Original Article

Heart Failure in Younger Adults in Africa: Evidence from the Ibadan Heart Failure Project

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Highlights

- Younger patients were predominantly females and presented with advanced heart failure signs. They more frequently had dilated cardiomyopathy, peripartum cardiomyopathy, and rheumatic heart disease.
- Older patients had a higher prevalence of hypertension/hypertensive heart failure, diabetes mellitus, and cor pulmonale.
- One-year mortality, rehospitalization, and composite outcomes did not differ significantly between age groups.

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ABSTRACT

Background: Heart failure (HF) is rising among younger adults in sub-Saharan Africa, yet data on their clinical profile and outcomes are limited. We compared clinical characteristics, etiology, and 1-year outcomes between younger and older HF patients in the Ibadan Heart Failure Project.

Methods: We included 1290 adults (≤50 y, n=430; >50 y, n=860) enrolled from 2016 through 2022. Baseline sociodemographic, clinical, laboratory, and echocardiographic data were collected. HF etiology was classified using ICD-10 codes. Medication use and 1-year outcomes, including rehospitalization, mortality, and a composite of rehospitalization and mortality, were assessed.

Results: Younger patients are predominantly females, more often single and employed, and presented with advanced HF signs, including paroxysmal nocturnal dyspnea, raised jugular venous pressure, S3 gallop, and cardiomegaly. Older patients had a higher prevalence of hypertension, diabetes mellitus, and peripheral edema. Hypertensive heart disease and cor pulmonale predominated in older patients (76% vs 44%), whereas younger patients more frequently had dilated cardiomyopathy (16% vs 7.4%), peripartum cardiomyopathy, and rheumatic heart disease (15% vs 6.2%). Guideline-directed therapy use was similar across ages. One-year mortality, rehospitalization, and composite outcomes did not differ significantly between age groups.

Conclusion: Younger HF patients in Nigeria present with severe nonischemic cardiomyopathies and advanced systolic dysfunction, whereas older patients have hypertensive and metabolic phenotypes. Despite these differences, 1-year outcomes were uniformly poor, reflecting the high burden of HF morbidity and mortality across all age groups in Nigeria.

Keywords: Heart Failure; Cardiac Failure; Age Group; Young; Old; Elderly

Introduction

In 2023, cardiovascular diseases accounted for approximately 1 in 3 deaths worldwide and remained the leading cause of disability-adjusted life years, with annual deaths rising from about 13.1 million in 1990 to 19.2 million in 2023.[1] Cardiovascular diseases account for most noncommunicable disease related deaths, with about 73% of these occurring in low- and middle-income countries, where the mean age of death for all-cause mortality in sub-Saharan Africa (SSA) is about 36 to 38 years, in contrast to 75 to 81 years in high-income settings.[2]

Cardiovascular diseases have become a significant health concern in SSA, driven by an ongoing epidemiological transition and associated with substantial morbidity and mortality.[3,4] Several initiatives have been implemented to monitor and mitigate this escalating health crisis. These include the Global Rheumatic Heart Disease Registry (REMEDY Study),[5] the Sub-Saharan Africa Survey of Heart Failure (THESUS-HF),[6] the ongoing THESUS-HF II,[7] and the Investigation of Rheumatic AF Treatment Using Vitamin K Antagonists, Rivaroxaban or Aspirin Studies (INVICTUS).[8] These resources have been pivotal in tracking the cardiovascular disease burden and developing local clinical guidelines. Emerging data indicate that the burden of HF is increasing among the younger adult population.[2–9]

Globally, HF is generally due to ischemic heart diseases, but in Africa, nonischemic etiology (cardiomyopathies, valvular heart disease, hypertensive HF, myocarditis, and congenital heart disease) tends to be more prevalent.[1–3–6] There are limited studies on the clinical profile, etiology, and prognosis of HF in younger adults, especially in Africa in general and Nigeria in particular, which has the largest young population in SSA. Available data from high-income countries suggest that the increasing burden of HF in younger adults may be attributed to the increasing burden of cardiometabolic risk factors, such as obesity and diabetes, in this population.[10–12]

In this study, we use data from the Ibadan Heart Failure Project to explore the sociodemographic characteristics, clinical features, and 1-year outcome of HF in young Africans living in Ibadan, a metropolis in southwestern Nigeria.

Methods

Study Population and Design

All patients aged 18 years or older registered in The Ibadan HF Project from 2016 through 2022 were included in the analysis. The patients were divided into those aged 50 years or younger and those older than 50 years, given the lower average life expectancy in Nigeria and the age structure of our HF population.

The Ibadan HF Project is a prospective, pragmatic, hospital-based, observational cohort registry of patients with HF, which was initiated in 2016 (NCT05936957). The inclusion criterion for the study was physician-diagnosed HF with clinical and echocardiographic assessment.[13] The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting observational studies.[14]

Procedure

HF was defined according to the European Society of Cardiology guidelines.[15] Baseline data were collected using standardized case report forms. Sociodemographic characteristics, cardiovascular risk factors, comorbidities, presenting symptoms, and medication history were recorded. Physical examination included anthropometry and vital signs. Laboratory tests included complete blood count, kidney function tests, fasting glucose, and lipid profile. HF etiology was determined through clinical assessment and echocardiography,[13] and these were classified using the International Classification of Diseases, 10th revision (ICD-10) codes.[16] These include hypertensive heart disease (I11.0, I11.9), dilated cardiomyopathy (I42.0), rheumatic heart disease (I05-I09), peripartum cardiomyopathy (O90.3), and ischemic heart disease (I20-I25). Cases of pericardial disease (I30-I32), thyrotoxic heart

disease (E05.5), congenital heart disease (Q20-Q28), HIV-associated cardiomyopathy (B23.8 with I42.9), and sickle cell-related cardiopathy (D57.x with I50.x) were coded where applicable.

Follow-up

Participants were placed on standard medications for HF at the baseline recruitment visit as recommended at the time of recruitment.[17–19] Individuals suffering from HF with reduced ejection fraction were commenced on sodium-glucose cotransporter-2 (SGLT-2) inhibitors when these medications became available.[20,21] Subjects with venous congestion were also placed on loop diuretics as required. Antiarrhythmic medications and anticoagulants were prescribed when required. They were reviewed initially at 1 month and thereafter every 3 months to inquire about hospital admissions, new diagnoses, and deaths. Participants or their next of kin were contacted by telephone before their scheduled visits to remind them of their follow-up visits. Copies of medical records and death certificates were reviewed to confirm incident events, and next-of-kin interviews and verbal autopsies were performed for out-of-hospital deaths. Incident deaths were adjudicated by 2 cardiologists based on medical records, next-of-kin interviews, and death certificates. Participants were followed up until the date of (i) death or (ii) date of last follow-up assessment, and data were censored at 1-year post-recruitment.

The demographic characteristics, clinical profile, laboratory findings, etiologic risk factors, and 1-year outcomes were compared between patients younger than 50 years and those aged 50 years or older, with outcomes defined as rehospitalization, mortality, or a composite of these.

Ethical Considerations

All subjects provided informed consent to participate in the study. Ethical approval was obtained from the Joint Ethics Committee of the University of Ibadan and University College Hospital, Ibadan. The study was carried out in accordance with international ethical principles.[22]

Statistical Analysis

Shapiro-Wilk test and histogram plots were used to test for normality of variables. Arithmetic means (standard deviation [SD]) were computed for normally distributed continuous variables, while medians (interquartile range [IQR]) were utilized to summarize continuous variables that were not normally distributed. Proportions were employed to summarize categorical sociodemographic and clinical variables. Bivariate analyses were performed with χ^2, t test, and Mann-Whitney tests as appropriate. Multivariable logistic regression was used to identify baseline sociodemographic, clinical, electrocardiographic, and echocardiographic characteristics associated with presentation at age >50 years, using presentation at age ≤50 years as the reference category. Candidate variables were selected based on clinical relevance and findings from baseline comparisons. Adjusted odds ratios and 95% confidence intervals were reported.

The study outcomes were first-ever hospitalization, mortality, or the composite of both. Participants were followed until the date of death or hospitalization or loss to follow-up. Differences in HF outcomes were investigated by age-at-risk using the log-rank test, and the differences in the cumulative incidence of each study outcome were expressed graphically by Kaplan-Meier plots. Univariable and multivariable Cox proportional hazards regression were drawn upon to determine the factors independently associated with each of the study outcomes.

Three multivariable models were developed: (i) Model 1, adjusted for potential confounders (age-at-risk, sex, marital status, education, occupation, smoking, alcohol, and body mass index [BMI] where appropriate); (ii) Model 2, which was additionally adjusted for potential clinical intermediate factors (eg, diabetes mellitus, hypertension, electrocardiographic (ECG) left ventricular hypertrophy, and arrhythmia); and (iii) Model 3, which additionally incorporated echocardiographic parameters. Because several cardiac structural and functional measures were available and were potentially correlated, a backward stepwise selection approach was used

to identify the most informative variables while minimizing model overfitting. The proportional hazards assumption was tested by examining Schoenfeld residuals for each measure in the association between the incident outcome and the natural log of follow-up time. A p-value of less than .05 was considered statistically significant in all analyses. All analyses were performed using Stata version 17.0 (StataCorp LLC, College Station, Texas) and plots were also generated using stata 17.0.

Results

Patient Characteristics

A total of 1290 patients were included, with 430 (33.3%) aged 50 years or younger and 860 (66.7%) aged older than 50 years. Sociodemographic characteristics are shown in (Table 1). The younger group had a mean (SD) age of 39 years, were mostly single and currently employed, while the older group had a mean (SD) age of 66 years. (Supplemental Table 1) shows cardiovascular risk factors and comorbidities. The older HF group had a higher prevalence of hypertension and diabetes. Clinical presentations varied across groups. Bilateral ankle edema was more prevalent among older adults (62% vs 55%; p=.016), while younger participants more often exhibited paroxysmal nocturnal dyspnea (59% vs 53%; p=.030), raised jugular venous pressure (32% vs 26%; p=.028), and an S3 gallop (34% vs 25%; p<.001). Cardiomegaly on chest radiograph was more common in younger participants (51% vs 44%; p=.017) as shown in (Supplemental Figure 1), while biophysical and laboratory findings are summarized in (Supplemental Table 2). Younger patients generally demonstrated higher hemoglobin and lower serum creatinine levels. Older patients exhibited higher fasting blood glucose and lipid abnormalities.

Echocardiographic and ECG findings are presented in (Supplemental Table 3). Younger patients demonstrated greater left ventricular dilation and lower ejection fraction, whereas atrial fibrillation and widened QRS duration were more frequent in older participants.

Patterns of etiology differed, with hypertensive heart disease more common among older patients (76% vs 44%), whereas dilated cardiomyopathy (16% vs 7.4%), rheumatic heart disease (15% vs 6.2%), and peripartum cardiomyopathy (12% vs 0.1%) were more frequent among younger individuals. Ischemic heart disease was observed predominantly in those older than 50 years (Figure 1).

Medication use is summarized in (Supplemental Figure 2). Both groups had high utilization of loop diuretics, spironolactone, ACE inhibitors, and β-blockers. Digoxin use was more common in younger patients (31% vs 21%; p<.001). Older patients more frequently received angiotensin receptor blockers (17% vs 11%; p=.011), statins (7.0% vs 2.3%; p<.001), oral hypoglycemic agents (8.0% vs 0.7%; p<.001), amiodarone (5.2% vs 2.8%; p=.044), SGLT2 inhibitors (4.1% vs 1.6%; p=.020), and novel oral anticoagulant drugs (NOACs) (3.0% vs 0.9%; p=.021).

Baseline Characteristics Associated with Presentation After Age 50 Years

In the multivariable logistic regression analysis, several baseline characteristics were independently associated with presentation at age older than 50 years (Table 2). Male participants had approximately 3-fold higher adjusted odds of presenting after age 50 years compared to female participants (aOR 3.08, 95%CI-2.16-4.40) Diabetes mellitus, hypertension, and arrhythmias were associated with a 6-fold, 3.6-fold, and 2.0-fold higher adjusted odds of presentation after age 50 years compared to younger individuals with HF (aOR 5.89, 95%CI-2.88-12.06; aOR 3.57, 95% CI-2.45-5.18, and aOR 2.47, 95% CI- 1.67-3.65, respectively).

Table 1. Baseline sociodemographic characteristics of the participants

Characteristic	Older HF Group (No. = 860)	Young HF Group (No. = 430)	p-value
Sex (No. [%])			
Male	523 (60.8)	197(45.8)	< .001
Female	337(39.2)	233 (54.2)	
Age	66 (9)	39 (8)	< .001
Marital Status (No. [%])			
Single	12 (1.4%)	59 (14%)	
Married	650 (76%)	352 (82%)	< .001
Divorced/separated	25 (2.9%)	14 (3.3%)	
Widowed	173 (20%)	5 (1.2%)	
Educational Status (No. [%])			
No formal education	111 (13%)	11 (2.6%)	
Primary education	204 (24%)	48 (11%)	< .001
Secondary education	265 (31%)	191 (44%)	
Post-secondary / University	268 (31%)	174 (40%)	
Postgraduate education	12 (1.4%)	6 (1.4%)	
Employment Status (No. [%])			
Unemployed	263 (31%)	165 (38%)	< .001
Employed	404 (47%)	264 (61%)	
Pensioner	193 (22%)	1 (0.2%)	
Monthly Income			
<50000	570 (66%)	284 (66%)	.934
≥50000	290 (34%)	146 (34%)	

HF: heart failure

Table 2: Multivariable logistic regression of baseline characteristics associated with presentation at age >50 years among adults with heart failure

Characteristics at Baseline	OR (95% CI)
Male sex	3.08 (2.16-4.40)
Married marital status	0.50 (0.32-0.79)
Education in 3 categories	
No formal education/primary education	Ref
Secondary education	0.24 (0.15-0.39)
Tertiary education	0.24 (0.15-0.39)
Diabetes mellitus	5.89 (2.88-12.06)
Hypertension	3.57 (2.45-5.18)
Body mass index (per unit higher)	1.05 (1.02-1.09)
Any arrhythmia	2.47 (1.67-3.65)
Deceleration time of mitral E wave (ms)	1.00 (1.00-1.01)
Aortic regurgitation	2.16 (1.30-3.59)
Mitral regurgitation	0.65 (0.46-0.93)

Outcome variable: presentation at age >50 years; reference category: presentation at age ≤50 years. ORs are adjusted odds ratios. Reference categories were female sex, unmarried/not currently married, no formal or primary education, absence of diabetes, absence of hypertension, absence of arrhythmia, absence of aortic regurgitation, and absence of mitral regurgitation.

Table 3. Rate of hospital admission at 6 and 12 months in the 2 groups

Variable	Older HF Group, No. (%)	Younger HF Group, No. (%)	Total, No. (%)	p-value
Hospitalization at 6 months	40 (4.8%)	19 (4.6%)	59 (4.7%)	.89
Death at 6 months	117 (13.8%)	47 (11.0%)	164 (12.9%)	.17
Hospitalization at 12 months	41 (4.9%)	21 (5.0%)	62 (4.9%)	.94
Death at 12 months	174 (20.6%)	76 (18.2%)	250 (19.8%)	.33

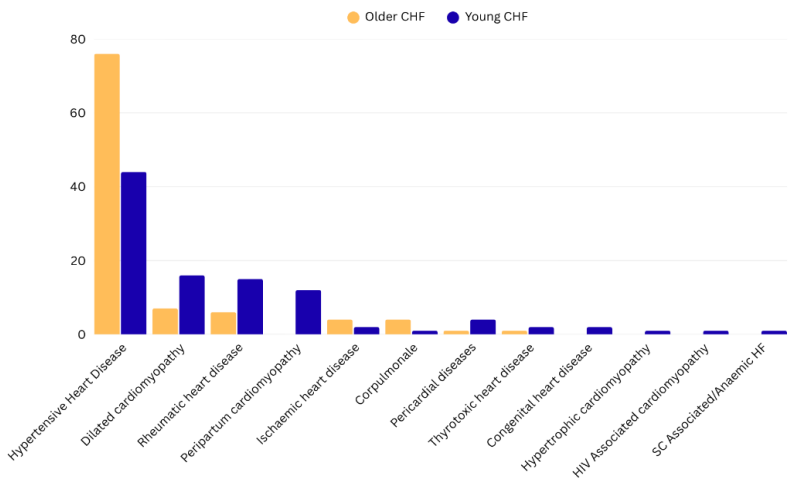

Figure 1. Etiologic risk factors for participants with heart failure according to age group

They also had higher BMI than younger individuals with HF (OR, 1.05; 95% CI, 1.02 to 1.09 per unit higher BMI). Interestingly, being married and having higher educational attainment were both associated with lower odds (OR, 0.50; 95% CI, 0.32 to 0.79; and OR, 0.24; 95% CI, 0.15 to 0.39, respectively) of having HF at older age. Additional independent determinants of older age at presentation included aortic incompetence (OR, 2.16; 95% CI, 1.30 to 3.59). Mitral regurgitation was associated with lower adjusted odds of presentation after age 50 years"

Outcomes

During 1-year follow-up, the incidence of the composite outcome of mortality and hospitalization did not differ significantly between patients aged 50 years or younger and those older than 50 years (p=.06) (Table 3). Similarly, age-at-risk was not associated with differences in 1-year hospitalization alone (p=.75) (Figure 2A) or all-cause mortality (p=.09) (Figure 2B). Cox proportional hazards models confirmed these findings, with hazard ratios close to unity for the composite outcome, mortality, and hospitalization across all models (Figure 2C). Specifically, patients older than 50 years had a hazard ratio of 1.01 (95% CI, 1.00 to 1.01) for the composite outcome, 1.01 (95% CI, 1.00 to 1.02) for mortality, and 1.00 (95% CI, 0.98 to 1.02) for hospitalization compared with younger patients (Table 4).

Table 4. Associations between age and 1-year outcomes

Age	Events	HR (95% CI)			
		Univariable	Model 1	Model 2	Model 3
Composite of Mortality and Hospitalization					
Age-at-risk ≤50 y	69	Ref	Ref	Ref	Ref
Age-at-risk >50 y	203	1.01 (1.00-1.01)	1.00 (1.00-1.01)	1.00 (1.00-1.01)	1.01 (1.00-1.01)
Mortality					
Age-at-risk ≤50 y	69	Ref	Ref	Ref	Ref
Age-at-risk >50 y	185	1.00 (1.00-1.01)	1.00 (1.00-1.01)	1.00 (1.00-1.01)	1.01 (1.00-1.02)
Hospitalization					
Age-at-risk ≤50 y	17	Ref	Ref	Ref	Ref
Age-at-risk >50 y	43	1.00 (0.99-1.01)	1.00 (0.99-1.02)	1.00 (0.98-1.01)	1.00 (0.98-1.02)

Model 1: adjusted for confounders (sex, marital status, education, occupation, smoking, alcohol and body mass index)
Model 2: Model 1+ first set of potential explanatory variables (diabetes mellitus, hypertension, electrocardiographic left ventricular hypertrophy, and arrhythmia)
Model 3: Model 2+ second set of potential explanatory variables (left ventricular ejection fraction, deceleration time of mitral E wave, aortic incompetence, and mitral incompetence)

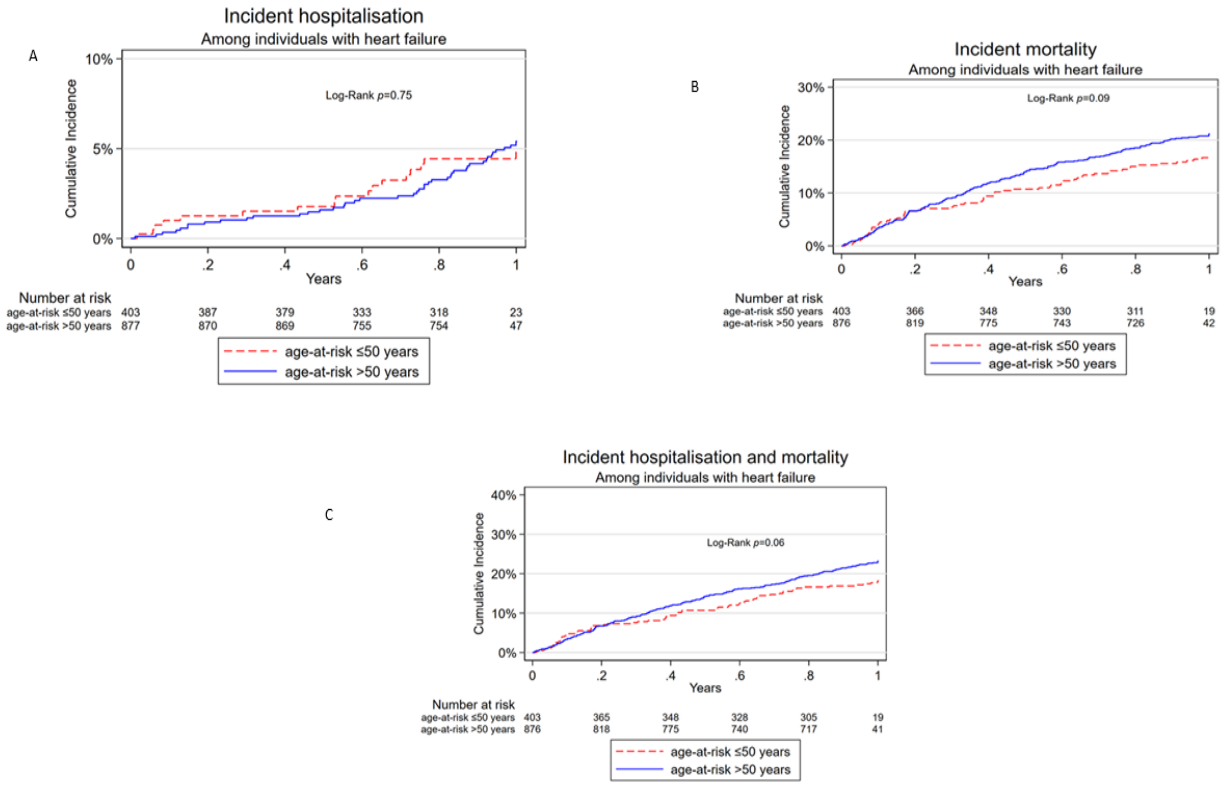

Figure 2. Cumulative incidence of hospitalization at 1 year by age-at-risk (A), mortality at 1 year by age-at-risk (B), and composite of hospitalization and mortality at 1 year by age-at-risk (C).
Supplemental Figure 1. Symptoms and signs of HF by age group.
Supplemental Figure 2. Foundational HF medications prescribed to participants by age group (A) and other medications prescribed to participants by age group (B).
HF: heart failure.

Discussion

In this large cohort of patients with chronic HF in Ibadan, we compared patients with HF aged 50 years or younger and those older than 50 years. Clinical characteristics were distributed as expected between age categories. Mortality, rehospitalization, and composite outcome events were lower in the younger group, but the time-to-event analysis showed that the difference was not statistically significant.

Younger patients were predominantly female, less likely to have hypertension or diabetes, and exhibited more advanced disease on presentation (eg, higher rates of paroxysmal nocturnal dyspnea, raised jugular venous pressure, S3 gallop, and cardiomegaly). In contrast, older patients (> 50 y) had a higher prevalence of traditional cardiometabolic risk factors (hypertension, diabetes, obesity) and more frequently presented with peripheral edema. Higher educational attainment was associated with lower adjusted odds of being in the older presentation group; however, this association may reflect cohort effects, socioeconomic differences, or healthcare access patterns rather than a direct biological relationship. The INTER-CHF study (African data) found most patients to be middle-aged men with hypertensive heart disease, and composite 1-year mortality or rehospitalization was 39%.[23] Our observation that younger Africans have severe HF manifestations is also consistent with reports that the burden of HF is growing in younger adults worldwide, driven by rising obesity, hypertension, and diabetes in this group.[24] Younger patients with chronic HF in this cohort exhibited more pronounced signs of volume overload and advanced disease, including higher rates of paroxysmal nocturnal dyspnea, cardiomegaly, raised jugular venous pressure, and S3 gallop, while older patients more commonly had bilateral ankle edema. Consistent with regional patterns, patients in SSA tend to present

at a younger age and with more advanced disease compared with those in high-income countries.[9] Etiologically, hypertensive heart disease predominated in older patients, while younger patients more frequently had dilated cardiomyopathy, rheumatic heart disease, and peripartum cardiomyopathy, consistent with previous SSA studies in which hypertensive heart disease and dilated cardiomyopathy are the most prevalent causes of HF.[6, 9, 23] Medication use was similar across age groups for guideline-directed therapies, although younger patients more frequently received digoxin, SGLT2 inhibitors, and antiarrhythmics, reflecting differences in comorbidity profiles and underlying etiologies, in accordance with current HF management guidelines.[25] Our study showed that younger patients had larger left ventricular dimension and lower ejection fraction, whereas older patients more frequently had atrial fibrillation and conduction delay, patterns previously reported in chronic HF cohorts.[26–28]

Despite these clinical differences, 1-year outcomes were remarkably similar in the 2 age groups. Several factors may explain the convergence of outcomes between younger and older patients in this cohort. First, the overall prognosis of HF in SSA remains poor, with high early mortality and rehospitalization rates reported in multicounty registries such as INTER-CHF and THESUS-HF. In such contexts, the generally elevated background risk may attenuate the survival advantage typically associated with younger age. Second, although younger patients in our study had fewer traditional cardiometabolic comorbidities, they more frequently presented with severe nonischemic cardiomyopathies, including dilated, rheumatic, and peripartum cardiomyopathy, and demonstrated greater left ventricular dilation and lower ejection fraction. These aggressive phenotypes may offset the expected protective effect of younger age. Third, differences in treatment patterns may also contribute to this convergence. Foundational HF therapies were used in both groups; still, younger patients more frequently received digoxin, whereas older patients more often received statins, angiotensin receptor blockers, and oral hypoglycemic agents, reflecting differences in comorbidity profiles. Finally, the relatively short follow-up duration of 1 year may not fully capture longer-term divergence in survival trajectories between age groups.[23, 29-31]

Finally, the similarly poor outcomes across ages in our registry reflect the generally high HF mortality in SSA, noted by studies such as INTER-CHF[23] and THESUS-HF[6], and contrast with some high-income reports of age-based survival differences.[3]

Limitations

The present study has several limitations. First, it is an observational, hospital-based registry and may preferentially include patients with more severe disease who present to tertiary care facilities. Second, ischemic heart disease was diagnosed primarily on clinical, ECG, and echocardiographic grounds because coronary angiography and advanced imaging modalities such as cardiac magnetic resonance imaging were not routinely available. As a result, some cases classified as nonischemic cardiomyopathy may represent unrecognized ischemic heart disease, which could lead to misclassification of etiology. However, these patients did not have 12-lead ECG features of coronary artery disease, and their echocardiogram did not show evidence of regional wall motion abnormality. Indeed, our community is still in the earlier phase of epidemiologic transition, unlike the picture in high- or higher-middle-income countries where coronary artery disease is the most common etiologic risk factor for HF. Third, follow-up was limited to 1 year, which may underestimate longer-term outcome differences between age groups. One future direction will be to examine outcomes at 2, 3, and 5 years or more, for which data are lacking in Africa. Finally, cause-specific mortality could not always be determined because some deaths occurred outside hospital settings.

Conclusion

HF in this Nigerian cohort shows marked age-related heterogeneity. Younger patients bear a disproportionate burden of nonischemic cardiomyopathies (including dilated and peripartum forms) and present with severe systolic dysfunction, whereas older patients more often have hypertension-related HF with comorbid

diabetes and atherosclerotic features. Despite these differences, 1-year rehospitalization and mortality rates were uniformly high across ages. These findings showcase the need for age-tailored prevention and management strategies: in young Africans, addressing rheumatic and pregnancy-related cardiomyopathies and emerging cardiometabolic risks; and in older patients, optimizing control of hypertension, diabetes, and coronary disease. They also highlight a global trend of increasing HF in younger adults, reminding clinicians worldwide that HF is no longer just a disease of the elderly and that outcomes remain poor across age groups despite guideline directed medical treatment in Nigeria.

Declarations:

Ethical Approval

Ethical approval was not required for conducting this research

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Conflict of Interest

The authors declare no conflicts of interest.

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