World Journal of Cardiovascular Diseases, 2026, 16(2), 83-94
https://www.scirp.org/journal/wjcd
ISSN Online: 2164-5337
ISSN Print: 2164-5329

# In-Hospital Prevalence of Heart Failure and Etiologic Factors at Monkole Hospital, Kinshasa, Democratic Republic of the Congo: A Retrospective Study of Medical Admissions during One Year of Observation

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**How to cite this paper:** Tonduangu, D.K., Nsuami, M.J., Dinganga, C.M., Situakibanza, H.N., Buila, N.B., Wumba, F.W., Ngimbi, M.N., Kintoki, E.V. and Longo-Mbenza, B. (2026) In-Hospital Prevalence of Heart Failure and Etiologic Factors at Monkole Hospital, Kinshasa, Democratic Republic of the Congo: A Retrospective Study of Medical Admissions During One Year of Observation. *World Journal of Cardiovascular Diseases*, **16**, 83-94.
https://doi.org/10.4236/wjcd.2026.162009

**Received:** December 19, 2025
**Accepted:** February 21, 2026
**Published:** February 24, 2026

## Abstract

**Background and Objectives:** In Kinshasa, the capital city of the Democratic Republic of the Congo and the largest and most populous city in Central Africa, the in-hospital prevalence of heart failure is currently unknown. This study sought to determine the in-hospital prevalence of heart failure among adult patients diagnosed with a cardiovascular disease in Kinshasa. **Methods:** We reviewed all cardiovascular diagnoses recorded on Excel spreadsheets for adult patients admitted at Monkole Hospital between January 1, 2019, and December 31, 2019. We calculated the prevalence of heart failure diagnosis and of cardiovascular comorbidities, and we determined the odds of a heart failure diagnosis in association with cardiovascular comorbidities using logistic regression analyses. **Results:** Of 442 patients aged ≥ 18 years diagnosed with a cardiovascular disease at the hospital in 2019, 145 (32.8%) were diagnosed

with heart failure, 97 (21.9%) were diagnosed with hypertensive heart disease, 85 (19.2%) were diagnosed with ischemic heart disease, 40 (9.0%) were diagnosed with pulmonary embolism, 32 (7.2%) were diagnosed with arrhythmia, 22 (5.0%) were diagnosed with hypertension, and 20 (4.5%) were diagnosed with cardiomyopathy. Independent predictors of a heart failure diagnosis were age ≥ 65 (adjusted odds ratio [AOR]: 3.62; 95% CI: 2.04 - 6.42), a diagnosis of ischemic heart disease (AOR: 4.17; 95% CI: 2.19 - 7.96), a diagnosis of pulmonary embolism (AOR: 6.91; 95% CI: 2.55 - 18.7), a diagnosis of hypertensive heart disease (AOR: 2.44; 95% CI: 1.37 - 4.35), age 50 to 64 (AOR: 1.90; 95% CI: 1.13 - 3.20), a diagnosis of arrhythmia (AOR: 32.1; 95% CI: 4.26 - 242.0), and a diagnosis of hypertension (AOR: 9.06; 95% CI: 1.99 - 41.2). **Conclusions:** Heart failure was the most frequent diagnosis among all adult patients diagnosed with a cardiovascular disease at Monkole Hospital in 2019. The one-year in-hospital heart failure prevalence of 32.8% we report is higher than the 25.6% to 42.5% in-hospital heart failure prevalences observed during 2 to 4 years in tertiary care facilities in Cameroon, Nigeria, and Togo.

## Keywords

Cardiovascular Diseases, Developing Countries, Global Health, Sub-Saharan Africa

## 1. Introduction

In sub-Saharan Africa, heart failure has become a major clinical and public health issue in recent decades owing to its morbidity, mortality, and cost to society. In a systematic review and meta-analysis of studies of patients admitted in primary to tertiary care facilities published between January 1, 1996, and June 23, 2017, 9.4% to 42.5% of patients admitted for medical heart diseases in Cameroon, Nigeria, and Togo had heart failure [1] [2]. The etiologies of heart failure in sub-Saharan Africa varied widely across studies, of which hypertensive heart disease was the most frequent, with a pooled prevalence of 39.2% (95% confidence interval [CI]: 32.6% - 45.9%) [1] [2]. Studies from Central Africa are sparse. Only 2 studies conducted at the Yaounde General Hospital in Cameroon were included in this systematic review and meta-analysis for the Central African region. With 167 patients in the 1998-2001 study [3] and 148 patients in the 2013-2016 study [4], the most frequent etiology of heart failure in this combined study population of 315 patients was hypertensive heart disease (42.3%; 95% CI: 20.2% - 66.1%) [1] [2]. For more than 5 decades, hypertension has been identified as the most frequent precursor of heart failure in males and females [5]-[8].

Kinshasa, the capital city of the Democratic Republic of the Congo (DRC), with its population currently estimated at more than 16 million, is the largest city in Central Africa. The prevalence of hypertension in Kinshasa was 13% in 1984 [9], which increased to 31% in 2008 [10]. Among 298 patients prescribed anti-hyper-

tensive medication in a network of primary care facilities in the city in 2012, 42% did not adhere to treatment, and 77% had uncontrolled hypertension [11]. From December 2015 to January 2016, the same proportion of uncontrolled hypertension (77%) was found in another study of 260 hypertensive patients in the network [12]. Despite this documented high and increasing prevalence of hypertension, the high prevalence of non-adherence to anti-hypertensive treatment and the associated high prevalence of uncontrolled disease, the risks of heart failure associated with hypertension in Kinshasa have not been characterized [5]-[7]. There is no cardiovascular disease registry in the DRC, and the in-hospital prevalence of heart failure in Kinshasa is currently unknown. In a recent cross-sectional study of physicians practicing in cardiology health services in Kinshasa, 52% indicated that they did not know the in-hospital prevalence of heart failure in the city, but 95% thought that this unknown prevalence tended to increase [13].

We conducted a retrospective study of medical admissions at Monkole Hospital, a public tertiary care hospital that maintained computerized files of all hospital admissions from January 1, 2019, to December 31, 2019, to determine the in-hospital prevalence of heart failure among adult patients diagnosed with a cardiovascular disease in Kinshasa.

## 2. Methods

### 2.1. Setting

Monkole Health Center is a multicenter hospital in Kinshasa, which opened its doors on March 26, 1991, with an outpatient service, and expanded over the following years with the opening of several outpatient health centers throughout the city (https://monkole.cd/en/). On June 2, 2014, a new building housing a hospital of 110 beds was inaugurated. Medical services are provided at the hospital through the department of Obstetrics and Gynecology, departments of Pediatrics, an Internal Medicine department, different ambulatory services, a 24/7 emergency department, an intensive care unit, and a Surgery department. Patients discharged with a condition that requires follow-up, including patients discharged with cardiovascular disease, are followed through an ambulatory service of the hospital. Administrative services include an Information Technology department, which, among other tasks, developed the capacity to maintain computerized files of all hospital admissions.

### 2.2. Study Design

We reviewed Excel spreadsheets of all patients diagnosed with a cardiovascular disease at the hospital during the calendar year 2019. Data on the spreadsheets included the date of hospital admission, the date of hospital discharge, the patient's date of birth, their gender, and the diagnoses received during the hospital stay. Depending on the patient's condition on admission, most were admitted through the emergency department then transferred into the internal medicine ward or to the intensive care unit. A few pregnant women were transferred into

Obstetrics and Gynecology. During hospital stay, a transfer from one unit/ward to another was logged into the spreadsheets as a discharge and admission, and such transfer was considered as one hospital stay. All diagnoses that were recorded during one hospital stay were retained for the purpose of this analysis. The diagnostic criteria used to diagnose these cardiovascular conditions, and whether the patient was discharged alive from the hospital or died during the hospital stay, were not recorded on the spreadsheets.

### 2.3. Ethical Considerations

The Ethics Committee of the School of Public Health, Faculty of Medicine, University of Kinshasa, approved this study. Because of the retrospective nature of the study using anonymized data, waiver of informed consent was granted.

### 2.4. Statistical Analysis

Logistic regressions were performed to examine associations of heart failure diagnoses with age, sex, and comorbidities diagnosed in at least 10 patients. Variables associated with a heart failure diagnosis at $p < 0.05$ in univariate logistic regressions were selected as possible predictors of heart failure diagnosis in a multivariate logistic regression. Variables associated with a heart failure diagnosis at $p < 0.05$ in multivariate logistic regression were considered independent predictors of a heart failure diagnosis in our study. Data analysis was performed using SPSS statistical software (IBM SPSS Statistics 25).

## 3. Results

### 3.1. Study Population

There were 442 patients aged ≥ 18 years who were diagnosed with a cardiovascular disease at Monkole Hospital in 2019. Of them, 225 (50.9%; age: 18 - 90 years; mean: 55.0* years; median: 56.0 years) were females and 217 (49.1%; age: 18 - 89 years; mean: 59.2* years; median: 61.0 years) were males (*$p = 0.005$).

### 3.2. Prevalence of Heart Failure Diagnoses and of Comorbidities

Table 1 describes additional age characteristics of all patients and the cardiovascular morbidities diagnosed among them during the 2019 hospital stay. Of the 442 patients, 145 (32.8%; 95% CI: 28.4% - 37.4%) were diagnosed with heart failure, 97 (21.9%; 95% CI: 18.2% - 26.1%) were diagnosed with hypertensive heart disease, 85 (19.2%; 95% CI: 15.7% - 23.2%) were diagnosed with ischemic heart disease, 40 (9.0%; 95% CI: 6.5% - 12.1%) were diagnosed with pulmonary embolism, 32 (7.2%; 95% CI: 5.0% - 10.1%) were diagnosed with arrhythmia, 22 (5.0%; 95% CI: 3.1% - 7.4%) were diagnosed with hypertension, and 20 (4.5%; 95% CI: 2.8% - 6.9%) were diagnosed with cardiomyopathy. There were 52 patients (11.8%) who were diagnosed with improperly characterized heart conditions, distributed evenly between males (12.4%) and females (11.1%).

**Table 1.** Age characteristics and cardiovascular diagnoses of 442 patients admitted at Monkole Hospital from January 1, 2019, to December 31, 2019.

| | Females (n = 225) | Males (n = 217) | Total (n = 442) |
|---|---|---|---|
| Age (years), n (%) | | | |
| 18 - 49 | 85 (37.8)* | 48 (22.1)* | 133 (30.1) |
| 50 - 64 | 66 (29.3) | 84 (38.7) | 150 (33.9) |
| ≥65 | 74 (32.9) | 85 (39.2) | 159 (36.0) |
| Diagnosis, n (%) | | | |
| Heart failure | 70 (31.1) | 75 (34.6) | 145 (32.8) |
| Hypertensive heart disease | 41 (18.2) | 56 (25.8) | 97 (21.9) |
| Ischemic heart disease | 40 (17.8) | 45 (20.7) | 85 (19.2) |
| Pulmonary embolism | 28 (12.4)** | 12 (5.5)** | 40 (9.0) |
| Arrhythmia | 23 (10.2)¶ | 9 (4.1)¶ | 32 (7.2) |
| Hypertension | 13 (5.8) | 9 (4.1) | 22 (5.0) |
| Cardiomyopathy | 10 (4.4) | 10 (4.6) | 20 (4.5) |
| Bradycardia | 2 (0.9) | 6 (2.8) | 8 (1.8) |
| Pericarditis | 5 (2.2) | 3 (1.4) | 8 (1.8) |
| Cardiogenic choc | 5 (2.2) | 2 (0.9) | 7 (1.6) |
| Heart palpitations | 6 (2.7) | 1 (0.5) | 7 (1.6) |
| Stroke | 2 (0.9) | 3 (1.4) | 5 (1.1) |
| Valve disease | 3 (1.3) | 2 (0.9) | 5 (1.1) |
| Uncharacterized heart disease | 25 (11.1) | 27 (12.4) | 52 (11.8) |

*p = 0.001; **p = 0.011; ¶p = 0.014.

### 3.3. Logistic Regression Analyses of Risk Factors for a Heart Failure Diagnosis

In univariate logistic regression analyses, the odds of a heart failure diagnosis increased significantly with age ≥ 65 and with a diagnosis of ischemic heart disease (p = 0.001), a diagnosis of arrhythmia (p = 0.006), a diagnosis of pulmonary embolism (p = 0.007), a diagnosis of hypertensive heart disease (p = 0.017), age 50 to 64 and a diagnosis of hypertension (p = 0.028) (Table 2). In a multivariate logistic regression controlling for all variables that were associated with a heart failure diagnosis in univariate analyses at p < 0.05 (Table 2), independent predictors of a heart failure diagnosis were age ≥ 65 (adjusted odds ratio [AOR]: 3.62; 95% CI: 2.04 - 6.42; p < 0.0001), a diagnosis of ischemic heart disease (AOR: 4.17; 95% CI: 2.19 - 7.96; p < 0.0001), a diagnosis of pulmonary embolism (AOR: 6.91; 95% CI:

2.55 - 18.7; p < 0.0001), a diagnosis of hypertensive heart disease (AOR: 2.44; 95% CI: 1.37 - 4.35; p = 0.002), age 50 to 64 (AOR: 1.90; 95% CI: 1.13 - 3.20; p = 0.016), a diagnosis of arrhythmia (AOR: 32.1; 95% CI: 4.26 - 242.0; p = 0.001), and a diagnosis of hypertension (AOR: 9.06; 95% CI: 1.99 - 41.2; p = 0.004). An interaction term including hypertensive heart disease and hypertension was added in the multivariate logistic regression because of the potential multicollinearity between both variables, which was not statistically significant (AOR: 0.00; 95% CI: 0.00 - …; p = 0.999).

**Table 2.** Demographic and comorbidity correlates of a heart failure diagnosis, Monkole Hospital, January 1, 2019, to December 31, 2019.

| | Heart failure n (%) | Logistic Regression Analyses | | | | | |
|---|---|---|---|---|---|---|---|
| | | Univariate Analyses | | | Multivariate Analysis | | |
| | | OR | (95% CI) | p[a] | AOR | (95% CI) | p[a] |
| All | 145 (32.8) | - | - | - | - | - | - |
| Age, years | | | | | | | |
| 18 - 49 | 31 (23.3) | Ref | - | - | Ref | - | - |
| 50 - 64 | 46 (30.7) | 1.69 | (1.06 - 2.70) | **0.028** | 1.90 | (1.13 - 3.20) | **0.016** |
| ≥ 65 | 68 (42.8) | 2.46 | (1.48 - 4.10) | **0.001** | 3.62 | (2.04 - 6.42) | **<0.0001** |
| Sex | | | | | | | |
| Female | 70 (31.1) | 1.17 | (0.79 - 1.74) | 0.440 | - | - | - |
| Male | 75 (34.6) | Ref | - | | - | - | |
| Comorbidities | | | | | | | |
| Hypertensive heart disease | | | | | | | |
| Yes | 22 (22.7) | 1.89 | (1.12 - 3.19) | **0.017** | 2.44 | (1.37 - 4.35) | **0.002** |
| No | 123 (35.7) | Ref | - | | Ref | - | |
| Ischemic heart disease | | | | | | | |
| Yes | 15 (17.6) | 2.67 | (1.47 - 4.86) | **0.001** | 4.17 | (2.19 - 7.96) | **<0.0001** |
| No | 130 (36.4) | Ref | - | | Ref | - | |
| Pulmonary embolism | | | | | | | |
| Yes | 5 (12.5) | 3.74 | (1.43 - 9.76) | **0.007** | 6.91 | (2.55 - 18.7) | **<0.0001** |
| No | 140 (34.8) | Ref | - | | Ref | - | |
| Arrhythmia | | | | | | | |
| Yes | 1 (3.1) | 16.8 | (2.27 - 124.2) | **0.006** | 32.1 | (4.26 - 242.0) | **0.001** |
| No | 144 (35.1) | Ref | | | Ref | | |

**Continued**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hypertension | | | | | | | |
| Yes | 2 (9.1) | 5.16 | (1.19 - 22.4) | **0.028** | 9.06 | (1.99 - 41.2) | **0.004** |
| No | 143 (34.0) | Ref | - | | Ref | - | |
| Cardiomyopathy | | | | | | | |
| Yes | 5 (25.0) | 1.49 | (0.53 - 4.18) | 0.449 | - | - | - |
| No | 140 (33.2) | Ref | | | | | |
| Uncharacterized heart disease | | | | | | | |
| Yes | 0 (0.0) | 0.00 | (0.00, -) | 0.997 | - | - | - |
| No | 145 (37.2) | Ref | | | | | |

[a]Boldface denotes p values that are statistically significant; AOR, adjusted odds ratio; OR, odds ratio; CI, confidence interval. AORs are adjusted for the interaction term hypertensive heart failure*hypertension, which was not statistically significant (p = 0.999).

## 4. Discussion

The involvement of the heart in infectious diseases was extensively studied in Kinshasa at the peak of the human immunodeficiency virus/acquired immune deficiency syndrome epidemic [14] [15], but not as much research has been conducted on noncommunicable, chronic heart diseases [16]. To our knowledge, this is the first study assessing the in-hospital prevalence of heart failure diagnoses and their putative causes in Kinshasa. We found that heart failure was the most frequent diagnosis among all adult patients diagnosed with a cardiovascular disease at Monkole Hospital in 2019. The one-year in-hospital prevalence of a heart failure diagnosis of 32.8% we report is higher than the 42.5% in-hospital heart failure prevalence observed during 4 years in a tertiary care facility in Nigeria [17], the 28.6%, 30.0%, and 33.3% in-hospital heart failure prevalences observed during 3 years in tertiary care facilities in Cameroon and Togo [3] [4] [18], and the 25.6% in-hospital heart failure prevalence observed during 2 years in another study conducted in a tertiary care facility in Togo [19].

In our study, the outcome and the predictor variables were recorded at the same time. Whether causation should be inferred from the associations we report should be based on the known biological plausibility of the processes involved, the demonstrated temporal sequence of causes preceding the disease from longitudinal studies, and their consistency with other studies [1] [2] [5]-[7] [20]. Because heart failure is a clinical syndrome resulting from different etiologies and pathophysiology and not a specific disease [8], we can report with a high degree of confidence that hypertensive heart disease is the leading cause of heart failure in the adult population of Kinshasa, and that age ≥ 65, ischemic heart disease, pulmonary embolism, arrhythmia, and hypertension at least double the odds of an adult "kinois" (an inhabitant of Kinshasa) of developing heart failure. This study provides documentation of morbidities that are leading to in-hospital heart failure

diagnosis in the city [13], and it adds to the literature on causal associations of heart failure for Central Africa, a region of the continent where fewer studies are conducted in this area [1] [2].

There is one study of heart failure etiologies from the eastern DRC city of Lubumbashi that was published in 2018 [21] and was not included in the systematic review and meta-analysis of studies published up to June 23, 2017 [1] [2], nor was it included in a narrative review of studies published between 2010 and 2021 [22]. In this study of 231 patients diagnosed with heart failure at a university hospital (n = 159) and at a private hospital (n = 72) between November 2014 and September 2016, dilated cardiomyopathy was the most frequent heart failure etiology (48%). This was similar to the findings of 2 studies from the neighboring eastern African country of Rwanda, where the leading cause of heart failure was dilated cardiomyopathy, found in 40% to 54% of cases [1] [2] [23] [24]. Our finding in the western DRC city of Kinshasa that hypertensive heart disease was the putative cause of 22% of heart failure cases was also similar to 20% to 66% of heart failure cases attributed to hypertensive heart disease in Yaounde, a Central African city in Cameroon, northwest of the DRC [3] [4]. These geographic distributions suggest a regional clustering of environmental, dietary, and behavioral risk factors that are leading to the development of cardiovascular diseases and ultimate heart failure in sub-Saharan African populations, including within the DRC [25]-[27].

Mortality data that are routinely collected and widely available in developed countries [28], are either unavailable or unusable for the DRC due to data quality issues. Statistics compiled by the World Health Organization for the DRC, which the organization advised to interpret with caution, ranked stroke, ischemic heart disease, and hypertensive heart disease among the 10 leading causes of death in 2021, having caused 49.1 deaths per 100,000, 40.2 deaths per 100,000, and 31.4 female deaths per 100,000 populations, respectively [29]. The high prevalence of life-threatening cardiovascular diagnoses in our study raises concerns about patients' outcomes at the hospital, particularly in-hospital heart failure mortality. In the study conducted by Malamba-Lez et al. in Lubumbashi [21], heart failure was the cause of 19% of in-hospital deaths and of 35% of deaths within one-year of diagnosis. The in-hospital heart failure mortality in Lubumbashi was within the range of 16.4% reported in Yaounde, Cameroon [30], 18.3% reported in Libreville, Gabon [31], and 19% reported at Moi Teaching and Referral Hospital in Western Kenya [32].

There are several limitations to this study. The retrospective review of pre-recorded data limited access to additional information on the criteria used to diagnose heart failure and all associated comorbidities among hospitalized patients. Reliance on data recorded on Excel spreadsheets without validation of diagnostic criteria against patients' charts affects the reliability of data we reported on. Only one patient was diagnosed with heart failure among 32 patients who were diagnosed with arrythmia. The extremely wide confidence intervals for arrhythmia in logistic regression analyses likely reflect the small sample size. The 52 patients di-

agnosed with what we labeled "uncharacterized heart disease" (11.8%) had a diagnosis recorded on the spreadsheets as a "cardiopathy to be determined", which represented diagnostic uncertainties. Had we accessed the clinicians' notes in the patients' charts, we would have collected more information to better characterize these conditions. The diagnoses we report are based on standard practices both at the hospital and in the city. However, they were made by physicians who recently demonstrated a very good knowledge of the guidelines of the European Society of Cardiology for the diagnostic of acute and chronic heart failure [13].

Although this study was not designed to change practice, it underscores the urgent need for a cardiovascular disease registry for the DRC to ensure research in cardiovascular diseases is conducted and practice of heart failure management is improved in Kinshasa, a city of 16 million in constant demographic growth, with a high and increasing prevalence of hypertension, the most frequent comorbidity associated with heart failure in sub-Saharan Africa [1] [2] [9] [10] [13]. The study additionally highlights the many opportunities for research at Monkole Health Center, particularly with the strength that the health center's infrastructure and organizational structure offer. For example, general services manage medical ambulances for the transport of patients and emergencies. The 24/7 emergency service of the Monkole Health Center (SAMU Monkole) is equipped with medical vehicles with resuscitation capacity and trained teams, which allows both the care of patients on the ground until transport to the hospital, increasing the chance of survival of patients with conditions such as stroke or cardiac decompensation (https://monkole.cd/en/). A study of 202 patients with confirmed diagnosis of stroke between May and October 2022 at 12 hospitals in Kinshasa showed that 89% of patients arrived at the hospital more than 4.5 hours after stroke onset [33]. The study highlighted the need to expeditiously coordinate transportation and admission of patients to a hospital where diagnostic resources and expert health care professionals for stroke management are available. Monkole Hospital is such a place. Future studies should seek to determine the in-hospital heart failure mortality among patients admitted at Monkole Hospital.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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