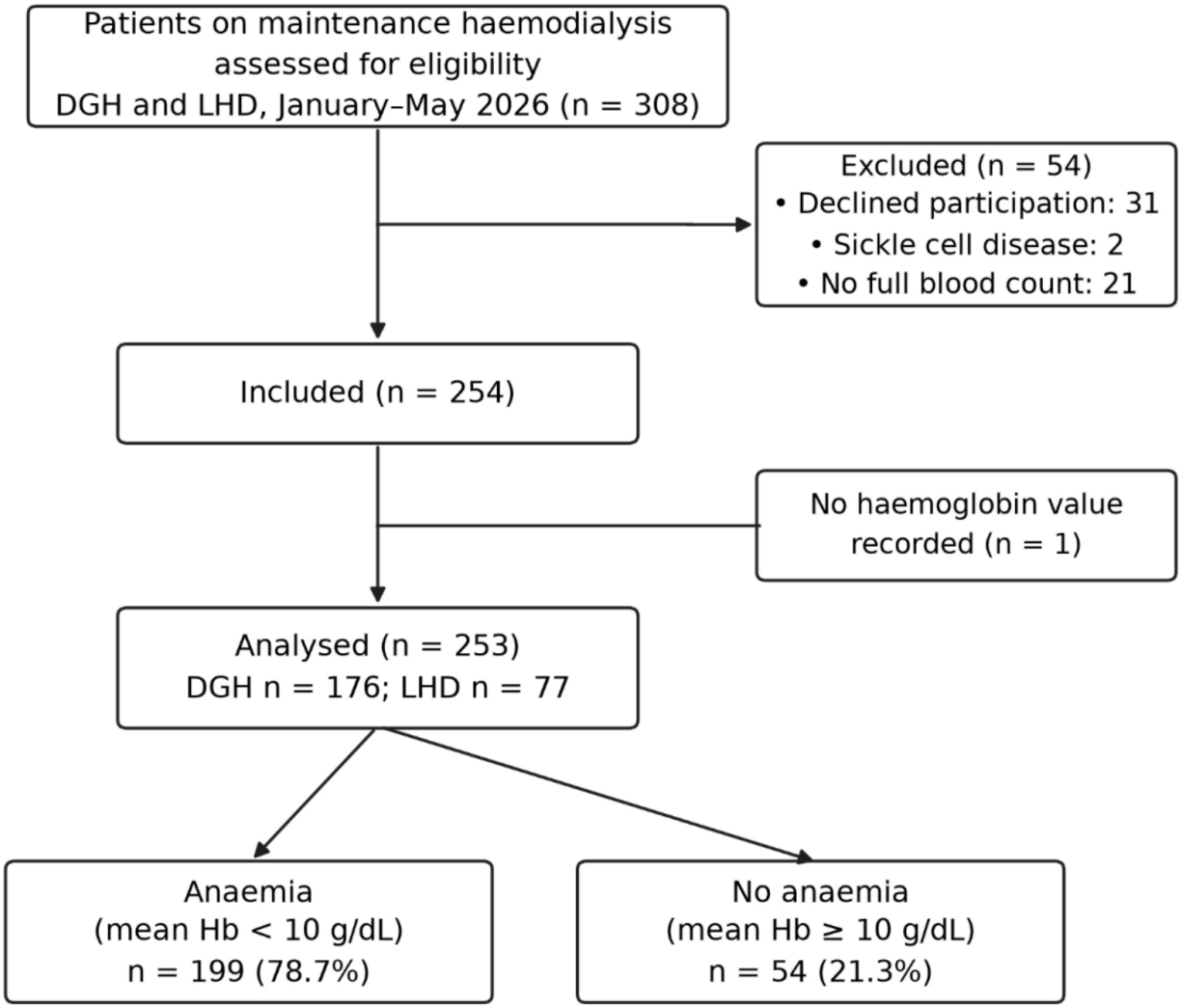


Figure 1

Flow diagram of the study participants. DGH, Douala General Hospital; LHD, Laquintinie Hospital of Douala; Hb, haemoglobin.

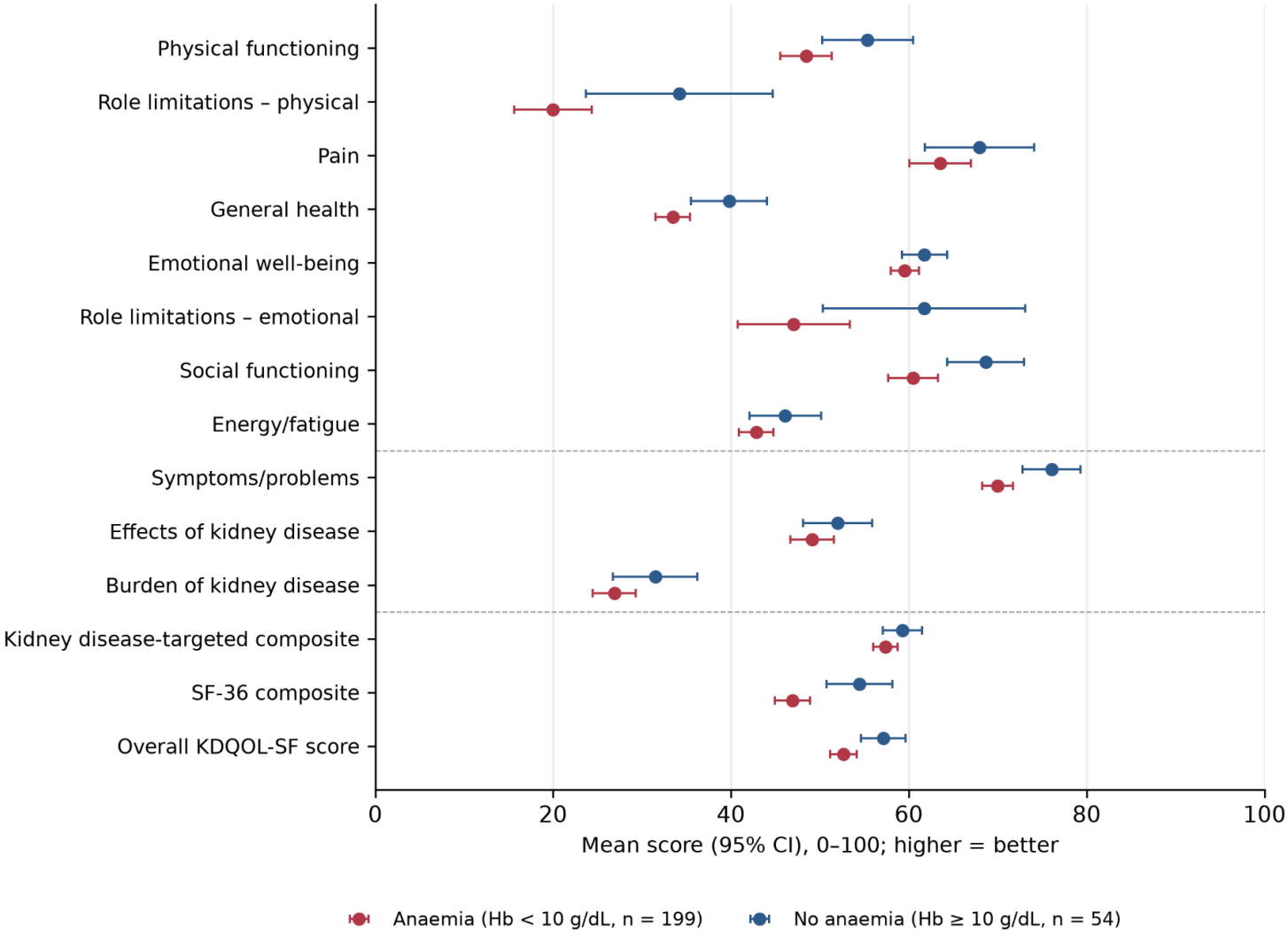


Figure 2

Mean KDQOL-SF scale and composite scores (95% confidence intervals) according to anaemia status. Scores range from 0 to 100; higher scores indicate better health-related quality of life. Kidney disease-targeted scales other than symptoms/problems, effects and burden of kidney disease are shown in Table 2.