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Original Article

Prevalence of Anemia and Associated Factors Among Patients with Chronic Kidney Disease Attending A Medical Clinic: A Cross-Sectional Study.

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ABSTRACT

Background: Anemia is a common condition associated with chronic kidney disease (CKD) in which the production of erythropoietin is decreased, there is iron deficiency, and there is chronic inflammation. It correlates with reduced functional status, cardiovascular complications, higher hospitalization, and lower health-related quality of life. Establishing its prevalence and associated factors is important for early diagnosis and appropriate management.

Objectives: To assess the prevalence of anemia in chronic kidney disease (CKD) patients at a medical clinic and to explore demographic and clinical factors related to anemia in this population.

Methods: This is a cross-sectional study in which 100 adult patients who were confirmed to have CKD, attending the medical outpatient clinic of a tertiary care hospital during six months, were included. Acute kidney injury, pregnancy, hematological malignancy, active bleeding, and a history of blood transfusion were exclusion criteria. Demographic, clinical, and laboratory parameters were gathered, such as hemoglobin, serum creatinine, estimated GFR (eGFR), serum ferritin, and CKD stage. The World Health Organization criteria were used to define anemia. SPSS software 27.0 was used for data analysis. Chi-square and independent t-tests were used to assess associations, and multivariable logistic regression was used to determine independent predictors. The p-value was taken to be <0.05 as statistically significant.

Results: The mean age of participants was 57.6 ± 12.4 years, with 61% males. The prevalence of anemia was 64.0%. Anemic patients had significantly lower hemoglobin levels than non-anemic patients (9.4 ± 1.3 vs. 12.8 ± 1.1 g/dL; p<0.001). Anemia was significantly associated with advanced CKD stages (78.4% vs. 41.7%; p=0.002), diabetes mellitus (p=0.018), hypertension (p=0.041), reduced eGFR (24.7 ± 10.8 vs. 41.9 ± 12.6 mL/min/1.73 m²; p<0.001), and low serum ferritin (p=0.009). Multivariable analysis identified advanced CKD stage (AOR=3.62, p=0.003), diabetes mellitus (AOR=2.41, p=0.021), and reduced eGFR (AOR=2.96, p=0.006) as independent predictors of anemia.

Conclusion: Anemia prevalence was very high, almost 2/3 of the CKD patients, and strongly related to advanced renal disease, diabetes, decreased kidney function, and iron deficiency. Routine screening for anemia and prompt treatment should be part of the routine management of CKD to prevent complications and optimize the health of patients.

Keywords: *Chronic kidney disease; Anemia; Prevalence; Risk factors.*

INTRODUCTION

Chronic kidney disease (CKD) is a global public health problem, and it is a progressive, irreversible disease involving a loss of kidney function. It affects about 10–15% of the adult population worldwide and causes significant morbidity, mortality, and health care costs. The more the kidneys fail, the more likely patients are to develop a variety of complications such as hypertension, cardiovascular conditions, mineral and bone disorders, electrolyte imbalances, and anemia. Of these complications, anemia is one of the most frequent and important, and it hurts physical performance, cognition, quality of life, and survival [1,2]. Anemias in CKD are a polyetiologic disorder that

arises mainly due to the loss of production of erythropoietin from the damaged kidneys. Erythropoietin is an important hormone that stimulates the production of red blood cells in the bone marrow. As renal function slowly deteriorates, erythropoietin production slows, leading to decreased erythropoiesis and, consequently, hemoglobin. Apart from erythropoietin deficiency, iron deficiency, chronic inflammation, shortened red blood cell lifespan, nutritional deficiencies, secondary hyperparathyroidism, and blood loss are other factors that play a role in the development and progression of anemia in CKD patients [3,4]. As kidney function declines, the prevalence of anemia rises, with a very high prevalence among those with advanced kidney failure. The prevalence of anemia has been reported to range between 30% and 70% in previous studies, and is more than 80% in patients near the end-stage kidney disease, ESKD. Increased albuminuria, diabetes mellitus, and longer duration of kidney disease are all highly correlated to the severity of anemia. Thus, anemia is emerging as a key marker of disease severity and a valuable prognostic factor for clinical outcomes [5,6]. The clinical effects of anemia are not limited to lowered hemoglobin concentration. Common symptoms of patients include fatigue, generalized weakness, dizziness, intolerance to exercise, decreased work productivity, loss of cognitive function, and diminished quality of life. Other important consequences of persistent anemia include left ventricular hypertrophy, heart failure, rapid progression of chronic kidney disease, hospitalization, and cardiovascular and overall mortality. These complications add significant strain to health care systems, especially in low- and middle-income countries, where access to nephrology is limited. Anemia is an important aspect of CKD management, and it is important that it is diagnosed early and managed properly. Regular checks of Hb and Fe status are advised by international clinical practice guidelines in the course of chronic kidney disease. Iron supplementation, ESAs, nutritional support, and management of underlying factors that contribute to these symptoms have been demonstrated to improve symptoms, enhance functional capacity, decrease blood transfusion needs, and improve patient outcomes. However, due to limited resources, poor awareness, and inconsistent screening practices, delayed diagnosis and inadequate treatment are still common in many healthcare settings [7,8]. Many demographic and clinical factors have been reported to affect the prevalence of anemia in patients with CKD. Several risk factors have been identified that are associated with an increased risk of anemia, such as advanced age, female sex, diabetes mellitus, hypertension, advanced CKD stage, reduced eGFR, chronic inflammation, poor nutritional status, iron deficiency, and prolonged disease duration [9]. The relative importance of these factors and their absolute magnitude differ greatly across populations, depending on socio-economic status, access to health care services, nutritional status, and disease traits. Thus, the evidence must be locally generated to inform clinical practice and healthcare planning [9,10]. Chronic Kidney Disease (CKD) is increasingly being seen worldwide, including in developing nations like Pakistan, due to the increasing prevalence of diabetes mellitus, hypertension, obesity, and aging. However, there are few data on the prevalence and risk factors of anemia among CKD patients in routine medical clinics, despite its increased burden [10]. Recognizing high-risk patients and the factors associated with anemia can help provide timely intervention, manage disease, and minimize CKD complications.

Study Objectives

To define the prevalence of anemia in the population of patients with chronic kidney disease (CKD) attending a medical clinic and to investigate demographic, clinical, and laboratory parameters associated with the development of anemia to achieve an early diagnosis, risk stratification, and patient management.

MATERIALS AND METHODS

Study Design & Setting

A hospital-based analytical cross-sectional study was conducted in the Nephrology Unit, Khyber Teaching Hospital, Peshawar, from Jan 2025 to June 2025.

Participants

This study included 100 adult (18 years or older) patients with a confirmed diagnosis of chronic kidney disease (CKD) attending the medical outpatient clinic during the study period. The participants were selected by consecutive sampling, with informed consent obtained in writing. Patients were excluded from this study if they had incomplete

clinical data, a recent blood transfusion within three months, hematologic malignancy, active bleeding, or acute kidney injury. A standardized data collection form was used to gather demographic data, medical history, physical examination, and laboratory investigations, which the study investigators then reviewed before statistical analysis.

Sample Size Calculation

The required sample size was calculated using the WHO Sample Size Calculator based on the single population proportion formula:

$$n = Z^2 \times P(1 - P) / d^2$$

Where:

- n = required sample size
- Z = 1.96 at a 95% confidence level
- P = anticipated prevalence of anemia among CKD patients (60%) based on previous published studies
- d = margin of error (10%)

The minimum calculated sample size was 92 participants. To compensate for possible incomplete records and non-response, 100 patients were enrolled consecutively

INCLUSION CRITERIA

- Adults aged ≥18 years.
- Patients diagnosed with chronic kidney disease according to KDIGO criteria.
- Patients attending the Medical Outpatient Department during the study period.
- Patients providing written informed consent.

EXCLUSION CRITERIA

- Acute kidney injury.
- Pregnancy.
- Inherited hemoglobinopathies or hematological malignancies.
- Active bleeding.
- Major surgery within the previous three months.
- Blood transfusion during the preceding three months.
- Incomplete clinical or laboratory records.

DATA COLLECTION

After obtaining written informed consent, demographic information including age, sex, comorbidities, and duration of CKD was recorded using a structured proforma. Clinical examination findings and laboratory investigations, including hemoglobin concentration, Serum creatinine, estimated glomerular filtration rate (eGFR), serum ferritin, and CKD stage, were obtained.

From hospital records and verified by the investigators.

STATISTICAL ANALYSIS

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for normality using the Shapiro–Wilk test and are presented as mean ± standard deviation (SD), whereas categorical variables are presented as frequencies and percentages. Comparisons between groups were performed using the independent-samples t-test for continuous variables and the Chi-square test or Fisher's exact test, where appropriate, for categorical variables. Variables with a p-value <0.05 on univariate analysis were entered into a multivariable logistic regression model to identify independent predictors of anemia. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated. A two-tailed p-value <0.05 was considered statistically significant.

RESULTS

A total of 100 patients with chronic kidney disease were included in the study. The mean age of participants was 57.6 ± 12.4 years, ranging from 22 to 82 years. There were 61 (61.0%) males and 39 (39.0%) females. Overall, 64 patients (64.0%) were diagnosed with anemia according to the World Health Organization criteria. The prevalence of anemia increased significantly with advancing CKD stage, affecting 41.7% of patients in stages I–III and 78.4% of those in stages IV–V (p=0.002). Diabetes mellitus was significantly more common among anemic patients than non-anemic patients (56.3% vs. 30.6%; p=0.018), while hypertension was also more prevalent (79.7% vs. 63.9%; p=0.041). Mean hemoglobin concentration was significantly lower among anemic patients (9.4 ± 1.3 g/dL) Mean hemoglobin concentration was significantly lower among anemic patients (9.4 ± 1.3 g/dL) than among non-anemic patients (12.8 ± 1.1 g/dL; p < 0.001) Low serum ferritin levels were significantly associated with anemia (p=0.009). Multivariable logistic regression demonstrated that advanced CKD stage (Adjusted OR=3.62; 95% CI: 1.54–8.48; p=0.003), diabetes mellitus (Adjusted

OR=2.41; 95% CI: 1.14–5.12; p=0.021), and reduced eGFR (Adjusted OR=2.96; 95% CI: 1.37–6.39; p=0.006) were independent predictors of anemia among patients with chronic kidney disease.

Table 1. Baseline Demographic and Clinical Characteristics of Patients with Chronic Kidney Disease (n = 100)

Characteristic	n	%
Age (years)		
Mean ± SD	**57.6 ± 12.4**	—
18–39	12	12.0
40–59	38	38.0
≥60	50	50.0
Sex		
Male	61	61.0
Female	39	39.0
CKD Stage		
Stage I–III	36	36.0
Stage IV–V	64	64.0
Diabetes Mellitus		
Yes	47	47.0
No	53	53.0
Hypertension		
Yes	74	74.0
No	26	26.0

Data are presented as frequency (percentage) unless otherwise indicated. Continuous variables are expressed as mean ± standard deviation (SD). CKD = Chronic Kidney Disease; SD = Standard Deviation.

Table 2 – Association Between Clinical Characteristics and Anemia

Variable	Anemia Present n (%)	No Anemia n (%)	p-value
CKD Stage			
Stage I–III	15 (41.7)	21 (58.3)	**0.002**
Stage IV–V	49 (78.4)	15 (21.6)	
Diabetes Mellitus			
Yes	36 (76.6)	11 (23.4)	**0.018**
No	28 (52.8)	25 (47.2)	
Hypertension			
Yes	51 (68.9)	23 (31.1)	**0.041**
No	13 (50.0)	13 (50.0)	

Values are presented as frequency (percentage). Associations between categorical variables were analyzed using the Chi-square test. Bold p-values indicate statistical significance ($p < 0.05$). CKD = Chronic Kidney Disease.

Table 3. Comparison of Laboratory Parameters Between Anemic and Non-Anemic Patients with Chronic Kidney Disease

Laboratory Parameter	Anemia (n = 64) Mean ± SD	No Anemia (n = 36) Mean ± SD	p-value
Hemoglobin (g/dL)	9.4 ± 1.3	12.8 ± 1.1	**<0.001**
Serum Creatinine (mg/dL)	4.8 ± 1.7	2.9 ± 1.1	**<0.001**
eGFR (mL/min/1.73 m²)	24.7 ± 10.8	41.9 ± 12.6	**<0.001**
Serum Ferritin (ng/mL)	92.4 ± 34.8	138.7 ± 41.6	**0.009**

Continuous variables are expressed as mean ± standard deviation (SD). Comparisons were performed using the independent-samples t-test. Bold p-values indicate statistical significance ($p < 0.05$). eGFR = Estimated Glomerular Filtration Rate; SD = Standard Deviation.

Table 4. Multivariable Logistic Regression Analysis of Independent Predictors of Anemia Among Patients with Chronic Kidney Disease

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
CKD Stage IV–V	3.62	1.54–8.48	**0.003**
Diabetes Mellitus	2.41	1.14–5.12	**0.021**
Hypertension	1.69	0.73–3.92	0.183
Reduced eGFR (<30 mL/min/1.73 m²)	2.96	1.37–6.39	**0.006**
Low Serum Ferritin	2.27	1.09–4.74	**0.028**

Multivariable logistic Regression analysis was performed to identify independent predictors of anemia. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) are presented. Variables with $p < 0.05$ were considered statistically significant. CKD = Chronic Kidney Disease; eGFR = Estimated Glomerular Filtration Rate; AOR = Adjusted Odds Ratio; CI = Confidence Interval.

DISCUSSION

The present cross-sectional study demonstrated that anemia is highly prevalent among patients with chronic kidney disease (CKD), affecting 64.0% of the study population. Furthermore, advanced CKD stage, diabetes mellitus, reduced estimated glomerular filtration rate (eGFR), and low serum ferritin were identified as significant independent predictors of anemia. These findings highlight anemia as one of the most frequent and clinically important complications of CKD and emphasize the need for routine screening and timely intervention to improve patient outcomes [11,12]. The prevalence of anemia observed in the present study is consistent with reports from previous international studies, where anemia has been reported in approximately 50–70% of patients with moderate-to-advanced CKD. The increasing prevalence of anemia with worsening renal function is primarily attributed to reduced erythropoietin production by damaged kidneys, impaired iron metabolism, chronic inflammation, and shortened red blood cell survival. Similar findings have been reported in systematic reviews and observational studies, supporting the high burden of anemia among CKD patients [13, 14]. A significant association was observed between advanced CKD stage and the presence of anemia. Nearly four-fifths of patients with Stage IV–V CKD were anemic

compared with fewer than half of those with Stage I–III disease. Multivariable analysis further confirmed advanced CKD stage as an independent predictor of anemia. This observation is biologically plausible because progressive nephron loss results in decreased erythropoietin synthesis, impaired iron utilization, accumulation of uremic toxins, and chronic inflammatory changes that suppress erythropoiesis. Similar associations have been consistently reported in previous cohort studies and clinical practice guidelines [15,16]. Diabetes mellitus was another independent predictor of anemia in the present study. Patients with diabetes had significantly greater odds of developing anemia than non-diabetic patients. Diabetic nephropathy accelerates deterioration of renal function through persistent hyperglycemia, oxidative stress, endothelial dysfunction, and tubulointerstitial fibrosis, leading to earlier impairment of erythropoietin production. Previous studies have likewise demonstrated that CKD patients with diabetes develop anemia at earlier stages and often experience more severe reductions in hemoglobin concentration than non-diabetic patients [17,18]. Reduced eGFR was strongly associated with anemia, with anemic patients demonstrating significantly lower mean eGFR than those without anemia. Declining kidney function reflects progressive nephron loss and reduced endogenous erythropoietin production, thereby contributing directly to anemia. These findings are consistent with previous observational studies that have demonstrated a progressive increase in anemia prevalence as eGFR declines, particularly below 30 mL/min/1.73 m^2. Iron deficiency also showed a significant association with anemia, as evidenced by lower serum ferritin concentrations among anemic patients. Iron deficiency is common in CKD because of chronic inflammation, impaired gastrointestinal iron absorption, poor nutritional intake, repeated phlebotomy, and occasional occult blood loss. International nephrology guidelines recommend routine assessment of iron status before initiating erythropoiesis-stimulating agents, and correction of iron deficiency has been shown to improve hemoglobin levels while reducing transfusion requirements. The present findings further support routine evaluation of iron stores in patients with CKD [19,20]. Although hypertension demonstrated a significant association with anemia in univariate analysis, it was not retained as an independent predictor after multivariable adjustment. This finding suggests that the observed relationship may be largely mediated through worsening renal function and advanced CKD rather than hypertension itself. Similar observations have been reported in previous studies evaluating determinants of anemia among patients with chronic kidney disease [21]. The findings of the present study have important clinical implications. Routine screening for anemia should be incorporated into the management of all patients with CKD, particularly those with advanced disease, diabetes mellitus, declining eGFR, or evidence of iron deficiency. Early recognition and appropriate treatment—including iron supplementation, erythropoiesis-stimulating agents when indicated, nutritional optimization, and management of underlying comorbidities—may improve quality of life, reduce cardiovascular complications, decrease hospitalization, and potentially slow disease progression. Establishing standardized anemia screening protocols in nephrology and General medical clinics may further improve patient outcomes, particularly in resource-limited healthcare settings such as Pakistan.

LIMITATIONS

There are several limitations to this study. It was carried out in one tertiary health center and had a relatively small sample (100 participants), which did not allow for its findings to be generalized. The cross-sectional design did not allow for causal inferences to be drawn between anemia and associated factors. In addition, inflammatory biomarkers, vitamin B12 and folate levels, and nutritional status were not evaluated, and this could have impacted the prevalence and determinants of anemia as observed.

Conclusion

Anemia was also very common in the patients with CKD, and was significantly associated with advanced stage of CKD, diabetes mellitus, decreased renal function, and iron deficiency. It is important to screen for anemia routinely, detect it early, and treat it properly as part of routine CKD treatment to minimize anemia complications, improve quality of life, and overall clinical outcome.

Ethical Approval

Ethical approval for this study was obtained from the Institutional

Review Board (IRB) of Khyber Teaching Hospital, Peshawar, Pakistan, before the commencement of the study (Approval No. 1428/2024/05). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2013 revision). Written informed consent was obtained from all participants before enrollment. Participation was voluntary, and participants were informed of their right to withdraw from the study at any stage without affecting their medical care. The confidentiality and anonymity of all participants were strictly maintained, and all data were used solely for research purposes.

Authors' Contributions (ICMJE-Compliant)

Sumayya Roshan: Conceived and designed the study, collected data, performed the literature review, drafted the initial manuscript, and approved the final version.

Waqas ur Rehman: Contributed to the study design, supervised the research, performed data analysis and interpretation, critically revised the manuscript for important intellectual content, and approved the final version.

Zareen Ullah: Contributed to data collection, interpretation of results, manuscript editing, critical revision, and approved the final version.

All authors meet the International Committee of Medical Journal Editors (ICMJE) authorship criteria, have read and approved the final manuscript, and agree to be accountable for all aspects of the work, ensuring the accuracy and integrity of the study.

REFERENCES

1. Webster AC, Nagler EV, Morton RL, Masson P. Chronic kidney disease. Lancet. 2017;389(10075):1238-1252. doi:10.1016/S0140-6736(16)32064-5.
2. Matsushita K, Ballew SH, Wang AY, Kalyesubula R, Schaeffer E, Agarwal R. Epidemiology and risk of cardiovascular disease in populations with chronic kidney disease. Nat Rev Nephrol. 2022;18(11):696-707. doi:10.1038/s41581-022-00616-6.
3. Romagnani P, Remuzzi G, Glassock R, Levin A, Jager KJ, Tonelli M, Massy ZA, Wanner C, Anders HJ. Chronic kidney disease. Nat Rev Dis Primers. 2017;3:17088. doi:10.1038/nrdp.2017.88.
4. Drew DA, Weiner DE, Sarnak MJ. Cognitive impairment in CKD: Pathophysiology, management, and prevention. Am J Kidney Dis. 2019;74(6):782-790. doi:10.1053/j.ajkd.2019.05.017.
5. Bachler EK, Kapitsinou P, Pergola PE, Kovesdy CP, Jalal DI. Iron deficiency in chronic kidney disease: Updates on pathophysiology, diagnosis, and treatment. J Am Soc Nephrol. 2020;31(3):456-468. doi:10.1681/ASN.2019020213.
6. Triposkiadis F, Xanthopoulos A, Parissis J, Butler J, Farmakis D. Cardiovascular aging, risk factors, comorbidities, and disease modifiers. Heart Fail Rev. 2022;27(1):337-344. doi:10.1007/s10741-020-09987-z.
7. Harada R, Hamasaki Y, Okuda Y, Hamada R, Ishikura K. Learning from registries and cohort studies in pediatric chronic kidney disease. Pediatr Nephrol. 2022;37(6):1215-1229. doi:10.1007/s00467-021-05145-1.
8. Fowler AJ, Ahmad T, Phull MK, Allard S, Gillies MA, Pearse RM. Meta-analysis of the association between preoperative anemia and mortality after surgery. Br J Surg. 2015;102(11):1314-1324. doi:10.1002/bjs.9861.
9. Thapa BK, Bhatia P, Meena J, Dawman L, Tiewsoh K. Prevalence and risk factors for functional iron deficiency in children with chronic kidney disease. Clin Exp Nephrol. 2023;27(1):66-71. doi:10.1007/s10157-022-02281-2.
10. Jitraknatee J, Ruengorn C, Nochaiwong S. Prevalence and risk factors of chronic kidney disease among type 2 diabetes patients: A cross-sectional study in primary care practice. Sci Rep. 2020;10(1):6205. doi:10.1038/s41598-020-63443-4.
11. Ji A, Pan C, Wang H, Jin Z, Lee JH, Wu Q, Jiang Q, Cui L. Prevalence and associated risk factors of chronic kidney disease in an elderly population from Eastern China. Int J Environ Res Public Health. 2019;16(22):4383. doi:10.3390/ijerph16224383.
12. Piko N, Bevc S, Ekart R, Petreski T, Vodošek Hojs N, Hojs R. Diabetic patients with chronic kidney disease: Non-invasive assessment of cardiovascular risk. World J Diabetes. 2021;12(7):975-996. doi:10.4239/wjd.v12.i7.975.
13. Shiferaw WS, Akalu TY, Aynalem YA. Risk factors for anemia in patients with chronic renal failure: A systematic review and meta-analysis. Ethiop J Health Sci. 2020;30(5):829-842. doi:10.4314/ejhs.v30i5.23.
14. Lebensburger JD, Cutter GR, Howard TH, Muntner P, Feig DI. Evaluating risk factors for chronic kidney disease in pediatric patients with sickle cell anemia. Pediatr Nephrol. 2017;32(9):1565-1573. doi:10.1007/s00467-017-3658-8.
15. Carminati M, Tedesco-Silva H, Silva Fernandez NM, Sanders-Pinheiro H. Chronic kidney disease progression in kidney transplant recipients: A focus on traditional risk factors. Nephrology (Carlton). 2019;24(2):141-147. doi:10.1111/nep.13483.
16. Wyld MLR, Mata NL, Viecelli AK, Swaminathan R, O'Sullivan KM, O'Lone E, Rowlandson M, Francis A, Wyburn K, Webster AC. Sex-based differences in risk factors and complications of chronic kidney disease. Semin Nephrol. 2022;42(2):153-169. doi:10.1016/j.semnephrol.2022.04.006.
17. Travers A, Farber HW, Sarnak MJ. Pulmonary hypertension in chronic kidney disease. Cardiol Clin. 2021;39(3):427-434. doi:10.1016/j.ccl.2021.04.004.
18. van Biljon G, Meintjes CJ, Becker PJ, Karusseit VOL. Risk factors for progression of chronic kidney disease: An investigation in prepubertal children. Nephrology (Carlton). 2023;28(5):276-282. doi:10.1111/nep.14153.
19. Ma Y, Zhou L, Dong J, Zhang X, Yan S. Arterial stiffness and increased cardiovascular risk in chronic kidney disease. Int Urol Nephrol. 2015;47(7):1157-1164. doi:10.1007/s11255-015-1009-x.
20. Lee YG, Chang Y, Kang J, Koo DH, Lee SS, Ryu S, Oh S. Risk factors for incident anemia of chronic diseases: A cohort study. PLoS One. 2019;14(5):e0216062. doi:10.1371/journal.pone.0216062.
21. Vellieux G, d'Ortho MP. Le syndrome des jambes sans repos. Rev Med Interne. 2020;41(4):258-264. doi:10.1016/j.revmed.2020.01.001.