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Epidemiology of Cardiovascular Mortality in Patients under 60 Years Old in a Cardiology Department in West Africa, Dakar-Senegal

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Abstract

Background: Our study aimed to examine cardiovascular mortality within the working-age population, exploring epidemiological, clinical, and paraclinical features, complications, and identifying etiological factors linked to mortality. **Methods:** We conducted a descriptive and analytical retrospective study from September 2019 to August 2022 at the General Hospital Idrissa POUYE in Dakar, we reviewed all the medical records of patients from 15 to 60 years old who died while admitted in the cardiology department. Data collected were socioeconomic status, clinical history, type of cardiovascular disaese, length of hospitalization, circumstances and timing of death. The data were analyzed with R. Studio version 2022.12.0 + 353 and Excel 2019, with a P-value < 0.05 considered as statistically significant. **Results:** The study included 73 patients, indicating a specific mortality rate of 8.8% and a proportional mortality of 39%. Predominantly male (sex ratio 1.2), the average age was 44. Key cardiovascular risk factors identified were sedentarism (76.7%), hypertension (28.8%), and smoking (21.9%). The leading cause for consultation was dyspnea (72.6%). Notable findings included a majority of patients presenting with general condition deterioration (90%) and cardiovascular collapse upon admission (23.3%). Physical exam revealed signs of heart failure in 63%. Echocardiography showed left ventricular ejection fraction impairment (81%) and pulmonary hypertension (78%). Immediate causes of death were primarily cardiogenic shock (45.2%) and septic shock (37%). The analytical study indicates that the data most closely associated with mortality

were age, socio-economic level, ischemic heart disease (p = 0.034), rheumatic valvulopathies, pulmonary embolism (p = 0.034), hypertension (HTA) (p = 0.009), smoking (p = 0.011), diabetes (p = 0.011), dyslipidemias, prolonged bedrest (p = 0.001), morbid obesity (p = 0.001), and COVID-19 infection (p = 0.017). **Conclusion:** The prevalence of ischemic heart diseases, pulmonary embolisms, and valvulopathies in premature mortality statistics underscores the need for enhanced cardiovascular prevention efforts.

Keywords

Mortality, Under 60 Years, Cardiovascular, Dakar

1. Introduction

The phenomenon of epidemiological transition schematically consists of a decline in infectious diseases and malnutrition in favor of non-communicable diseases, primarily cardiovascular diseases and cancers. In developed countries, the control of most infectious diseases has gradually allowed this shift towards chronic and degenerative diseases, while simultaneously, life expectancy lengthened over the past century. This same phenomenon is now widely underway in developing countries, currently at different stages of progress depending on the respective levels of development of these countries [1].

Epidemiological studies show that cardiovascular diseases are at the heart of these changes. It is estimated that at the beginning of the 20th century, they were responsible for less than 10% of global mortality. Currently, the number of deaths attributable to cardiovascular diseases is estimated at 17.7 million, accounting for 31% of total global mortality. Among these deaths, it is estimated that 7.4 million are due to coronary heart disease and 6.7 million to stroke [2]. Of the 17 million deaths occurring before the age of 70 due to non-communicable diseases, 82% occur in low- or middle-income countries, and 37% are attributable to cardiovascular diseases [2]. Projections indicate that the annual number of deaths attributable to cardiovascular diseases, for example, is expected to rise from 17 million in 2008 to 25 million in 2030 [3]. The explanations are multiple, mainly related to population aging and lifestyle changes accompanying socio-economic development and intensive urbanization; behavioral risk factors such as smoking, physical inactivity, poor diet, and excessive alcohol consumption.

These diseases generate significant direct costs (years of life lost, disabilities, use of healthcare) and indirect costs (loss of productivity due to mortality and morbidity) that are likely to increase; all age groups are affected, and more than 90% of premature deaths due to non-communicable diseases occur in low- or middle-income countries [4]-[7]. Today, one of the main sustainable development goals is to reduce by one-third, by 2030, the rate of premature mortality due to non-communicable diseases [8].

In Africa, too much emphasis is still placed on infectious diseases. Yet, these silent killers, cardiovascular diseases (CVDs) and chronic non-communicable diseases (CNCDs) in general, deserve more sustained attention. In Senegal, WHO estimated that non-communicable diseases accounted for 42% of all deaths in 2018; and cardiovascular diseases (17%) represented the largest proportion [9]-[11]. Premature mortality due to CVDs is a real public health issue; in Sub-Saharan Africa (SSA) and Senegal in particular, we have little epidemiological data in this regard. This is what motivates our study, which focuses on the epidemiology of cardiovascular mortality among individuals of working age, considering that the legal retirement age in Senegal is 60 years.

The objectives of the study were to determine cardiovascular mortality in the population aged up to 60 years, analyze the epidemiological, clinical, and para-clinical aspects, and determine the etiological aspects and associated prognostic factors.

2. Materials and Methods

2.1. Study Design

We conducted a descriptive and analytical cross-sectional study with retrospective data collection. The study was conducted over a period of 3 years from September 1, 2019, to August 31, 2022 at Idrissa Pouye General Hospital, a tertiary medical center in Dakar. Patients between 18 and 60 years old who were hospitalized and deceased in the cardiology departments of Idrissa Pouye General Hospital during the study period were included in the study. We excluded all patients with incomplete medical records. Data collection.

We used a survey form validated by a committee of experts consisting of three cardiologists and an epidemiologist to collect data.

Parameters colleted were:

- Socioeconomic status: education level, place of living, working status and place of living
- Clinical history
- Cardiovascular risk factors: high blood pressure, diabetes mellitus, over-weight or obesity, tobacco use, hypercholesterolemia
- Medication
- Biological parameters: aneamia, LDLc, HbA1C, fasting blood glucose, C-reactive protein
- Echocardiographic parameters: left ventricular ejection fraction, left ventricular pressure fillings and right ventricular systolic function
- Reason for hospitalization in the cardiology department: ischeamic heart disease, pulmonary embolism, rheumatic heart disease, peripheral artery disease, heart failure, stroke, other cardiomyopathies
- Length of hospitalization in days
- Circumstances of death
- Timing of death

2.2. Statistical Analysis

The data were entered into the EPI Info 7.2.5.0 software. Data analysis was performed using R. Studio software version 2022.12.0 + 353 and Excel 2019. Qualitative variables were expressed as proportions (percentages), and quantitative variables as mean ± standard deviation. The median interquartile range was used for parameters showing no normal distribution. Categorical variables were compared using the Chi-square test or Fisher's exact test; as appropriate, continuous variables were analyzed using the Student's t-test or Mann-Whitney U test, depending on the data distribution. The difference was statistically significant if the p-value was less than 0.05.

2.3. Ethical Considerations

This study was approved by the ethics committee of Cheikh Anta Diop University of Dakar. This study was carried out in collaboration with the hospital management after obtaining approval from the cardiology department to access the records of deceased patients.

Data confidentiality were ensured throughout the study.

3. Results

During the study, 188 deaths were recorded among 1752 hospitalized patients of all ages. Among these patients, 73 deaths concerned adults aged 60 years or less, representing a specific mortality rate of 8.8% for this population, or 39% of the observed proportional mortality.

The highest number of deaths was observed in 2021, in the specific context of the SARS-CoV-19 pandemic (Figure 1). On the socio-epidemiological level, the average age was 44 years. The most affected age groups were those of 51 to 60 years and 31 to 40 years (Figure 2). Men were slightly more represented with a male-to-female ratio of 1.2. In this study population, 43.8% were unemployed and 56% had a low socio-economic status. The majority resided in the suburbs of Dakar.
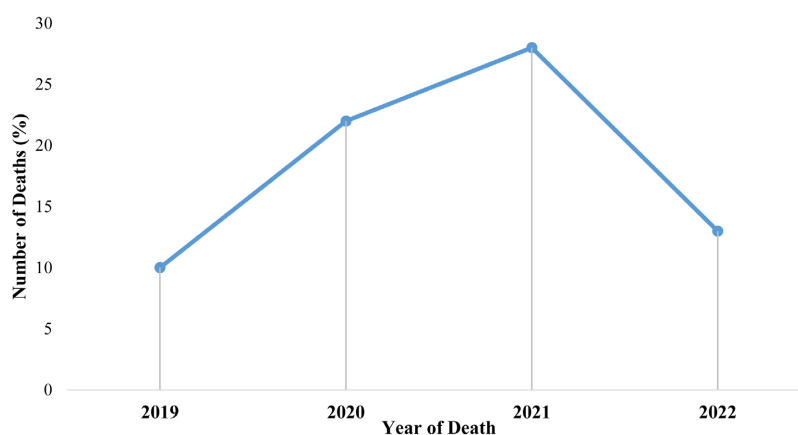

Figure 1. Distribution of patients by year of admission to the cardiology department (n = 73).
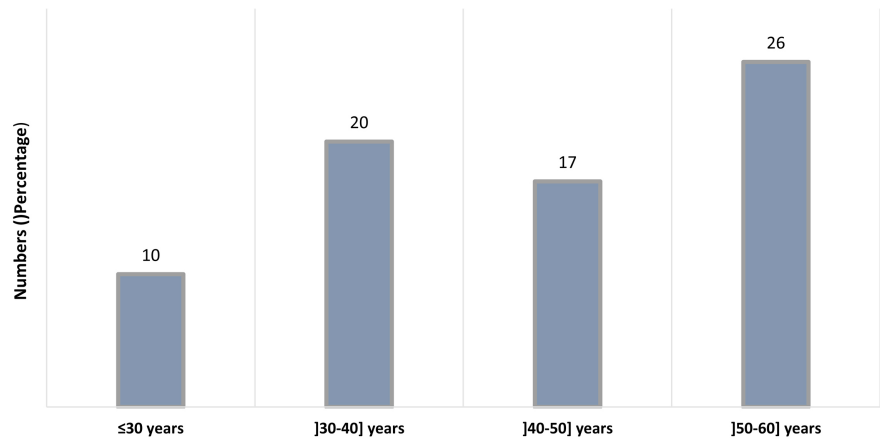
Figure 2. Distribution of patients by age group (n = 73).

Clinically, the history of cardiovascular diseases was frequent (20.5%), with a predominance of rheumatic valvulopathies, cardiomyopathies, and unexplained cardiopathies. Cardiovascular risk factors included physical inactivity (76.7%), hypertension (28.8%), smoking (21.9%), and diabetes (15.1%) (**Figure 3**). Stratified cardiovascular risk showed very high (20.5%), high (12.4%) to low (45.2%) risks according to ESH classifications. Venous thromboembolic events were also common, often related to gyneco-obstetric conditions (24%) or prolonged bed rest (24%).
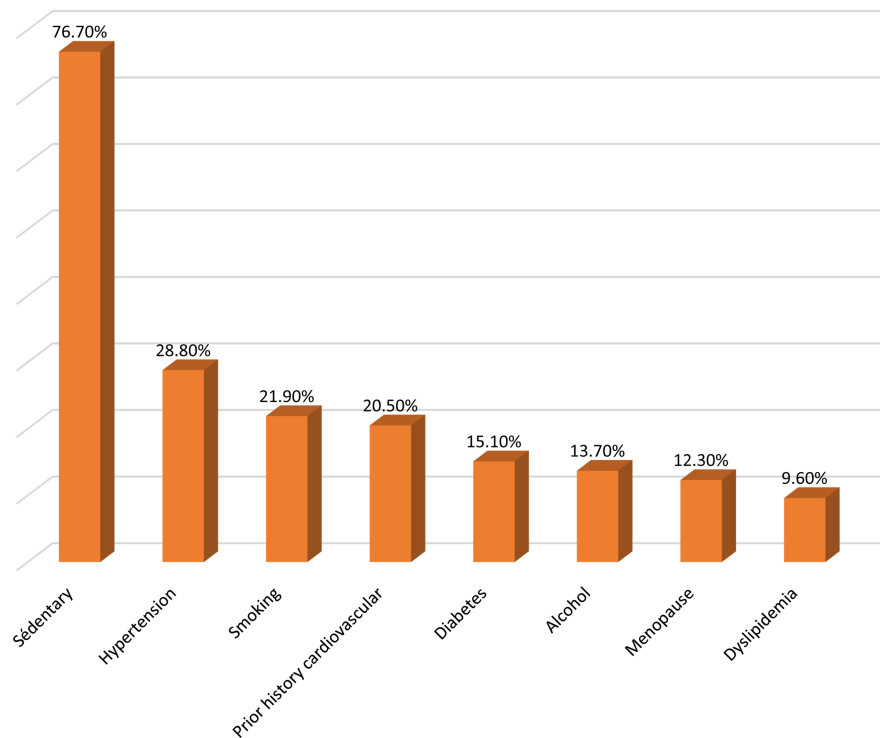

Figure 3. Distribution of patients by cardiovascular risk factors (n = 73).

The main symptoms at admission included dyspnea (72.6%), lower limb ede-

ma (38.4%), chest pain (28.8%), and cough (24.7%) (Table 1). Physical signs often revealed heart failure (63%), heart murmurs (23%), and arrhythmias (18%).

Table 1. Distribution of functional signs (n = 73).

Functional signs	Number of cases	Percentage
Dyspnea	53	72.6
Increase in lower limbs volumes	28	38.4
Chest pain	21	28.8
Cough	18	24.7
Allegation fever	13	17.8
Big painful legs	6	8.2
Hemoptysis	8	11
Vomiting	7	9.6
Lameness	2	2.7
Palpitation	2	2.7
Syncope	1	1.4

Paraclinical examinations showed dyslipidemia in 39.3% of patients with 36% having elevated LDL-c, rhythm disorders in 46.6% with a predominance of atrial fibrillation (21.9%), and chest X-ray abnormalities with 49.3% showing cardiomegaly and 33% showing signs related to pleuropneumonia. Cardiac ultrasound revealed significant alterations in the left ventricular ejection fraction in 81% of cases, pulmonary hypertension (60.4%), and dilation of the inferior vena cava (69.1%). It also allowed the diagnosis of ischemic heart disease in 48% of cases, followed by rheumatic valvular disease in 28% of cases (Figure 4). Coronary angiography and CT angiography confirmed diagnoses in some patients, despite their high cost.
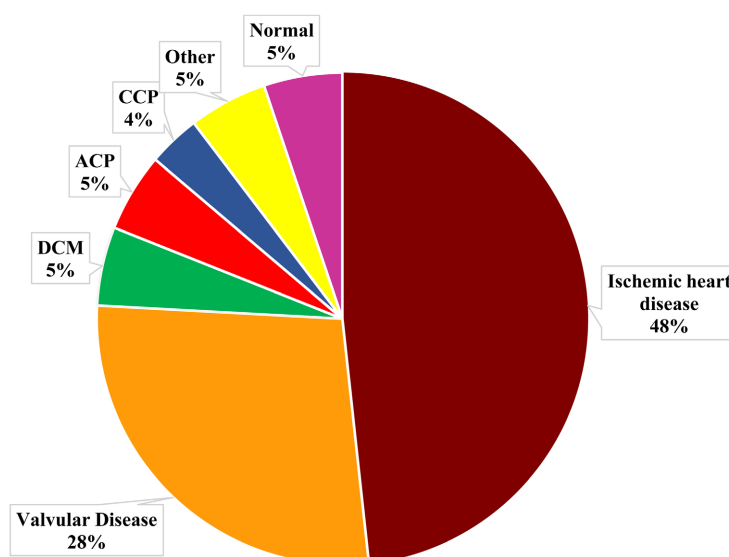

Figure 4. Distribution of pathologies on echocardiography (n = 56).

The most frequent diagnoses were ischemic heart diseases (40%), including 44.8% of acute coronary syndromes (ACS) and 55.2% of chronic ischemic heart diseases, rheumatic valvulopathies (18%), pulmonary embolism (15%), and strokes (4.1%).

Treatments mainly involved diuretics (63%), anticoagulants with LMWH (52%) and VKAs (42%), inotropic agents (47.9%). Other medications used included beta-blockers (36%), ACE inhibitors or ARBs (31%). Thrombolysis was performed in 38.5% of ACS cases and 35.4% of pulmonary embolism cases. Angioplasty was performed in 30.8% of ACS patients.

Immediate causes of death included cardiogenic shock (45.2%), acute respiratory failure (38.5%), septic shock (37%), heart failure (31.5%), and rhythm disorders (19.2%) (Table 2). However, 67% of patients died during on-call hours.

Our analysis revealed a significant link between mortality from ischemic heart disease and cardiovascular risk factors (Table 3), as well as between mortality from pulmonary embolism and risk factors for venous thromboembolic disease (Table 4).

Table 2. Distribution of patients by complications.

Type of complications	Effective	Frequency
Cardiogenic shock	37	50.7%
Acute respiratory failure	28	38.5%
Septic shock	27	37.0%
Heart failure	23	31.5%
Rhythm disorder (FA, TV, TSV, Flutter)	14	19.2%
Coma	11	15.1%
Blood sugar imbalance	7	9.6%
Hemorrhage under anticoagulant	6	8.2%
Thrombocytopenia	5	6.8%
Anemia	4	5.5%
Hypovolemic shock	3	4.1%
Multi organ failure	1	1.4%
Stroke during hospitalization	1	1.4%

The factors significantly associated with death were age over 50 years, low socio-economic status, ischemic heart disease (p = 0.034), rheumatic valvulopathies, pulmonary embolism (p = 0.034), hypertension (p = 0.009), smoking (p = 0.011), diabetes (p = 0.011), dyslipidemia, bed rest (p = 0.001), morbid obesity (p = 0.001), and COVID-19 infection (p = 0.017).

4. Discussion

Cardiovascular mortality rate in this tertiary setting among patients aged ≤ 60

Table 3. Distribution of ischemic heart diseases by cardiovascular risk factors.

	Ischemic Herat Disease		
	Numbers (n)	Percentage (%)	p-value
Sex			0.599
Male	16	40.0	
Female	13	39.4	
Event history cardiovascular			0.002
Yes	11	73.3	
No	18	31.0	
Sedentary lifestyle			0.387
Yes	24	42.9	
No	5	29.4	
Diabetes			0.011
Yes	8	72.7	
No	21	33.8	
Hypertension			0.009
Yes	13	61.9	
No	16	30.7	
Diabetes + Hypertension			0.038
Yes	6	85.7	
No	23	34.8	
Dyslipidemia			0.001
Yes	7	100	
No	22	33.3	
Tobacco			0.011
Yes	11	68.7	
No	18	31	
Alcohol			0.027
Yes	7	70	
No	22	34.9	

years old was 39%, with a male predominance and a mean age of 43.5 years old. Ischemic heart disease was the leading cause of deaths followed by rheumatic heart disaese. Hypertension was the most frequent preventable cardiovascular risk factor. We also noted a prevalence of cardiogenic shock of 50%. Deaths were more frequent during on-call hours, probably due to medical team fatigue and increased workload Before interpreting these findings, it is important to aknowledge the limitations of our study. The retrospective data collection and lack of electronic records make it challenging to retrieve some data from patients

Table 4. Distribution of deaths from pulmonary embolism by risk factors for venous thromboembolism.

	Pulmonary Embolism		
	Numbers (n)	Percentage (%)	p-value
Tobacco			0.252
Yes	1	6.7	
No	11	19	
Cancer			0.001
Yes	2	100	
No	10	14.1	
Taking estrogen-progestins			0.42
Yes	1	33.3	
No	11	15.7	
Recent surgery			0.001
Yes	2	100	
No	10	14.1	
Trauma-Burns			0.017
Yes	2	66.7	
No	10	14.3	
Sarscov			0.017
Yes	2	66.7	
No	10	14.3	
Menopause			0.433
Yes	1	11.1	
No	11	17.2	
Underlsaying heart disease			0.0043
Yes	2	16.6	
No	10	16.4	
Venous stasis (bed rest)			<0.001
Yes	6	75	
No	6	9.2	
Morbid obesity			0.001
Yes	2	100	
No	10	14.1	

records such as ECGs. Incomplete or unreadable records led to substansial loss of data. The lack of resources also prevented the completion of certain necessary investigations such as echocardiography, leading to an information bias regarding the cause of death.

Notwithstanding these limitations, our study offers valuable insights regarding cardiovascular mortality and its determinants in our Sub-Saharan setting. Our findings emphasize that there is a crucial requirement to allocate resources towards developing a strong surveillance system with centralized electronic records. This will enable efficient monitoring of cardiovascular morbidity and mortality, ultimately leading to better management and prevention of related health issues.

Our findings appears to be similar to the literature [12]-[15]. The Pan American Health Organization reported a CVD mortality rate of 32.4% in 2012. In France, Santos et al. reported in 2015 that 8.9% of CVD deaths occurred prematurely [12] [16]. In Madagascar, a study by Rafamatanantsoa showed that more than half of CVD deaths occurred before the age of 60 [17]. According to Murray and Lopez, CVD mortality in sub-Saharan Africa among adults under 60 years old was 26.3% in 1990 [18]. These data suggest an increase in premature CVD mortality, especially in developing countries. Low and middle-income countries are experiencing a shift towards noncommunicable diseases while continuing to struggle with infectious diseases. The fact that rheumatic heart disease was the second most frequent cause of cardiovascular death corroborates it perfectly. In sub-Saharan Africa, the share of disability-adjusted life years linked to cardiovascular diseases (CVDs) has risen from 19% to 30% of the total burden [19]. Moreover, the number of CVD deaths in Sub-Saharan Africa (including Senegal) has increased by over 50% in the last thirty years. CVD-related deaths in SSA tend to happen at younger ages, leading to a high number of disability-adjusted life years (DALYs) [20]. Socioeconomic determinants of health have a great impact on health inequity. Rapid urbanization, growing population and lifestyle modifications with fatty diet and lack of physical activity lead to the rise of atherosclerotic risk factors such as hypertension and diabetes [21]-[23]. This highlights the need to inform proper preventive strategies to tackle this growing burden.

Our study points out several future directions. We need to conduct a nationwide cohort study to monitor the incidence of cardiovascular diseases, its risk factors and lethality. Also, investing in good linkage systems and electronic health records will facilitate cardiovascular disease surveillance in our country. This is now mandatory to overcome the double burden we are currently facing.

5. Conclusion

The study highlights the complexity of managing cardiovascular diseases in a resource-limited context. It also underscores the importance of ischemic heart diseases and rheumatic valvulopathies in cardiovascular mortality in Senegal. The high rates of complications and premature mortality emphasize the need to improve access to care and early screening for cardiovascular risk factors and rheumatic heart disease. This study underscores the necessity for an integrated approach to address the challenges of cardiovascular diseases, focusing on prevention, early diagnosis, and improvement of healthcare system.

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Ethics Approval and Consent to Participate

This study was approved by the ethics committee of the Cheikh Anta Diop University of Dakar.

Availability of Data and Materials

The data and materials of this study are available upon request and ready to be shared. For further information, please contact the corresponding author, Aliou Alassane NGAIDE.

Authors and Contributors

Aliou Alassane NGAIDE, and Abdoul KANE designed the study protocol, participated in the data collection and writing of the draft manuscript.

Ngone Diaba GAYE and Momar DIOUM oversaw the execution of the study, participated in data analysis and critically revised the manuscript for important intellectual content.

Mame Diarra SENE and Mouhamadou Bamba NDIAYE participated in study design and in data analysis.

Joseph Salvador MINGOU and Alassane MBAYE participated in statistical analysis and interpretation of results.

Declaration of Interests

None of the other authors have any conflicts of interest or relevant disclosures.

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