Chronic venous insufficiency of the lower limbs in Kinshasa (DR Congo)

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1 Abstract

***Objective**: To determine the burden and impact of chronic venous insufficiency (CVI) of the lower limbs in Kinshasa, Democratic Republic of Congo (DRC).*

***Method**: We conducted a retrospective clinical study on a random sample of 393 patients diagnosed with chronic venous disease (CVD) between 2019 and 2024 at an urban hospital in Kinshasa. These patients represented 81% of a larger cohort of 486 individuals who presented with dermatologic disorders of the lower limbs during the study period.*

***Results**: Disease severity, as per the CEAP clinical classification, indicated that 536 limbs (68%) in 362 patients (92%) presented with advanced stages (C3 to C6). The pattern of venous disease was primarily characterized by edema (25%) and active venous ulcers (25%).*

***Conclusions**: Our observations confirm the significant predominance of venous pathology in lower limb dermatologic disorders and the primary cause of lower limb ulcers, consistent with findings from Western populations. In Kinshasa —and likely in other megacities across sub-Saharan Africa—these results highlight the dual burden of non-communicable and infectious diseases that challenges healthcare systems.*

The vernacular term "MBASU," traditionally used to describe a spectrum of dermatological conditions (including simple erythema, papules, unsightly wounds, edema or fibrosis, and both healed and active ulcers), has been erroneously restricted to specific infectious causes such as Buruli ulcer. This misclassification perpetuates public health misconceptions rooted in a 20th-century perspective.

Based on our field experience, we strongly advocate for the promotion of timely and accurate diagnosis to mitigate the substantial medical, social, and economic impacts of Chronic Venous Insufficiency (CVI). CVI is a reversible condition, and its harmful consequences—including potentially fatal outcomes—can be prevented with appropriate intervention. For clinicians, we propose a new locally-rooted terminology: "Non-infectious MBASU (NIM)" to explicitly distinguish CVI manifestations from "Infectious MBASU (IM)."

2 Introduction

Chronic Venous Insufficiency (CVI) constitutes a significant global health burden, affecting a substantial proportion of the worldwide population. In sub-Saharan Africa, and particularly within the Democratic Republic of Congo (DRC), the presentation of CVI is characterized by unique social, epidemiological and clinical specificities, distinguishing it from manifestations observed in other global regions. Several contributing factors underpin these regional distinctions.

Demographic Context

Sub-Saharan Africa's demographic landscape is undergoing profound transformation. With an estimated population of 1.2 billion in 2022, projections indicate a rise to 2.7 billion within the next half-century, thereby surpassing the populations of both China and India. This trajectory positions the region as the sole global area experiencing sustained growth in its labor market. Over this horizon, the working-age population (15-64 years) in sub-Saharan Africa is projected to constitute a progressively dominant share of the global total, increasing from 12% in 2022 to an estimated 22% by 2050 and 30% by 2075. (1)

Habitat

African megacities are currently undergoing explosive growth. For instance, Kinshasa's population tripled between 2000 and 2024 to 20 million inhabitants, at an annual growth rate of 4.50%. (2) This urban concentration shapes distinct epidemiological profiles related to etiologies s.a. veinous insufficiency, arteriopathy and diabetes, distinct from those observed in rural areas with a focus on infectious pathologies.

Cultural Perception

Dermatological disorders are widely perceived, even among the intellectual elite, as having a mystical etiology. The vernacular term 'MBASU,' which translates to 'malevolent sorcery' in the Democratic Republic of Congo, exemplifies this. The management of these conditions frequently involves traditional healers, indigenous practitioners, or religious leaders, who employ traditional rituals and administer ineffective or inappropriate esoteric remedies. In this context, patients grappling with disabling sequelae often experience profound professional, familial, and psychological difficulties.

Infectious diseases

Traditionally, infectious diseases have been a significant health challenge in many parts of Sub-Saharan Africa, particularly in rural areas. Infectious pathologies, such as Buruli ulcer, are still widely associated with malevolent sorcery and popularization of the subject by modern media has created collective psychosis. (3) (4) Buruli ulcer affects the trunk and all four limbs, and is predominant in adolescents living in rural marshy regions. It is the third mycobacterial disease affecting humans, after leprosy and tuberculosis. It frequently manifests as an initially painless nodule that can evolve into a plaque or diffuse edema on the face, arms, and legs. The disease can progress without pain or fever. In the absence of treatment, or sometimes even during antibiotic therapy, the nodule, plaque, or edema can ulcerate within four weeks. In some cases, bone involvement may occur, resulting in deformities. (5) The number of cases remains however marginal in comparison to other wound etiologies. According to the WHO, the confirmed cases for the DRC (2025 population: 111 million) were: 74 (2023), 84 (2022), 54 (2021), and 111 (2020). (6) (7) In Kinshasa (population: 20 million), 13 positive cases were reported over three years of observation (2016–2018). (8)

Chronic venous insufficiency

Diagnosis is often significantly delayed due to a confluence of factors. The complex interplay between coexisting endemic infectious and emerging non-communicable diseases (NCDs), coupled with the aforementioned socio-demographic challenges, collectively impairs timely and accurate etiological diagnosis, frequently resulting in severe complications such as edema, fibrosis, and active or healed ulcers at advanced stages. Furthermore, effective CVI management necessitates substantial human and material resources, which are largely inaccessible in regions with limited healthcare infrastructure. This includes, but is not limited

to, diagnostic tools like Doppler ultrasound, advanced wound care modalities (e.g., specialized dressings, high-quality compression stockings, pressotherapy, negative pressure therapy), interventional procedures (e.g., foam sclerotherapy, endovenous radiofrequency or glue ablation).

3 Objective

This study addresses the well-established scarcity of clinical data and medical research on CVI in sub-Saharan Africa. (9) By providing clinical examination-based data and analysis, this research will help to objectify the necessary human, financial, and material resources and conditions required for the effective management of CVI.

4 Context

This study was conducted at a hospital in Kinshasa (DRC), which provides a comprehensive care pathway for lower limb wounds. The accompanying images (Figure 1) illustrate the clinical case of a 57-year-old male with post-thrombotic syndrome and ***CEAP C3,6 CVI (indicating edema and active ulcer)*** *secondary to left great and small saphenous vein incompetence. The key stages of this pathway demonstrate wound evolution and the impact of the interventions from admission through post-procedural care, including patient admission, debridement, negative pressure wound therapy (NPWT), minimally invasive radiofrequency ablation (RFA) surgery, grafting, and post-procedural care.*

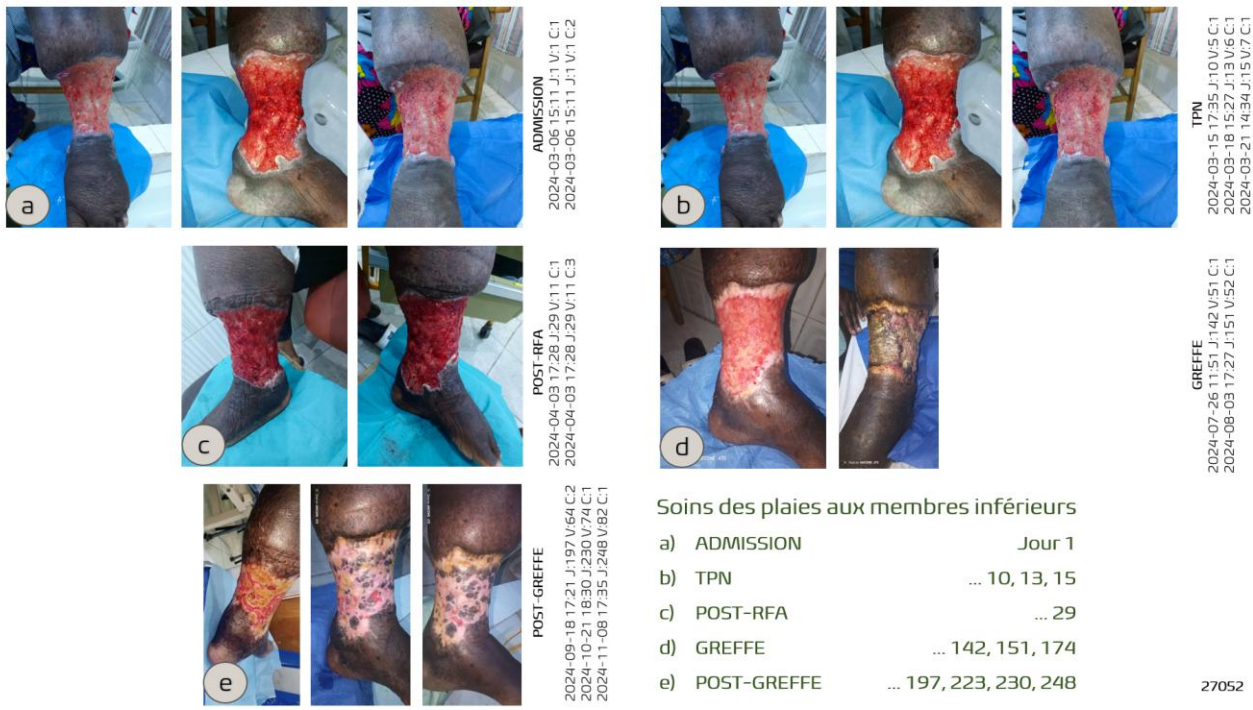

Figure 1

5 Methods

5.1 Study Design and Patient Selection

This retrospective observational study, conducted from January 2019 to June 2024, aims to ***characterize the nature of dermatologic disorders (locally known as "MBASU")*** *observed in patients during clinical examination, thereby* ***analyzing in detail the most prevalent etiology****. Patients are from Kinshasa and were included in the study based on the following two criteria:* (1) ***Medical Criteria:*** *Patients presented with lower limb conditions of vascular, diabetic, or neoplastic origin.* (2) ***Financial Criteria:*** *With the exception of social cases, patients were financially responsible for the long-term costs associated with general and specialized medical consultations, as well as wound care tailored to their specific condition. For context, a general consultation was billed at 6 USD (2024), while specialized consultations ranged from 20 to 30 USD, depending on the specialty.*

All patients were examined by the (lead) author using Doppler ultrasound over the specified period. Patients' clinical severity was classified according to the Clinical, Etiological, Anatomical, Pathophysiological (CEAP) classification system. (10) Briefly, the clinical (C) component grades severity from C0 (no visible or palpable signs of venous disease) to C6 (active venous ulcer). Specific clinical classes include C0: No visible or palpable signs of venous disease; C1: Telangiectasias or reticular veins; C2: Varicose veins; C3: Edema; C4: Skin changes ascribed to venous disease (e.g., pigmentation, eczema, lipodermatosclerosis); C5: Healed venous ulcer; and C6: Active venous ulcer. The disease severity was defined as either mild (C0 to C2: no visible signs to varicose veins) or severe (C3 to C6: edema to active venous ulceration). The CEAP class was assigned per patient based on the highest class of clinical signs identified in either of the lower limbs. For analyses of limb laterality, the highest CEAP value was determined for each limb, and these paired values were compared within patients. To conduct a systematic bilateral limb assessment, we supplemented the CEAP classes with a 'Not Affected' (NA) grade for cases where only one limb was affected.

5.2 Data Collection and Statistical Analysis

Etiology: *Clinical data were retrospectively collected from the medical records of patients. After characterizing the different etiologies of dermatological conditions, with the venous cause pre-identified as a primary outcome of interest, we analyzed the following variables: patient age, sex, disease severity. CEAP (Clinical, Etiological, Anatomical, Pathophysiological) classes were further regrouped by patient age group, sex, and limb laterality (right vs. left).*

Patient sex distribution*: The distribution of patient sex was analyzed using the chi-square goodness of fit, exact binomial for equality of proportions, and proportion z-tests.*

Patient age distribution*: Age distribution characteristics such as median and variability measures were evaluated using bootstrap methods (n=10,000). Distributions were assessed by sex for normality using the Shapiro-Wilk test, and compared using non-parametric tests, including the Mann-Whitney U test and the Kolmogorov-Smirnov test.*

Disease Severity*: Disease severity distribution (C0-C2 versus C3-C6) and sex-based differences were evaluated using the Chi-square test, Fisher's exact test, binomial test, two-sample proportion Z-tests, and Relative Risk calculations.*

***CEAP classes and sex**: Sex-related CEAP association analyses included a chi-square test of independence, identification of significant adjusted residuals, and quantification of associations using Cramér's V. Considering the ordinal nature of CEAP stages, we compared sex distributions using the Mann-Whitney U test. Additionally, we evaluated each CEAP class stratum using Chi-Squared or Fisher's exact tests, a binomial test for deviation from an equal split, and a two-proportion z-test to compare male and female frequencies across their respective distributions. Finally, we assessed risk ratios and their 95% confidence intervals.*

***CEAP classes and age**: The association between CEAP classes and age, treated as a continuous variable, was evaluated using correlation analyses, including Spearman's rank correlation coefficient and Kendall's tau-b. Asymmetric association patterns were assessed using Goodman-Kruskal gamma and Somers' D. Additionally, Theil's uncertainty coefficients were used to quantify the predictive association between the variables.*

***CEAP classes and laterality**: Laterality-related CEAP evaluations included paired statistical methods, such as the Stuart-Maxwell and Bowker tests for overall marginal homogeneity and symmetry, the Wilcoxon signed-rank test, and the McNemar test for marginal homogeneity by CEAP category.*

***CEAP classes and sex, age, laterality as predictors (CLMM, CLM, ordinal GEE, binary GEE)**: To evaluate how age, sex, and laterality predict clinical signs, ordinal logistic regression models were fitted: (1) a Cumulative Link Mixed Model (CLMM) with random intercepts for patient ID to account for within-subject correlation; (2) a Cumulative Link Model (CLM) with fixed effects for simplified inference on covariates; and (3) the ordinal variant of the Generalized Estimating Equations (GEE) model. For a CEAP stratum-wise regression analysis, the binary GEE model variant was employed. To account for cases of unilateral limb disease, the CEAP classification was supplemented with the 'NA' (Not Affected) class.*

***Patient treatment**: A basic summary report was produced.*

5.3 Tools

All analyses were conducted using statistical libraries in Python 3.11 and R 4.5.1. Statistical significance was set at $p<0.05$, and confidence intervals (CI) were set at 95%.

6 Results

Data tables

Table 1	Etiology of dermatologic disorder in lower limbs		
	Pathology	%	Patients
	Venous	81%	393
	Arterial	5%	26
	Mixed	2%	8
	Diabetic	9%	45
	Cancerous	3%	14
	Total		486

Table 2	Patient age distribution										
		Age									Total
		10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	393
	Frequency	5	15	37	62	92	92	72	17	1	

Table 3	Disease Severity (patient-level)			
	Sex	Severity		
		C0..C2	C3..C6	Total
	M	12	156	168
	F	19	206	225
	Total	31	362	393

Table 4	CEAP classes segmented by sex (patient-level)							
	Sex	CEAP						
		C0	C1	C2	C3	C4	C5	C6	Total
	M	0	3	9	35	20	13	88	168
	F	1	3	15	69	31	19	87	225
	Total	1	6	24	104	51	32	175	393

Table 5	CEAP classes segmented by age (patient-level)								
	Age	CEAP							
		C0	C1	C2	C3	C4	C5	C6	Total
	10-19	0	0	0	3	0	1	1	5
	20-29	0	1	1	4	3	0	6	15
	30-39	0	0	4	9	4	1	19	37
	40-49	0	1	3	15	8	5	30	62
	50-59	0	0	5	29	6	7	45	92
	60-69	1	1	9	20	21	10	30	92
	70-79	0	3	2	20	7	7	33	72
	80-89	0	0	0	4	2	1	10	17
	90-99	0	0	0	0	0	0	1	1
	Total	1	6	24	104	51	32	175	393

Table 6	CEAP class pairs by laterality (limb-level) All patients									
	ceap_R	ceap_L								
		NA	C0	C1	C2	C3	C4	C5	C6	Total
	C6	21	1	0	17	11	4	8	21	83
	C5	0	0	1	2	2	6	6	7	24
	C4	3	1	2	2	6	21	1	5	41
	C3	13	0	2	7	60	7	2	7	98
	C2	3	1	0	17	8	2	4	31	66
	C1	2	0	3	0	0	1	1	3	10
	C0	1	0	0	1	0	1	0	1	4
	NA	0	0	1	2	14	5	7	38	67
	Total	43	3	9	48	101	47	29	113	393

Table 7	CEAP class pairs by laterality per sex (limb-level)					
		All		Males	Females	
	Diagonal	128	33%	42	25%	86	38%
	NA_right	67	17%	34	20%	33	15%
	NA_left	43	11%	21	13%	22	10%
	Other	155	39%	71	42%	84	37%
	Total	393	100%	168	100%	225	100%

Table 8	Logistic regression without limb clustering (CLM)								
	Variable	Estimate	Std. Error	z value	Pr(>|z|)	Estimate	OR	ower 95%CI	pper 95%CI
	age	0.007	0.004	1.573	0.116	0.007	1.007	0.998	1.015
	sexM	0.010	0.129	0.075	0.940	0.01	1.01	0.784	1.3
	lateralityR	-0.452	0.127	-3.557	0.000	-0.452	0.637	0.496	0.816
	NA|C0	-1.688	0.269	-6.283			Right limb has 36% lower odds		
	C0|C1	-1.615	0.268	-6.035			of higher category than reference		
	C1|C2	-1.435	0.266	-5.404			(significant)		
	C2|C3	-0.623	0.260	-2.396					
	C3|C4	0.445	0.260	1.709					
	C4|C5	0.933	0.262	3.558					
	C5|C6	1.270	0.264	4.810					
	McFadden pseudo R^2 0.0055								

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Figures

Figure 2

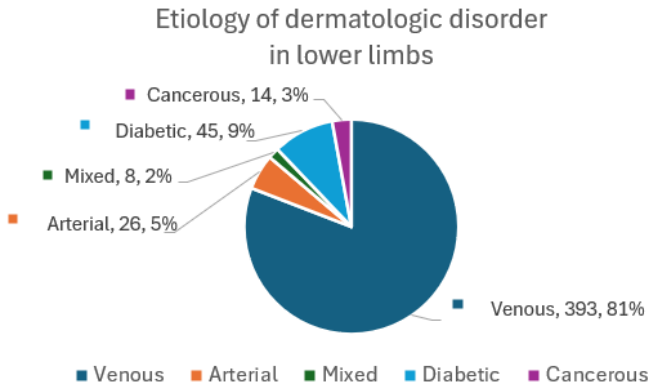


Figure 3

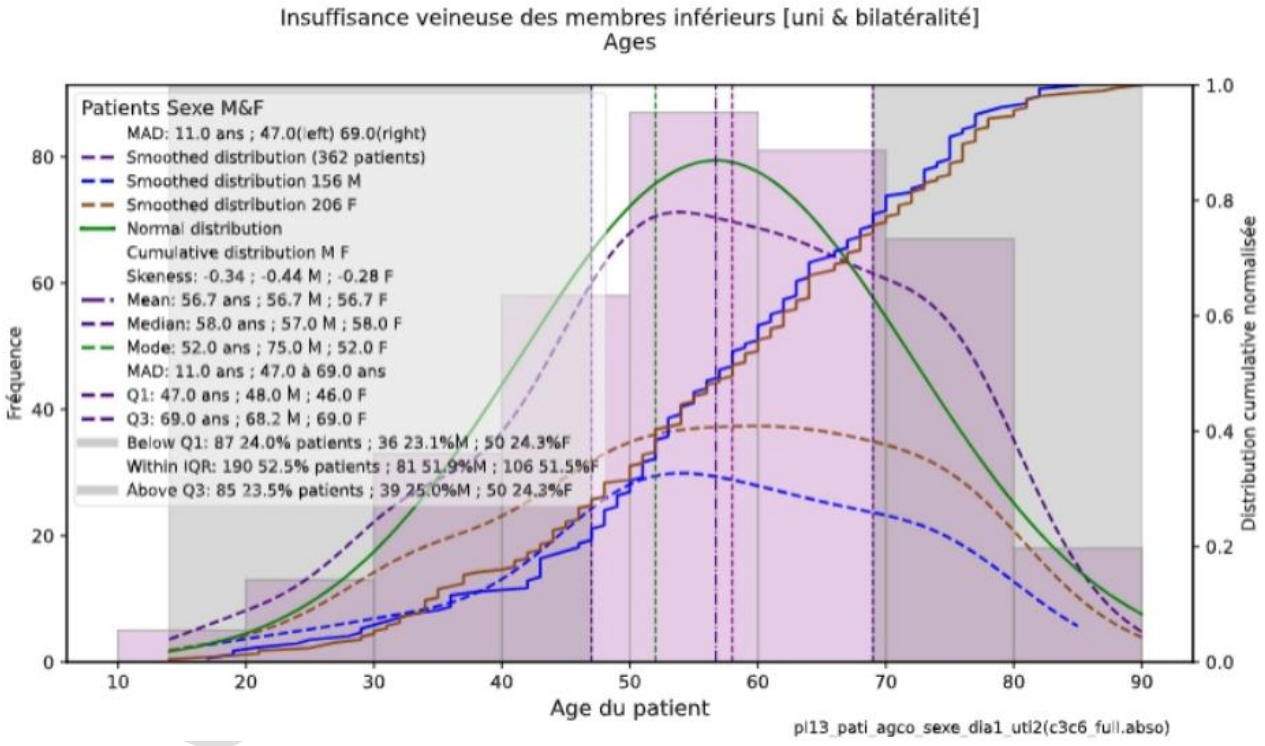
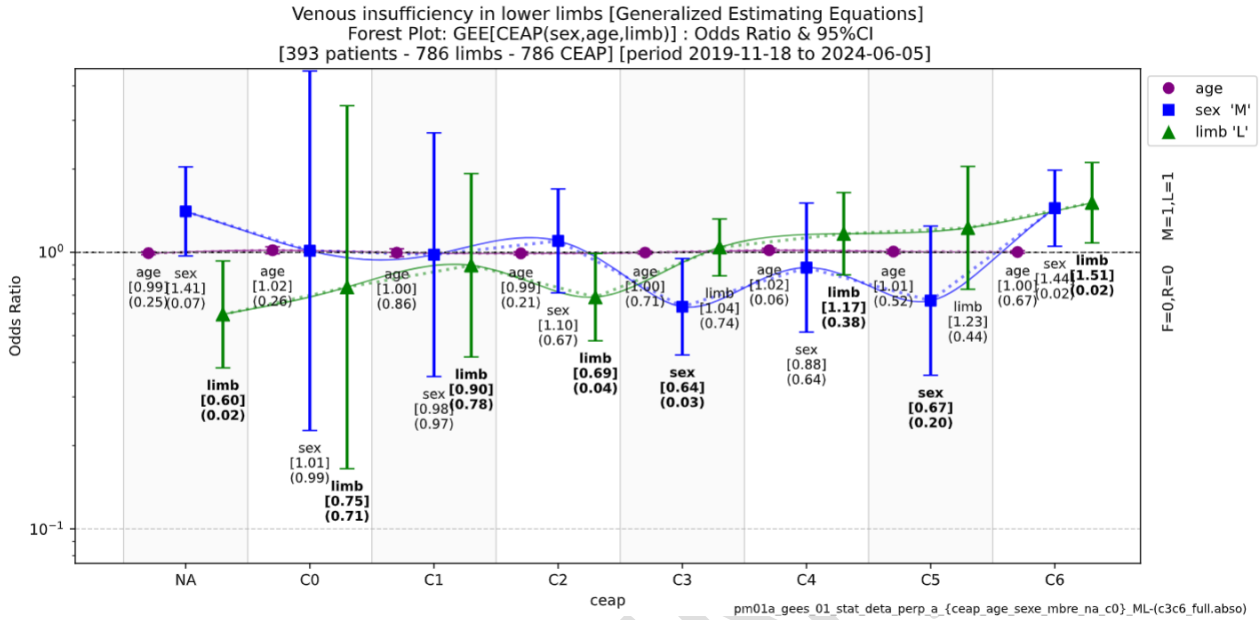


Figure 4



Etiology *(table 1, figure 2): The venous cohort, consisting of 393 patients, was drawn from a population of 486 patients who were examined for dermatological disorders during the study period.* ***Pathologies of venous vascular (80%), arterial (6%), mixed (2%),*** *as well as* ***diabetic without venous involvement (10%)****, and* ***cancerous (3%)*** *origin were diagnosed. No infectious causes were identified.*

Patient sex distribution *(table 3): The venous cohort included 168 males (42.7%; 95% CI: 37.9%-47.6%) and 225 females (57.3%; 95% CI: 52.3%-62.1%). A Chi-square goodness-of-fit analysis indicated a significant deviation from an equal distribution ($\chi^2 = 8.27$, $p = 0.004$). This finding was further supported by an exact binomial test ($p = 0.005$) and a proportion z-test ($p = 0.004$).* ***The female-to-male odds ratio was 1.34:1****, with a small effect size (0.146).*

Patient age distribution *(table 2): The age distributions of male and female patients exhibited nearly identical median ages, with males at 57 years and females at 58 years. Females showed slightly greater variability in age (MAD = 12 years) compared to males (MAD = 10 years).* ***The confidence intervals for the median, Median Absolute Deviation (MAD), and Interquartile Range (IQR) largely overlapped, indicating strong similarities between the two groups. Non-normal distributions were confirmed for both sexes using the Shapiro-Wilk test*** *($p < 0.01$). The Mann-Whitney U test (U = 18,729, near the midpoint value, $p = 0.878$) and the Kolmogorov-Smirnov test (D = 0.052, $p = 0.938$) both support the conclusion that male and female patients were age-matched. Effect sizes were negligible, further supporting these findings: the rank-biserial correlation was 0.009 (95% CI = [-0.108, 0.124]), and Cliff's Delta was -0.009. Despite these strong similarities, subtle but notable differences exist between the age distributions. Regarding kurtosis,* ***females exhibit a more pronounced platykurtic value*** *(–0.5746 vs. –0.2103), meaning* ***their age distribution is more spread out and less peaked*** *compared to that of males. In conclusion, male and female age distributions largely overlap. . In terms of skewness,* ***males show slightly higher negative skewness, indicating relatively more males at younger ages*** *(–0.4565 vs. –0.2936). The cumulative distribution functions revealed that* ***females tend to consult at an***

earlier age compared to males, with notable peaks of divergence at 46 years for females and 64 years for males. *The crossover point, where consultation rates between females and males equalize, occurs at approximately 55 years.*

Disease Severity *(table 3): The cohort exhibited a marked predominance of chronic venous insufficiency (CVI) with 362 patients (92.1%; 95% CI: 89.0–94.5%) affected. Of these, 156 were male (43%) and 206 were female (57%). In contrast, only 31 patients (7.9%; 95% CI: 5.5–11.0%) had mild disease, comprising 12 males (39%) and 19 females (61%). Sex-related analyses, including a chi-square test ($\chi^2 = 0.224$, $p = 0.636$) and Fisher's exact test ($p = 0.708$), yielded non-significant results. These findings were corroborated by proportion z-tests ($p = 0.636$). The Wilson confidence intervals for the proportions (mild group: CI: -0.066 to 0.044; severe group: CI: -0.045 to 0.067), along with the estimation of the odds ratio (95% CI: 0.393 to 1.769) and relative risk (95% CI: 0.568 to 1.421), reinforced the absence of any significant association between sex and disease severity levels. However, binomial tests indicated* ***a statistically significant overrepresentation of females in the severe category ($p = 0.010$)***.

CEAP classes and sex *(table 4): The distribution of patients across CEAP classifications exhibited a bimodal pattern. Edema (C3: 104 patients, 26.5%) and ulcerative (C6: 175 patients, 44.5%) clinical signs collectively accounted for 71% of the study population. A descriptive analysis of CEAP stage sex-related distributions revealed that* ***male patients had a higher median severity (Median = C6) compared to females (Median = C4)***. *The dispersion of CEAP scores was modest in both groups, with an interquartile range (IQR) of 3.0.* ***The median absolute deviation (MAD) was 0.0 in males, indicating a pronounced clustering of high-stage values, particularly in C6. In contrast, females exhibited a slightly broader spread (MAD = 1.0)***. *The mode for both males and females was C6. The chi-square test of independence yielded a chi-square statistic of 9.042 with a p-value of 0.171, indicating no significant association between sex and CEAP classification.* ***However, notable deviations were seen in the adjusted residuals: females had a significantly higher than expected frequency for CEAP grade C3 (adjusted residual = 2.19), while males had a higher than expected frequency for grade C6 (adjusted residual = 2.71).*** *Given the ordinal nature of CEAP stages, a* ***Mann-Whitney U test was conducted to compare the distribution of CEAP grades between males and females. This test revealed a statistically significant difference (U = 21,696, with a 14.79% difference from the midpoint favoring male patients****, $p = 0.008$). The rank-biserial correlation indicated a small effect size ($r = 0.127$), suggesting a modest difference in grade distributions. Furthermore,* ***the common language effect size (Vargha-Delaney A) indicated that a randomly selected male patient has a 57.4% probability (95% CI: 0.521 – 0.627; bootstrap = 10,000) of exhibiting a higher CEAP grade than a randomly selected female patient.***

The stratum-wise analysis of the CEAP distributions provided further insights. For the majority of CEAP strata (C0, C1, C2, C4, C5), there was a consistent lack of significant findings across all tests, indicating proportional sex representation within these categories and in relation to their overall male and female populations. Significant findings were observed at the C3 and C6 disease strata. Among females, 69 out of 225 (30.7%) were classified as C3, compared to 35 out of 168 males (20.8%). This difference was statistically significant, as confirmed by the chi-squared test with Yates' correction ($\chi^2 = 4.287$, $p = 0.038$, small effect size (Cohen's $w = 0.104$)), the two-proportion z-test ($z = -2.186$, $p = 0.029$, 95% CI: -0.180 to -0.010), and the binomial test ($p = 0.001$). The risk ratio for females compared to males was 1.47 (95% CI: 1.03–2.10), indicating a 47% higher likelihood of C3 classification among females. In the C6 category, 88 out of 168 males (52.4%) were classified as C6, compared to 87 out of 225 females (38.7%). This difference was also statistically significant (chi-squared with Yates' correction: $\chi^2 = 6.779$, $p = 0.009$, small effect size (Cohen's $w = 0.131$); two-proportion z-test: $z = 2.706$, $p = 0.007$, 95% CI: 0.038 to 0.234). The binomial test showed no deviation from a 50:50 sex

distribution (88 males vs. 87 females; p = 1.0). The risk ratio for males compared to females was 1.36 (95% CI: 1.09–1.69), indicating that males have a significantly higher risk of progressing to C6 disease. However, the binomial test suggests a balanced representation among C6 patients. ***These findings further highlight that sex is a statistically significant factor influencing CEAP grade assignment in both the C3 and C6 strata, though the effect sizes are modest. The inclusion of the binomial test result for C6 provides additional nuance, showing that while males are more likely to reach the most severe disease stage, the absolute number of males and females with active ulcers is nearly equal.***

CEAP classes and age *(table 5) The statistical analysis of CEAP classes by age reveals that classes C3 through C6, which represent 92.1% of the total cohort, are characterized by a relatively narrow age range, predominantly within the 50s and 60s. Specifically, males had a median age of 57 with a median absolute deviation (MAD) of 10, while females had a median age of 58 with a MAD of 12.*

Age demonstrated consistently negligible associations with CEAP severity across all analytical approaches. Spearman's rank correlation yielded a coefficient (ρ) of 0.011 (p = 0.835), while Kendall's tau produced a coefficient (τ) of 0.008 (p = 0.832), both indicating virtually no monotonic relationship. Asymmetric association measures provided concordant evidence: Somers' D for CEAP conditioned on age was 0.007 (p = 0.832), and in the reverse direction, it was 0.010 (p = 0.832). Goodman-Kruskal's gamma was 0.010 (p = 0.992, SE = 1.000, Z = 0.010), with the large standard error reflecting the minimal association strength. All correlation coefficients were substantially below conventional thresholds for even small effect sizes (all < 0.10), and the p-values provided no evidence against the null hypothesis of independence. Theil's uncertainty coefficients were U(CEAP|age) = 0.372 and U(age|CEAP) = 0.488. These moderate values suggest that CEAP classification might be slightly more informative for predicting age than age is for predicting CEAP classification.

An analysis was also conducted for CEAP age associations, segmented by sex. The female group exhibited outcomes consistent with the global analysis: Spearman's rho (0.104, p = 0.118), Kendall's tau (0.080, p = 0.113), Somers' D (CEAP|age: 0.069, p = 0.111; age|CEAP: 0.093, p = 0.111), Goodman-Kruskal's gamma (0.094, p = 0.924), and Theil's U (CEAP|age: 0.410; age|CEAP: 0.583). However, the male results indicated a slightly non-significant, yet moderate, negative association between CEAP and age: Spearman's rho (-0.138, p = 0.075), Kendall's tau (-0.109, p = 0.066), Somers' D (CEAP|age: -0.089, p = 0.075; age|CEAP: -0.132, p = 0.075), Goodman-Kruskal's gamma (-0.135, p = 0.892), and Theil's U (CEAP|age: 0.419; age|CEAP: 0.627). ***This negative association for males can be explained by the C6 class, which exhibited a significant weight for males (88 out of 168, i.e., 52%) with a median age of 53.5, inferior to the median age for all other classes: C1: 71.0, C2: 57.0, C3: 62.0, C4: 62.0, and C5: 64.0****.*

CEAP classes and laterality *(tables 6, 7): The influence of laterality on CEAP classification was ultimately examined. Among the 393 patients, 149 (37.9%) exhibited higher disease severity in the left limb, 116 (29.5%) in the right limb, and 128 (32.6%) showed equal severity in both limbs.* ***Global symmetry tests, including the Stuart-Maxwell test (p = 0.128) and Bowker test (p = 0.226), did not detect significant asymmetry in the distribution of CEAP grades****. For the assessment of paired differences, the Wilcoxon signed-rank test yielded an observed statistic of 28,486.5 (p = 0.0058), which is substantially lower than both the theoretical expected value (34,582.5) and the simulated mean under equilibrium (37,642.4, SD = 290.7, z-score = -31.5).* ***When present, the asymmetry in disease severity between the limbs, with the left limb being more severely affected than the right, was highly significant. Male patients exhibited greater asymmetry (p = 0.034) compared to female patients. McNemar analysis identified significant asymmetries in the NA class (right***

limb only = 67, left limb only = 43, p = 0.028), the C2 class (right limb only = 49, left limb only = 31, p = 0.057) and the C6 class (right limb only = 62, left limb only = 92, p = 0.019). *When synthesizing the distribution of CEAP class pairs between the left and right limbs,* ***several patterns emerge****. Approximately* ***one third of patients (33%) present with symmetrical disease****, with both limbs classified as C3-C3 in 15% of total cohort cases.* ***Unilateral disease is also frequently observed: 17% of patients exhibit unilateral disease on the left side, with NA-C6 being the predominant pattern (10% of all cases), while 11% present unilateral disease on the right, again with C6-NA as the most frequent presentation (5% of all cases).*** *The remaining 39% of patients display a variety of other CEAP class pairings, reflecting the heterogeneity of disease expression in this population.* ***Male patients exhibited greater asymmetry (C6-NA or NA-C6) compared to female patients (C3-C3).***

CEAP classes and sex, age, laterality as predictors *(table 8, figure 3): In our evaluation of the association between CEAP classes and patient characteristics a Cumulative Link Mixed Model (CLMM) was applied using the formula ceap ~ sex + age + laterality + (1 | patient). This model revealed negligible variance for the random effect, resulting in numerical instability. Subsequently, a Cumulative Link Model (CLM) was employed, which provided stable parameter estimates and standard errors. The analysis indicated that laterality was a significant predictor for CEAP classes ($p < 0.001$), whereas age and sex were not significant predictors. Specifically, patients with right limb involvement exhibited 36% lower odds of being classified into a higher CEAP category compared to those with left limb involvement. The overall model fit, as measured by McFadden's pseudo R^2, was negligible at 0.55%. Furthermore, relaxing the proportional odds assumption for each predictor did not improve the model fit, since the AIC value remained stable. Stratum-wise CEAP binary GEE analysis revealed the following predictor effects: (1) Age: is not significantly associated with any outcome of CEAP ; (2) Sex: males have a 36% lower odds (OR = 0.636, 0.425–0.950, p = 0.027) of presenting with C3 disease than women as well as a 44% higher odds (OR = 1.443, 1.051–1.982, p = 0.023) of having CEAP class C6 compared to women (3) Laterality: left limb is associated with a 40% reduction in odds of having venous disease (NA) compared to the right limb (OR = 0.596, 0.382–0.931, p = 0.023), a 31% reduction in odds of having CEAP class C2 (OR = 0.689, 0.479–0.991, p = 0.045) and a 51% increase in odds of having CEAP class C6 (OR = 1.511, 1.081–2.112, p = 0.016).*

Patient treatment*: All patients benefited from nursing care, tailored to their follow-up compliance and financial capacity. Where appropriate, our procedures included the use of compression stockings and advanced wound-healing techniques, such as specialized dressings and negative pressure wound therapy. Radiofrequency ablation (RFA) surgery was performed on 90 out of the 362 severely diseased patients (25%). Additionally, two patients underwent further treatment for recurrence involving the small saphenous veins.*

7 Key Findings

Etiology: *Our analysis of a cohort of* ***486 patients*** *presenting with lower limb dermatologic disorders upon clinical examination revealed a high prevalence (80%) of* ***vascular venous etiology****, aligning with the 60-80% range typically observed in developed countries (9).*

Patient sex distribution*: The cohort of 393 venous patients, including 225 females and 168 males, presents a female-to-male odds ratio of 1.34:1.*

Patient age distribution*: The age distributions for both males and females are* ***non-normal and left-skewed****, with a more pronounced skew for males. Although there is substantial overlap (median: males 57 years,*

females 58), MAD: males 10 years, females 12)), the distributions show several key differences. ***Female age distributions are generally more spread out and less peaked*** *than those of males. Beyond the youngest age group (15 to 30 years), in which males are very slightly overrepresented, females generally present for consultation at earlier ages compared to males. Specifically, there is a peak divergence around 46 years, where females are more prevalent, and at 64 years for males, with the crossover point being at 55 years*

Disease Severity*: In the cohort, 362 patients (92.1%) are found to be severely affected (C3-C6) as opposed to mildly affected (C0-C2). While there is* ***no overall association between sex and disease severity****, females are* ***significantly overrepresented within the severe disease category****.*

CEAP classes and sex*: The distribution of patients across CEAP classifications exhibit a bimodal pattern with* ***edema and ulcerative clinical signs collectively accounting for 71% of the study population****. We observe notable differences between the sexes: male patients had a higher median class (C6) compared to females, whose median was C4.* ***The frequency of C6 is significantly higher among males, while C3 is more common among females****.* ***Although males are more likely to reach the most severe disease stage, the absolute number of males and females with active ulcers is nearly equal****.*

CEAP classes and age*: Classes* ***C3 through C6****, which* ***account for 92.1% of the total cohort****, are characterized by a relatively narrow age range, with most patients in their 50s and 60s. Among males, there is a negative association between the severity of clinical signs and age.*

CEAP classes and laterality: *In isolation, the right limb exhibited a significant prevalence of the NA and C2 classes, whereas the left limb showed a significant prevalence of the C6 class. In pairwise comparisons of patient limbs, approximately one-third of patients (33%) present with symmetrical disease, with both limbs classified as C3-C3 in 15% of total cohort cases. Stratified by sex, females demonstrated a higher rate of bilateral concordance (38%) compared to males (25%). Unilateral disease is also frequently observed: 17% of patients exhibit unilateral disease on the left side, with an emerging pattern of NA-C6 progression, observed in 5% of overall cases, while 11% present unilateral disease on the right, again with C6-NA as the most frequent presentation and 5% of overall cases. The remaining 39% of patients display a variety of other CEAP class pairings. Male patients exhibited greater asymmetry (C6-NA or NA-C6) compared to female patients (C3-C3).*

CEAP classes and sex, age, laterality as predictors*: The findings suggest two main points: (1) sex-specific differences, with males being underrepresented in moderate disease (C3) but overrepresented in severe disease (C6), and (2) that the left limb is less likely to present with NA and C2 disease stages but more likely to present with the C6 disease level. Age has been confirmed as not being a significant predictor.*

Multiple Testing Correction and Findings*: Across all analyses examining associations between CEAP class and the variables sex, age, and laterality, no results remained statistically significant after applying Bonferroni or False Discovery Rate (FDR) corrections. The only borderline findings were observed in the limb laterality stratum-based analyses for the NA, C2, and C6 classes, where nominal p-values approached significance using the FDR method.*

Patient treatment: *Out of 362 patients with C3-C6 disease, only 90 patients (25%) who required treatment had the financial means to access radiofrequency ablation (RFA) treatment, which was combined with skin grafting as needed.*

8 Discussion

Our clinical observations confirm the significant predominance of venous pathology as the primary cause of lower limb ulcers, consistent with findings from Western populations. (11) The study also underscores the disproportionately high burden of advanced-stage CVI, with 92% of patients classified within CEAP grades C3 to C6 at initial presentation. This contrasts sharply with patterns observed in high-income countries, where early detection and the widespread availability of minimally invasive interventions have markedly slowed disease progression. (12)

In many low-income settings, dermatological and vascular conditions are often misunderstood by the general population, including among educated individuals. These conditions are sometimes believed to have mystical or spiritual origins, occasionally attributed to ancestral or familial transgressions. As a result, patients frequently turn to traditional healers, spiritual leaders, or religious practitioners before seeking formal medical care. These culturally embedded health-seeking behaviors, combined with a shortage of trained medical personnel and limited access to affordable healthcare, contribute to delayed medical presentation and, consequently, to the high prevalence of advanced CVI stages observed in this study.

Our cohort demonstrated a statistically significant female-to-male ratio of 1.34:1, which is consistent with the 1.28:1 ratio reported in the Bonn study. Regarding CEAP clinical classes and the influence of sex and age, the association of the ***C3 clinical class*** *with female sex and earlier age of presentation may be linked to sociological factors. These include increased health awareness and a greater emphasis on body aesthetics among women. Furthermore, well-established risk factors for venous disease development, such as* ***hormonal fluctuations*** *during the menstrual cycle, pregnancy, and menopause, may contribute to the progression of moderate disease, thereby prompting earlier medical attention.*

Conversely, the association between CEAP C6 classification and male sex, along with delayed medical presentation, may reflect the financial pressures faced by older men who continue to support their families in settings where healthcare costs are mostly not mutualized. The urgency to seek care often arises only when severe clinical manifestations demand immediate intervention, further contributing to late-stage diagnoses. Occupational factors, such as prolonged static standing or heavy lifting, may also accelerate disease progression in men.

Two additional age-related findings warrant further consideration. First, the absence of a significant association between CEAP classification and chronological age may be explained by delayed healthcare-seeking behavior among both males and females. Within this context, our cohort reflects a cross-sectional snapshot along the age continuum in which the disease burden is disproportionately concentrated in severe cases, manifesting in a non-linear and sex-specific pattern. Second, the unexpected inverse association between age and clinical severity among males appears to be driven primarily by their overrepresentation in the CEAP C6 category. Notably, the median age of males in this group is 53.5 years, which is consistently lower than the median ages observed across all other CEAP classes, which range from 57 to 71 years. This group consists of active male adults in their early 50s who are facing the most severe form of the disease and possess sufficient financial resources to undergo minimally invasive surgery.

CEAP classes and laterality*: The statistics reveal clear patterns of symmetrical bilateral involvement (33%) and unilateral involvement (28%), which together account for 61% of all cases. Regarding asymmetry, while left-sided disease may be partially explained by anatomical factors such as left common iliac vein compression (May-Thurner syndrome), (13) (14) other contributors such as occupational asymmetry,*

repetitive strain, or limb dominance may also play a role. This is particularly relevant in low-income settings, where physically demanding work is common and may predispose individuals to asymmetric disease progression.

CEAP classes and sex, age, and laterality as predictors: *Logistic regression analysis, using CEAP classes and sex, age, and laterality as predictors, confirmed the results of classical analysis tests. The absence of an overall association between CEAP classes and grouping variables was usefully complemented by stratum-based analysis, which revealed local associations with sex and laterality..*

9 Conclusions

Medical Aspects

Our analysis of Kinshasa patients presenting with lower limb dermatological conditions in a clinical environment leads to two primary conclusions. First, ***vascular etiology predominates (80% of cases) over other causes of lower limb wounds in this cohort****. Consequently, the notion of infectious causes being a significant or even prevalent etiology for skin wounds, particularly in megacities of tropical regions, appears to be unfounded. It actually highlights the dual burden of non-communicable and infectious diseases that challenges healthcare systems in sub-Saharan African megacities. (15) (16) Second, advanced disease levels within our cohort are overwhelming, with* ***92% of patients classified in CEAP C3-C6 severity categories****. These results contrast with large-scale global epidemiological studies, notably the Vein Consult Program, where 24% of patients were at the stage of chronic venous insufficiency (C3-C6) and 'the prevalence of ulcers, healed and active (2.1%), is in agreement with published data' (9) (17)*

Socioeconomic Aspects

Our findings are indicative of a growing disconnect between the demographic momentum in sub-Saharan Africa and the capacity of its health systems to address emerging challenges. As the region's youthful labor force expands (in the DRC, the median age of the population is 15 years, 2025), so too do the legitimate aspirations for improved living standards and long-term development.

Demographic projections for the Democratic Republic of the Congo (DRC) suggest that the urban population will surge from 30 million in 2025 to 200 million by 2050, while the rural population is expected to grow from 50 million to 70 million. This demographic shift will result in the former being approximately three times the size of the latter by 2050. (18) Much of the global health discourse, however, continues to view African disease burdens through a 20th-century lens, with a narrow focus on infectious diseases. This outdated perspective overlooks the dual burden of disease now confronting many low- and middle-income countries, particularly in megacities where rapid urbanization, changing lifestyles, and informal labor patterns are accelerating the rise of non-communicable diseases.

Conditions like Chronic Venous Insufficiency (CVI) are part of this silent epidemic. Integrating vascular health into broader NCD strategies is no longer optional—it is essential to safeguarding the functional health of working-age populations and ensuring that demographic potential is not undermined by preventable chronic disability. Unfortunately, chronic veinous insufficiency appears to remain marginalized in international aid programs for low-income countries. For instance, the 'WHO Cooperation Strategy with the Democratic Republic of Congo 2024-2029' fails to address the issue of Chronic Venous Insufficiency (CVI) altogether. (19)

10 Recommendations

*In Kinshasa (DRC), the term "**MBASU**," traditionally encompassing diverse dermatological signs such as simple erythema or papules, unsightly wounds, edema or fibrosis, healed or active ulcers, has been erroneously narrowed to specific infectious causes like Buruli Ulcer, fueling public health misconceptions. Hence, for clarity in language, we propose using the terms "**Non-infectious MBASU (NIM)**" and "**Infectious MBASU (IM)**." It's vital that the vernacular language reflects the scientific evidence contributed by this study, in a manner that the collective understanding integrates this crucial distinction.*

Strategically, the continued predominance of chronic venous insufficiency—an eminently manageable condition with timely intervention—highlights significant opportunities for strategic healthcare investment and policy advancements, consisting in:

***Funding prioritization:** Private and public funding should be primarily directed towards managing vascular-related conditions (direct costs) and implementing measures to alleviate the economic burden of this scourge (indirect costs).*
***Public Awareness Campaigns:** Information, awareness, screening, and prevention campaigns should be conducted, emphasizing the benefits of early detection and the treatable nature of vascular diseases.*
***Initial Hospital Assessment:** As a first step, hospitals should consider the possibility of Non-infectious MBASU (NIM), thereby prioritizing Chronic Venous Disease (CVD) or, in advanced stages, Chronic Venous Insufficiency (CVI) when managing lower limb ulcer wounds.*
***Medical Education Reform:** Higher education curricula for medical and nursing students should incorporate the significant importance of therapies related to vascular conditions.*
***Collaborative Expertise:** Establish shared expertise between vascular and infectious disease specialties to optimize available resources for the benefit of patient health.*

11 Funding

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12 Conflict of interest

None.

13 Keywords

chronic venous insufficiency, clinical epidemiology, CEAP clinical signs

14 References

1. **Worldbank.** Afrique Capital Humain – Sommets des chefs d'Etat – Juillet 2023. [Online] https://thedocs.worldbank.org/en/doc/a328ed9a49f4b7fbf56d4d91093d53ac-0010012023/original/le-temps-de-l-afrique-tirer-parti-du-dividende-d-mographique-fr.pdf.

2. **World Population review.** Kinshasa, DR Congo Population 2024. *https://worldpopulationreview.com/*. [Online] https://worldpopulationreview.com/cities/dr-congo/kinshasa .

3. *Committee A, first report WHA 57.1 Surveillance and control of Mycobacterium ulcerans disease (Buruli ulcer).* **World Health Organization.** 21 May 2004. 57th plenary meeting Geneva 17-22 May 2004. p. 1.

4. **World Health Organization.** Cotonou Declaration on Buruli Ulcer 2009. [Online] 30 March 2009. https://www.who.int/publications/i/item/WHO-HTM-NTD-GBUI-2009.1.

5. —. En République démocratique du Congo, un hôpital traque l'ulcère de Buruli. *World Health Organization - Organisation Mondiale de la Santé.* [Online] https://www.afro.who.int/fr/countries/democratic-republic-of-congo/news/en-republique-democratique-du-congo-un-hopital-traque-lulcere-de-buruli.

6. **Worldometer, RDC.** DR Congo Demographics. [Online] https://www.worldometers.info/demographics/democratic-republic-of-the-congo-demographics.

7. **World Health Organization.** Number of confirmed cases of Buruli Ulcer reported. *World Health Organisation.* [Online] 2024. https://www.who.int/data/gho/data/indicators/indicator-details/GHO/number-of-confirmed-cases-of-buruli-ulcer-reported.

8. *Surveillance of the Buruli Ulcer in The Democratic Republic of Congo (Drc): Preliminary Results (2016-2018).* **Bajani, Marie José Kabedi.** 5, 2019, Am J Biomed Sci & Res., Vol. 6. AJBSR.MS.ID.001062.

9. *An Epidemiological Survey of Venous Disease Among General Practitioner Attendees in Different Geographical Regions on the Globe: The Final Results of the Vein Consult Program.* **Marc E. Vuylsteke, Roos Colman, Sarah Thomis, Geneviève Guillaume, Damien Van Quickenborne, Ivan Staelens.** 9, s.l. : SAGE Journals, Angiology, Vol. 69, pp. 779-785.

10. **Eklöf Bo, et al.** *Revision of the CEAP classification for chronic.* American Venous Forum. 2004.

11. *Ulcères de jambe.* **Bureau, J.-M & Debure, C.** 2006, EMC - Angéiologie, Vol. 1, pp. 1-12.

12. *Epidemiology of chronic venous disorders in geographically diverse populations: results from the Vein Consult Program.* **Rabe E, Guex JJ, Puskas A, Scuderi A, Fernandez Quesada F, VCP Coordinators and Collaborators.** 2, 2012, International Angiology : a Journal of the International Union of Angiology, Vol. 31, pp. 105-115.

13. *Evaluation of clinical and ultrasonographic prognostic factors for detection of iliac venous obstructions in patients with advanced chronic venous insufficiency.* **Viviane Chaib Gomes Stegun, Patrick Bastos Metzger, Ana Amélia Carvalho Melo Cavalcante, Thaís Lye Okamoto Yamakami, Fabio Henrique Rossi.** 3 17, 2025, Phlebology.

14. *The clinical characteristics of lower extremity lymphedema in 440 patients.* **Steven M. Dean, Elizabeth Valenti, Karen Hock, Julie Leffler, Amy Compston, William T. Abraham.** 5, 9 2020, JVS-VL, Vol. 8, pp. 851-859.

15. *Leg ulcers: uncommon presentations Clinics in Dermatology.* **Finn Gottrup MD, Tonny Karlsmark MD.** 6, 2005, Vol. 23, pp. 601-611.

16. *Skin Disease in the Tropics and the Lessons that can be Learned from Leprosy and Other Neglected Diseases.* **Hay, Roderick J.** 9, 2020, Acta Derm Venereol., Vol. 100.

17. *VEIN CONSULT Program: interim results.* **Françoise, Pitsch.** 3, s.l. : Les Laboratoires Servier, 2012, Phlebolymphology, Vol. 19, pp. 132-137.

18. **UN Department of Economic and Scial Affairs.** Country Profiles - Democratic Republic of the Congo. [Online] https://population.un.org/wup/countryprofiles?country=Democratic%20Republic%20of%20the%20Congo.

19. **World Health Organization.** Stratégie de coopération de l'OMS avec la République démocratique du Congo 2024-2029. *https://www.afro.who.int.* [Online] https://www.afro.who.int/fr/countries/democratic-republic-of-congo/publication/strategie-de-cooperation-de-loms-avec-la-republique-democratique-du-congo-2024-2029.