

Cardiovascular Diseases in Senegalese Hospitals: A Multicenter Descriptive Study in Ten Cardiology Units

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How to cite this paper: Fall, P.M.D., Ndiaye, P.G., Sene, K., Ngoma, A., Ngayuna, J., Tine, M.B., Beye, S.M., Manga, S., Thiam, M., Fall, M.M., Leye, M., Mboup, M.C., Ngaide, A.A. and Dioum, M. (2026) Cardiovascular Diseases in Senegalese Hospitals: A Multicenter Descriptive Study in Ten Cardiology Units. *World Journal of Cardiovascular Diseases*, 16, 814-829.
<https://doi.org/10.4236/wjcd.2026.1610075>

Received: August 28, 2026

Accepted: October 20, 2026

Published: October 23, 2026

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Abstract

Background: Cardiovascular diseases (CVD) represent a growing burden in sub-Saharan Africa. Hospital-based epidemiological data remain limited and geographically fragmented in Senegal. **Objective:** To describe the epidemiological, clinical, paraclinical and in-hospital outcome profile of patients hospitalized for CVD in ten cardiology units geographically distributed across Senegal. **Patients and Methods:** We conducted a multicenter descriptive cross-sectional study in ten Senegalese hospitals during January 2025. The participating centers were purposively selected to include cardiology units from Dakar and several major regions of Senegal. A total of 256 consecutive patients with a confirmed cardiovascular diagnosis who provided informed consent were included. Because the study database did not systematically record the number of eligible patients who declined participation or the number screened before exclusion, these numbers could not be reliably reconstructed retrospectively. **Results:** The mean age was 58.86 ± 17.69 years, with a slight female predominance (51.6%). Hypertension documented on admission was present in 40.6% of patients, valvular heart disease in 28.1%, and acute coro-

nary syndromes in 23.5%. Among the 224 patients who underwent echocardiography, 53 (23.7%) had left ventricular systolic dysfunction (LVEF $\leq 50\%$), corresponding to 20.7% of the overall study population. Emergency admissions accounted for 70.7% of cases. Troponin was measured in only 28.5% of patients and BNP/NT-proBNP in 6.3%. In-hospital mortality was 7.8% ($n = 20$), while 42.2% of patients required admission to a cardiology intensive care unit. **Conclusion:** This multicenter hospital-based study highlights a substantial burden of hypertension, valvular heart disease and acute coronary syndromes among patients admitted to cardiology units across Senegal. The high proportion of emergency admissions and the limited availability of cardiac biomarkers underline persistent diagnostic and healthcare-access constraints. The observed left ventricular systolic dysfunction should be interpreted cautiously because etiological investigations were not systematically available.

Keywords

Cardiovascular Diseases, Senegal, Hospital-Based Epidemiology, Hypertension, Left Ventricular Systolic Dysfunction, Acute Coronary Syndrome, Sub-Saharan Africa

1. Introduction

Cardiovascular diseases (CVD) are the leading cause of death worldwide, accounting for approximately 17.9 million deaths annually [1]. In sub-Saharan Africa, the cardiovascular transition is accelerating under the influence of urbanization, population ageing and changes in lifestyle and dietary patterns [2] [3].

In Senegal, hospital-based cardiovascular data remain fragmented and have historically been concentrated in referral centers in Dakar [4] [5]. Socioeconomic determinants, including limited health insurance coverage, low educational level and geographical distance from specialized facilities, may contribute to delayed presentation and difficulties in accessing appropriate cardiovascular care [6].

The epidemiological profile of cardiovascular disease in Senegal is therefore important to document, particularly through data collected from both Dakar and regional cardiology units.

The objective of this study was to describe the epidemiological, clinical, paraclinical and in-hospital outcome profile of patients hospitalized for cardiovascular diseases in ten Senegalese cardiology units geographically distributed across the country.

2. Patients and Methods

2.1. Study Design and Setting

We conducted a multicenter descriptive cross-sectional study during January 2025 in ten Senegalese hospitals: Idrissa Pouye General Hospital (HOGIP), Dalal Jamm Hospital, Cheikhoul Khadim Hospital in Touba, Principal Hospital of Dakar (HPD), Kaolack Regional Hospital, Fatick Regional Hospital, Hôpital de la

Paix in Ziguinchor, Saint-Louis Regional Hospital, Mansour Barro Hospital in Mbour, and Fann National University Hospital Center.

The participating hospitals were purposively selected to include cardiology units from Dakar and several major regions of Senegal, including northern, central, western and southern areas. This geographic distribution was intended to provide broad national coverage of hospital-based cardiology practice. However, the participating centers were not selected using population-proportional or probability-based sampling; therefore, the study should not be considered nationally representative of the Senegalese population.

2.2. Study Population and Inclusion Criteria

Patients admitted to the participating cardiology units with a confirmed cardiovascular diagnosis and who provided informed consent were eligible for inclusion.

Patients with a primary non-cardiovascular condition or an unusable medical record were excluded.

Patients were recruited consecutively during January 2025. The study database did not systematically record the number of eligible patients who declined participation or the number of patients screened before exclusion. These numbers could therefore not be reliably reconstructed retrospectively. A total of 256 patients who met the predefined inclusion criteria and provided informed consent were included in the final analysis.

2.3. Data Collection

Data were collected using a standardized data collection form.

The variables collected included demographic and socioeconomic characteristics, mode of admission, clinical symptoms and signs, cardiovascular risk factors, medical history, laboratory tests, electrocardiographic findings, imaging examinations and in-hospital outcome.

2.4. Operational Definitions

The following operational definitions were used.

Hypertension

Hypertension was defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg on admission, or a documented history of treated hypertension, according to the 2018 ESC/ESH recommendations.

Hypertensive heart disease

Hypertensive heart disease was defined as documented hypertension associated with cardiac structural or functional abnormalities compatible with hypertensive cardiac involvement, including left ventricular hypertrophy, left atrial enlargement, increased left ventricular filling pressures, or heart failure in the absence of another predominant cardiac etiology.

Elevated blood pressure at admission alone was not considered sufficient to diagnose hypertensive heart disease.

Acute coronary syndrome

ST-elevation acute coronary syndrome (STE-ACS) was diagnosed on the basis of compatible ischemic symptoms and diagnostic ST-segment elevation on electrocardiography.

Non-ST-elevation acute coronary syndrome (NSTEMI-ACS) was diagnosed on the basis of clinical evidence of myocardial ischemia combined with available biomarker and/or electrocardiographic findings, according to the information documented in the medical records.

Because troponin testing was not systematically available, the diagnosis of NSTEMI-ACS should be interpreted with caution.

Heart failure

Heart failure was defined clinically on the basis of compatible symptoms and/or signs, including dyspnea and congestion, supported when available by echocardiographic evidence of cardiac structural or functional abnormalities, in accordance with contemporary European recommendations.

Left ventricular systolic dysfunction was defined as a left ventricular ejection fraction (LVEF) $\leq 50\%$.

Left ventricular systolic dysfunction of undetermined etiology

Left ventricular systolic dysfunction of undetermined etiology was defined as LVEF $\leq 50\%$ in patients without documented evidence of acute coronary syndrome or another identified predominant etiology.

Because troponin testing was not systematically performed, absence of troponin elevation was considered only when troponin had actually been measured. Patients without troponin testing were not considered troponin-negative.

This descriptive classification does not imply an ischemic etiology in the absence of systematic coronary angiography or other definitive etiological investigations [7].

2.5. Statistical Analysis

Descriptive analyses were performed using SPSS Statistics (IBM Corp.). Quantitative variables were expressed as mean $\pm$ standard deviation, and qualitative variables as counts and percentages.

For variables allowing multiple responses, percentages were calculated using the total number of patients as the denominator, and the possibility of multiple responses was explicitly indicated.

Missing data were reported for each variable when applicable.

3. Results

3.1. Characteristics of the Study Population

A total of 256 patients were included from the ten participating centers.

The three largest recruiting sites were HOGIP, Dalal Jamm and Touba Hospital, contributing 37, 36 and 36 patients, respectively.

The distribution of participants by hospital and their demographic characteristics is presented in **Table 1**.

Table 1. Distribution by hospital and demographic characteristics (N = 256).

Parameter	n	%/Unit
Participating hospitals		
HOGIP (Dakar)	37	14.5
Dalal Jamm (Dakar)	36	14.1
Touba Hospital	36	14.1
HPD (Dakar)	30	11.7
Kaolack Hospital	30	11.7
Fatick Hospital	24	9.4
Ziguinchor Hospital	20	7.8
Saint-Louis Hospital	19	7.4
Mbour Hospital	14	5.5
Fann Hospital (Dakar)	10	3.9
Total	256	100.0
Sex		
Female	132	51.6
Male	124	48.4
Sex ratio M/F	0.93	-
Age		
Mean age $\pm$ SD (years)	58.86 $\pm$ 17.69	-
Range (years)	17 - 99	-
Patients $\geq$ 60 years	137	53.5
Patients $\geq$ 70 years	82	32.0

3.2. Socioeconomic Profile and Mode of Admission

Almost all patients (91.4%) paid for their healthcare out of pocket. More than half (57.0%) had received no formal education, while 58.2% came from regions outside Dakar.

The categories describing previous hospitalization and outpatient follow-up were not mutually exclusive. Thus, a patient could have a history of previous hospitalization and/or outpatient follow-up while being included for the current hospitalization. Percentages were therefore calculated using the total study population (N = 256), and the corresponding counts may exceed the total number of patients when summed (**Table 2**).

Table 2. Socioeconomic characteristics and mode of admission (N = 256).

Parameter	n	%
Socioeconomic characteristics		
Direct out-of-pocket payment	234	91.4

Continued

Health insurance coverage	22	8.6
No schooling	146	57.0
Schooled (French or Arabic)	110	43.0
Origin: regions outside Dakar	149	58.2
Origin: Dakar	93	36.3
Origin: other country	14	5.5
Hospitalization history/follow-up		
New hospitalization	198	77.3
Previously hospitalized	38	14.8
Outpatient follow-up	25	9.8
Current mode of admission		
Transfer from emergency department/SAMU	104	40.6
Direct emergency admission	77	30.1
Transfer from another department	45	17.6
Scheduled hospitalization	14	5.5
Total urgent admissions	181	70.7

Hospitalization history/follow-up categories were not mutually exclusive; therefore, their percentages do not necessarily sum to 100%.

Regarding the current mode of admission, 70.7% of patients were admitted urgently, including 40.6% transferred from an emergency department or SAMU. Only 5.5% of hospitalizations were scheduled.

3.3. Clinical Presentation on Admission

Dyspnea was the most frequently reported symptom, occurring in 165 of the 256 patients (64.5%), followed by chest pain (43.0%) and lower limb edema (25.8%).

Clinical signs of heart failure were present in 50.0% of patients on admission. Blood pressure ≥ 140 mmHg was recorded in 40.6%, and tachycardia in 36.0%. Signs of shock were present in 5.1% of patients (**Table 3**).

Table 3. Symptoms and clinical parameters on admission (N = 256).

Parameter	n	%
Symptoms*		
Dyspnea	165	64.5
Chest pain	110	43.0
Lower limb edema	66	25.8
Cough	61	23.8

Continued

Palpitations	37	14.5
Hemiplegia/Aphasia	11	4.3
Other	39	15.2
Systolic blood pressure on admission (N = 256)		
<90 mmHg—hypotension/shock	6	2.3
90 - 140 mmHg—normal	146	57.0
>140 mmHg—hypertension	104	40.6
Heart rate (N = 250)		
Mean heart rate	91.64 bpm	-
<50 bpm—bradycardia	14	5.6
50 - 100 bpm—normal	146	58.4
>100 bpm—tachycardia	90	36.0
Physical examination		
Clinical signs of heart failure	128	50.0
Heart murmur	56	21.9
Irregular heart sounds	50	19.5
Signs of shock	13	5.1

Multiple responses were allowed; therefore, percentages do not sum to 100%.

3.4. Cardiovascular Risk Factors

Hypertension was the most frequent cardiovascular risk factor (39.7%), followed by physical inactivity (36.2%) and diabetes (13.2%).

Overall, 75.9% of patients had at least one major modifiable cardiovascular risk factor.

3.5. Paraclinical Results

3.5.1. Laboratory Tests

Creatinine (94.5%) and hemoglobin (93.8%) were the most frequently performed laboratory tests.

Cardiac biomarkers remained markedly underused: troponin was measured in only 28.5% of patients and BNP/NT-proBNP in only 6.3%.

Among the available results, elevated CRP was found in 36.9% of patients tested, renal dysfunction in 18.5%, and elevated LDL cholesterol in 27.7% of patients tested (**Table 4**).

3.5.2. ECG and Imaging

An ECG was performed in all patients and showed abnormalities in 92.2% of cases.

Table 4. Performance rate and abnormalities of laboratory tests (N = 256).

Test	Performed (n)	Rate (%)	Pathological threshold	Abnormalities (% tested)
Hematology and renal function				
Hemoglobin	240	93.8	<12 g/dL (F)/<13 g/dL (M)	9.2
Creatinine	242	94.5	>110 µmol/L	18.5
Inflammatory markers				
CRP	193	75.4	>5 mg/L	36.9
INR (patients on VKA: 13.7%)	194	75.8	Outside [2 - 3]	4 patients
Metabolic panel				
Fasting blood glucose	135	52.7	>5.6 mmol/L	26.2
HbA1c	78	30.5	>6.0%	13.8
LDL cholesterol	134	52.3	>3.4 mmol/L	27.7
Triglycerides	127	49.6	>1.7 mmol/L	16.9
Cardiac biomarkers				
Troponin	73	28.5	>0.04 ng/mL	12.3
BNP/NT-proBNP	16	6.3	>100 pg/mL	5 patients
D-dimers	21	8.2	>500 µg/L	3 patients

Echocardiography was performed in 224 patients (87.5%). Cardiac chamber dilatation was observed in 44.1% of the patients who underwent echocardiography.

Among the 224 patients who underwent echocardiography, 53 (23.7%) had left ventricular systolic dysfunction (LVEF ≤ 50%), corresponding to 20.7% of the overall study population (**Table 5**).

Table 5. Main ECG and echocardiographic findings.

Finding	n	%
ECG (N = 256 performed; abnormalities: 92.2%)		
STE-ACS—ST elevation	45	17.6
Atrial fibrillation	26	10.2
NSTE-ACS	15	5.9
2nd + 3rd-degree AV block	13	5.1
Atrial flutter	6	2.3
Echocardiography (N = 224 performed; rate: 87.5%)		
Cardiac chamber dilatation	99	44.2
Elevated LV filling pressures	87	38.8

Continued

Dilated left ventricle	67	29.9
Valvular heart disease	63	28.1
LV systolic dysfunction (LVEF $\leq$ 50%)	53/224	23.7
Pericardial effusion	18	8.0

Coronary angiography was performed in 14.5% of patients ($n = 37$). Significant coronary stenosis was identified in 86.5% of the patients investigated, and 32.4% had three-vessel disease.

Chest radiography was performed in 44.1% of patients and showed cardiomegaly in 21.1% of the overall study population.

3.6. Nosological Profile

Hypertension documented on admission was present in 40.6% of patients. Valvular heart disease was identified in 28.1%, while acute coronary syndromes accounted for 23.5% of the study population.

Among patients who underwent echocardiography, 53 (23.7%) had left ventricular systolic dysfunction (LVEF $\leq$ 50%). In the absence of systematic coronary angiography and complete biomarker assessment, these cases were classified as left ventricular systolic dysfunction of undetermined etiology when no predominant alternative etiology was documented (**Table 6**).

Table 6. Nosological classification of cardiovascular diseases (N = 256).

Nosological group/finding	n	Prevalence (%)
I. Ischemic heart disease		
ACS (total)	60	23.5
-STE-ACS	45	17.6
-NSTEMI-ACS	15	5.9
LV systolic dysfunction of undetermined etiology (LVEF $\leq$ 50%)	53/224	23.7
II. Hypertension and hypertensive cardiac involvement		
Hypertension documented on admission	104	40.6
Heart failure with elevated LV filling pressures	99	38.7
III. Valvular heart disease		
Total valvular heart disease	71	28.1
-Functional	28	10.9
-Degenerative	26	10.2
-Rheumatic	17	6.6

Continued

IV. Rhythm and conduction disorders		
Atrial fibrillation	26	10.2
2nd + 3rd-degree AV block	13	5.1
Atrial flutter	6	2.3
V. Other cardiovascular diseases		
Pulmonary embolism	21	8.2
Pericardial effusion	18	7.0
Ischemic stroke	16	6.3
Hemorrhagic stroke	1	0.4

Categories were not necessarily mutually exclusive because patients could have coexisting cardiovascular conditions.

Among the 224 patients who underwent echocardiography; corresponding to 20.7% of the overall study population. Categories were not necessarily mutually exclusive because patients could have coexisting cardiovascular conditions.

3.7. In-Hospital Outcome and Mortality

Overall, 42.2% of patients required admission to a cardiology intensive care unit, while 56.3% were managed in general cardiology.

The outcome was favorable in 87.9% of patients. In-hospital mortality was 7.8% (n = 20).

Table 7. In-hospital outcome, mortality and complications (N = 256).

Parameter	n	%
In-hospital outcome		
Favorable outcome	225	87.9
Non-fatal complications	12	4.7
In-hospital deaths	20	7.8
Mode of discharge		
Discharged home	224	87.5
Transfer to another facility	12	4.7
In-hospital death	20	7.8
Documented in-hospital complications		
Ischemic stroke	8	3.1
Acute pulmonary edema	7	2.7
De novo atrial fibrillation	3	1.2
Hemorrhagic stroke	1	0.4

Continued

Severity indicators on admission		
Admitted to intensive care unit	108	42.2
STE-ACS	45	17.6
Severe bradycardia (<50 bpm)	14	5.6
Signs of shock	13	5.1

The main documented in-hospital complications were ischemic stroke (3.1%), acute pulmonary edema (2.7%) and de novo atrial fibrillation (1.2%) (**Table 7**).

4. Discussion

4.1. Demographic and Socioeconomic Profile

The mean age of the study population was 58.86 years, comparable with several African hospital-based cardiovascular series reporting mean ages in the sixth decade of life [8] [9].

The slight female predominance observed in our study (51.6%) may partly reflect the substantial burden of hypertension and hypertensive heart disease among African women [10]. However, this finding should not be interpreted as evidence of a causal relationship in the present study.

The socioeconomic profile was characterized by a high proportion of patients paying for care out of pocket (91.4%) and a substantial proportion without formal education (57.0%). Such socioeconomic factors may contribute to delayed healthcare utilization and difficulties in accessing specialized cardiovascular services [11].

Hospital-based studies from Senegal have similarly highlighted the importance of hypertension and other cardiovascular risk factors among patients presenting with cardiovascular disease.

4.2. Left Ventricular Systolic Dysfunction of Undetermined Etiology

The absence of systematic coronary angiography, which was performed in only 14.5% of patients, together with the limited use of cardiac biomarkers, prevents reliable attribution of this ventricular dysfunction to a specific etiology.

In particular, troponin was measured in only 28.5% of patients and BNP/NT-proBNP in only 6.3%. Therefore, silent ischemic heart disease, hypertensive cardiac remodeling and dilated cardiomyopathy could not always be differentiated.

This limitation is particularly relevant in sub-Saharan African settings, where the etiological spectrum of heart failure is heterogeneous. Hospital-based Senegalese studies have previously documented substantial contributions from hypertension and structural cardiac disease to heart failure presentations [12]. Similar heterogeneity has been reported in other sub-Saharan African hospital-based cohorts [13].

The observed prevalence should therefore be regarded as a descriptive finding rather than as evidence of a specific ischemic or hypertensive etiology.

4.3. Cardiovascular and Nosological Profile

Hypertension documented on admission was present in 40.6% of the study population and was also the most frequent cardiovascular risk factor. This is consistent with the substantial burden of hypertension reported in sub-Saharan Africa [14].

The interpretation of hypertensive cardiac involvement requires caution because hypertension alone is not synonymous with hypertensive heart disease. In the present revised analysis, hypertension documented at admission was therefore reported separately from structural or functional cardiac abnormalities compatible with hypertensive cardiac involvement.

Valvular heart disease accounted for 28.1% of the cardiovascular diagnoses. Rheumatic forms represented 6.6% of the study population, illustrating the continuing contribution of valvular disease in sub-Saharan African cardiology practice [15].

Acute coronary syndromes accounted for 23.5% of admissions, with a predominance of STE-ACS (17.6%). Previous Senegalese hospital studies have documented the increasing importance of ACS and significant delays in access to specialized care. In a prospective Dakar cohort, Mboup *et al.* reported prolonged delays between symptom onset and hospital presentation among patients with ACS [16]. More recent Senegalese data have also documented the clinical burden and management challenges of ACS in women admitted to a referral cardiology center [17].

The predominance of STE-ACS in our study should nevertheless be interpreted cautiously because troponin testing was not systematically available. The limited availability of biomarkers may have influenced the identification and classification of NSTEMI-ACS.

At the regional level, a systematic review of ACS studies in sub-Saharan Africa reported long delays to hospital admission, limited use of medicalized transport and substantial disparities in access to reperfusion therapy, with STEMI remaining a major presentation [18].

4.4. Mode of Admission

The urgent nature of 70.7% of admissions illustrates the severity of presentations reaching cardiology units.

This finding is consistent with the important burden of cardiovascular emergencies reported in other West African hospital settings. In Mali, prospective hospital-based studies have documented a substantial volume of cardiovascular emergencies and significant diagnostic and therapeutic constraints [19].

The high proportion of emergency admissions in our study may reflect several interacting factors, including delayed presentation, limited access to outpatient

cardiology services in some regions, socioeconomic barriers and limited cardiovascular awareness.

The fact that 58.2% of our patients originated from regions outside Dakar also illustrates the role of interregional referral in Senegalese cardiology practice.

The underuse of cardiac biomarkers, with troponin available in only 28.5% and BNP/NT-proBNP in 6.3% of patients, further illustrates the technical and economic constraints affecting cardiovascular diagnostic pathways.

4.5. In-Hospital Mortality

The overall in-hospital case fatality rate was 7.8%. This figure falls within the broad range reported in African hospital-based cardiovascular cohorts [18] [20].

The observed mortality should be interpreted in light of the severity of the admitted population. More than 40% of patients required intensive care, 5.1% presented with signs of shock, and 17.6% had STE-ACS.

The documented complications, particularly ischemic stroke and acute pulmonary edema, further illustrate the severity of cardiovascular disease at admission.

However, causal attribution of death to specific cardiovascular diagnoses was not possible because the precise cause of death was not systematically coded.

5. Limitations

Several limitations should be acknowledged.

First, the study was hospital-based and included patients admitted to cardiology units; therefore, the findings cannot be extrapolated directly to the general Senegalese population.

Second, the ten participating centers were purposively selected to provide broad geographic coverage rather than through population-proportional or probability-based sampling. Consequently, the study should not be interpreted as nationally representative in a population epidemiological sense.

Third, the study database did not systematically record the number of eligible patients who declined participation or the number screened before exclusion. These numbers could therefore not be reliably reconstructed retrospectively.

Fourth, the absence of a complete etiological work-up represents an important classification limitation. Coronary angiography was performed in only 14.5% of patients, troponin was measured in 28.5%, and BNP/NT-proBNP in 6.3%.

Fifth, the absence of systematic cardiac MRI and the limited availability of coronary angiography, particularly in regional centers, restricted diagnostic precision.

Sixth, the classification of NSTEMI-ACS was necessarily based on the clinical, electrocardiographic and biomarker information available in the medical records. Because troponin was not systematically measured, some NSTEMI-ACS diagnoses may have remained uncertain.

Seventh, the study was descriptive and no multivariable analysis was performed. The number of deaths ($n = 20$) was insufficient to support a robust multivariable

model of mortality.

Finally, the precise causes of in-hospital death were not systematically coded, limiting the interpretation of case fatality by individual nosological group.

6. Conclusions

This multicenter hospital-based study provides a broad description of cardiovascular disease among patients admitted to ten cardiology units distributed across several regions of Senegal.

Hypertension documented on admission, valvular heart disease and acute coronary syndromes represented major components of the observed cardiovascular burden. Among patients who underwent echocardiography, 23.7% had left ventricular systolic dysfunction, corresponding to 20.7% of the overall study population.

The high proportion of emergency admissions and the limited availability of cardiac biomarkers highlight persistent challenges in early diagnosis and access to specialized cardiovascular care.

The interpretation of left ventricular systolic dysfunction and NSTEMI-ACS remains limited by the absence of systematic troponin testing and coronary angiography. Future prospective multicenter studies using standardized diagnostic criteria and systematic etiological investigations are needed to improve cardiovascular epidemiological surveillance in Senegal.

The main priorities identified by this study include strengthening primary prevention of hypertension and other cardiovascular risk factors, expanding access to regional cardiology services, improving availability of cardiac biomarkers and developing prospective multicenter cardiovascular registries.

Author Contributions

Conceptualization, M.D.F.P. and M.D.; Methodology, M.D.F.P., P.G.N. and M.D.; Investigation and data collection, all authors in their respective cardiology units (P.G.N., K.S., A.N., J.N., HOGIP; M.B.T., Fatick; S.M.B., Saint-Louis; S.M., Ziguinchor; M.T., Kaolack; M.M.F., Touba; M.L., Mbour; M.C.M., HPD; A.A.N., Dalal Jamm; M.D., Fann); Data curation and formal analysis, M.D.F.P.; Writing—original draft, M.D.F.P.; Writing—review and editing, all authors; Supervision, M.D. All authors have read and approved the final version of the manuscript.

Conflicts of Interest

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

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