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Gender differences in clinical characteristics and outcome of acute heart failure in sub-Saharan Africa: results of the THESUS-HF study

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ORIGINAL PAPER

Gender differences in clinical characteristics and outcome of acute heart failure in sub-Saharan Africa: results of the THESUS-HF study

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Abstract
Background The impact of gender on the clinical characteristics, risk factors, co-morbidities, etiology, treatment and outcome of acute heart failure in sub-Saharan Africa has not been described before. The aim of this study was to evaluate the sex differences in acute heart failure in sub-Saharan Africa using the data from The sub-Saharan Africa Survey of Heart Failure (THESUS-HF).
Methods and results 1,006 subjects were recruited into this prospective multicenter, international observational heart failure survey. The mean age of total population was 52.4 years (54.0 years for men and 50.7 years for women). The men were significantly older ($p = 0.0045$). Men also presented in poorer NYHA functional class (III and IV), $p = 0.0364$). Cigarette smoking and high blood pressure were significantly commoner in men (17.3 vs. 2.6 % and 60.0 vs. 51.0 % respectively). On the other hand, atrial fibrillation and valvular heart disease were significantly more frequent in women. The mean hemoglobin concentration was lower in women compared to men (11.7 vs. 12.6 g/dl, $p \leq 0.0001$), while the blood urea and creatinine levels were higher in men ($p < 0.0001$). LV systolic dysfunctional was also seen more in men. Men also had higher E/A ratio indicating higher LV filling pressure. Outcomes were similar in both sexes.

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Conclusions Although the outcome of patients admitted for AHF in sub-Saharan regions is similar in men and women, some gender differences are apparent suggesting that in men more emphasis should be put on modifiable life risk factors, while in women prevention of rheumatic heart diseases and improved nutrition should be addressed vigorously.

Keywords Gender · Sex · Heart failure · Africa

Introduction

Heart failure (HF) is a global public health problem [1]. In the United States alone, more than 5.8 million persons are affected [2, 3] while over 23-million individuals have been estimated to have HF worldwide [2]. Furthermore, about 2.4 million hospital admissions in the US are related to HF as primary and secondary diagnoses every year [3]. The cost of HF consumes up to 39 million dollars in the US each year [3]. The data from Europe or Japan are similar [4]. Prognosis is poor. Mortality risk after HF admission is 11.3 % at 1 month, 33.1 % at 1 year, and over 50 % at 5 years [3].

Major HF registries have shown that women compared to men are older, have higher frequency of hypertension as etiological cause, are less likely to have coronary artery disease (CAD) and have higher mean ejection fraction (EF), and are also more likely to have heart failure with normal EF than men [5–9].

Differences between the sexes with respect to the etiology, risk factors, co-morbidities, management and outcome in patients with HF have not been described in sub-Saharan African populations.

Study aims

The aim of this report is, therefore, to explore the sex differences in the clinical characteristics, treatment and prognosis of HF using the data from The sub-Saharan Africa Survey of Heart Failure (THESUS-HF) [10].

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Materials and methods

Design and setting

The THESUS-HF registry [10] was a prospective multicenter, international observational survey of HF in 12 Cardiology Units from nine sub-Saharan African countries which included Cameroon, Ethiopia, Kenya, Mozambique, Nigeria, Senegal, South Africa, Sudan and Uganda. Ethics approval was obtained from the institutional ethics committee, subjects gave informed written consent and the study conformed to international standards as enshrined by the Helsinki declaration [11].

Data collection

Data were collected with the use of uniform and standardized case report forms. The primary cause of HF was based on the European Society of Cardiology (ESC) guidelines [12, 13]. An exhaustive materials and methods of the survey have been published elsewhere [10].

In brief, information obtained included socio-demographic data, cardiovascular risk factors, medical history/co-morbid conditions, etiological risk factors, in-hospital treatment, length of hospital stay (LOS), in-hospital outcome as well as outcome at 1, 3 and 6 months. Also collected were laboratory investigations such as blood tests, 12-lead ECG and echocardiography.

All the echocardiograms were performed according to the guidelines of the American Society of Echocardiography [14, 15]. An ejection fraction (LV ejection fraction estimated by Simpson's method) of $\geq$50 % was used to identify HF with normal ejection fraction.

Subjects were eligible to participate if they were 12 years or older and admitted with clinical symptoms and signs suggestive of HF. All the cases (de novo or decompensated chronic HF) were confirmed by echocardiography. The exclusion criteria included patient with acute ST-segment myocardial infarction, dialysis-dependent chronic renal disease, nephrotic syndrome, hepatic failure and other causes of hypoalbuminemia. Diagnoses of etiologic conditions were based on standard criteria as previously reported [10]. Specifically peripartum cardiomyopathy (PPCM) was diagnosed based on published guidelines [16, 17].

Statistical analysis

Data were managed centrally at Momentum Research Inc., Durham, USA. Categorical variables are presented as proportions, while continuous variables are presented as mean (SD) or median (inter quartile range—25th and 75th percentiles).

Comparison of continuous variables was with 2-tailed, 2-sampled *t* test while Chi square statistics were used for the comparison of categorical variables between men and women. Mortality and readmission rates were estimated using the Kaplan–Meier method.

The data for the whole cohort were compared according to gender. This was further analyzed after excluding women who had PPCM.

A 2-tailed p value of <0.05 was assumed as statistically significant. SAS software (SAS, version 9.2; SAS Institute, Inc. USA) was used for analysis.

Results

One thousand and six subjects were recruited into the study (494 men and 511 women, the sex of one subject was not reported). The mean age of study population was 52.4 years (54.0 years for men and 50.7 years for women).The men were significantly older ($p = 0.0045$), but not so when 74 women with PPCM were excluded ($p = 0.647$) (Table 1).

The age distribution according to gender is shown in Figs. 1 and 2. Over 98 % of the cohort was Blacks. The mean body mass index was 24.9 kg/m^2 and this was similar in both sexes even after excluding those with PPCM. History of previous admission for HF was commoner in men (24.7 vs. 19.6 %, $p = 0.0502$, 0.286 after excluding women with PPCM). Men also had a poorer NYHA functional class (III and IV) 1 month before admission, $p = 0.0364$, 0.0220 after excluding women with PPCM).

In terms of cardiovascular risk factors and past medical history, cigarette smoking and high blood pressure were significantly reported more in men (17.3 vs. 2.6 and 60.0 vs. 51.0 % respectively). The gender difference in high blood pressure prevalence became insignificant after removing women with PPCM.

On the other hand, atrial fibrillation and valvular heart disease were significantly more frequent in women, especially when women with PPCM were excluded (Table 1).

The mean heart and respiratory rates were significantly higher in women (105.7 vs. 101.6 beats/min, 31.3 vs. 30.0 cycles/min, respectively).

Table 2 shows the baseline laboratory profile of the subjects on admission in terms of gender.

The mean hemoglobin concentration was lower in women compared to men (11.7 vs. 12.6 g/dl, $p \leq 0.0001$) while the blood urea and creatinine levels were higher in men ($p < 0.0001$).

Table 3 and supplemental Table 1 depict the sex distribution of echocardiographic variables. Virtually, all the echocardiographic parameters were significantly higher in men compared to women.

In terms of valvular dysfunction, aortic lesions were more frequent in men. Left ventricular (LV) systolic dysfunctional was also seen more in men. Men also had higher E/A ratio indicating higher LV filling pressure. LV ejection fraction was also significantly lower in men.

Etiology-wise, (Table 4), women had higher rates of rheumatic heart disease, endomyocardial fibrosis and human immunodeficiency virus (HIV)-associated cardiomyopathy while hypertensive HF, dilated cardiomyopathy and ischemic heart disease were common in men.

The major 12-lead ECG findings according to gender are shown in supplemental Table 2. As previously stated atrial fibrillation was significantly commoner in women (27.5 vs. 19.5 %, $p = 0.0338$), especially after excluding those women with PPCM ($p = 0.0049$) while ST-T changes were observed more in men (36.9 vs. 25.8 %, $p = 0.0066$ and 0.0002 after excluding those with PPCM).

Medications

Supplemental Tables 3 and 4 show the medications on admission and discharge, respectively, according to gender. Women more frequently received digitalis compounds than men (15.8 vs. 11.4 %, $p = 0.0416$).

Outcome

Table 5 shows the outcome variables. These are similar in men and women even after excluding women with PPCM. Figure 3 shows the survival curves according to gender.

Discussion

Our study revealed some sex differences in African subjects with AHF. Men were older than the women. HF was generally commoner in women especially before the age of 50 years. From the age of 50–70 years, it tended to be more frequent in men. Previous history of HF (acute on chronic HF) was seen more in men. The burden of CV risk factors such as hypertension and cigarette smoking was higher in men. Anemia was reported more frequently in women while renal impairment was more frequent in men. Echocardiographic parameters were more abnormal in men and there were some differences in the etiology of HF in men and women. Atrial fibrillation was commoner in women while left ventricular hypertrophy (LVH), ECG features of ischemic and ST-T abnormalities were commoner in men. Although health outcomes were slightly worse in men, these were not statistically significant.

In the Euro-HF survey, HF was less frequently diagnosed in women (39 %) [18]. Women were generally older than men in all the HF registries in high-income countries

Table 1 Baseline socio-demographic characteristics profile of the patients by gender

Characteristic	Total (n = 1,006)	Male (n = 494)	Female (n = 511)	P value*	Female (excluding peripartum CM) (n = 437)	P value**
Age (years), mean (SD), 25th percentile, median, 75th percentile	52.4 (18.3) 39.0, 55.0, 67.0	54.0 (16.9) 43.0, 55.0, 67.0	50.7 (19.5) 33.0, 53.0, 67.0	0.0045	54.6 (18.3) 41.0, 58.0, 70.0	0.6473
>65 years (*n*/%)	269 (26.7 %)	134 (27.1 %)	135 (26.4 %)	0.8003	135 (30.9 %)	0.2057
Race						
Black (*n*/%)	984 (98.5 %)	486 (98.8 %)	497 (98.2 %)	0.4680	423 (97.9 %)	0.2999
BMI (kg/m^2), mean (SD)	24.9 (5.8)	24.7 (5.0)	25.1 (6.5)	0.2583	25.4 (6.7)	0.0604
Admitted for HF in 12 months prior to admission	222 (22.1 %)	122 (24.7 %)	100 (19.6 %)	0.0502	95 (21.7 %)	0.2868
No. of HF admissions in prior 12 months, mean (SD)	0.37 (0.78)	0.41 (0.77)	0.34 (0.78)	0.1523	0.38 (0.82)	0.5280
NYHA class 1 month before admission (*n*/%)						
I	121 (18.1 %)	59 (18.0 %)	62 (18.2 %)	0.0364	49 (16.1 %)	0.0220
II	303 (45.3 %)	133 (40.6 %)	170 (50.0 %)		157 (51.6 %)	
III	217 (32.4 %)	118 (36.0 %)	98 (28.8 %)		90 (29.6 %)	
IV	28 (4.2 %)	18 (5.5 %)	10 (2.9 %)		8 (2.6 %)	
CV risk factors, past medical history						
Smoking (*n*/%)	98 (9.8 %)	85 (17.3 %)	13 (2.6 %)	<0.0001	12 (2.8 %)	<0.0001
Hypertension (*n*/%)	556 (55.5 %)	296 (60.0 %)	259 (51.0 %)	0.0040	255 (58.6 %)	0.6603
Peripheral vascular disease (*n*/%)	12 (1.2 %)	9 (1.8 %)	3 (0.6 %)	0.0732	3 (0.7 %)	0.1282
Stroke (*n*/%)	25 (2.5 %)	10 (2.0 %)	15 (2.9 %)	0.3513	11 (2.5 %)	0.6095
Hyperlipidemia (*n*/%)	90 (9.2 %)	52 (10.8 %)	38 (7.6 %)	0.0852	35 (8.2 %)	0.1888
Atrial fibrillation (*n*/%)	184 (18.4 %)	77 (15.7 %)	107 (21.1 %)	0.0283	107 (24.7 %)	0.0006
Ischemic heart disease (*n*/%)	82 (8.2 %)	46 (9.3 %)	36 (7.1 %)	0.1893	36 (8.3 %)	0.5648
Valvular heart disease (*n*/%)	272 (27.2 %)	113 (22.9 %)	159 (31.4 %)	0.0025	153 (35.4 %)	<0.0001
Cardiomyopathy (*n*/%)	416 (41.9 %)	200 (40.9 %)	216 (42.9 %)	0.5320	158 (36.7 %)	0.1974
Cor pulmonale (*n*/%)	72 (7.2 %)	36 (7.4 %)	36 (7.1 %)	0.8872	35 (8.1 %)	0.6744
Pacemaker (*n*/%)	4 (0.4 %)	4 (0.8 %)	0 (0.0 %)	0.0580	0 (0 %)	0.1270
Pericardial disease (*n*/%)	53 (5.3 %)	29 (5.9 %)	24 (4.7 %)	0.4132	20 (4.6 %)	0.3875
Diabetes mellitus (*n*/%)	114 (11.4 %)	58 (11.8 %)	56 (11.0 %)	0.6790	52 (11.9 %)	0.9584
Depression (*n*/%)	33 (3.3 %)	15 (3.0 %)	18 (3.5 %)	0.6572	18 (4.1 %)	0.3654
Dementia (*n*/%)	22 (2.2 %)	9 (1.8 %)	13 (2.6 %)	0.4342	13 (3.0 %)	0.2475
Malignancy (*n*/%)	13 (1.3 %)	5 (1.0 %)	8 (1.6 %)	0.4399	8 (1.8 %)	0.2896
Symptoms on admission						
Orthopnea, mean (SD)[a]	2.31 (0.76)	2.33 (0.76)	2.29 (0.75)	0.5298	2.24 (0.77)	0.0961
Signs on admission						
Peripheral edema, mean (SD)[b]	1.83 (1.04)	1.87 (1.05)	1.78 (1.03)	0.1844	1.73 (1.05)	0.0394
Rales, mean (SD)[c]	1.68 (0.92)	1.66 (0.90)	1.70 (0.94)	0.4981	1.68 (0.97)	0.7197
Temperature (^{o}C), mean (SD)	36.7 (0.6)	36.7 (0.7)	36.6 (0.6)	0.1980	36.6 (0.6)	0.1629
Respiratory rate (changed to b/min), mean (SD)	30.7 (7.9)	30.0 (7.5)	31.3 (8.3)	0.0120	31.1 (8.6)	0.0484

Table 1 continued

Characteristic	Total (n = 1,006)	Male (n = 494)	Female (n = 511)	P value*	Female (excluding peripartum CM) (n = 437)	P value**
Heart rate, mean (SD)	103.7 (21.6)	101.6 (21.4)	105.7 (21.6)	0.0029	103.8 (21.9)	0.1316
Systolic blood pressure (mmHg), mean (SD)	130.4 (33.5)	132.4 (33.7)	128.5 (33.4)	0.0611	131.4 (34.0)	0.6425
Diastolic blood pressure (mmHg), mean (SD)	84.3 (20.9)	85.5 (21.2)	83.2 (20.7)	0.0840	84.1 (21.3)	0.3093
Pulse pressure (mmHg), mean (SD)	46.2 (19.7)	47.0 (19.4)	45.4 (20.0)	0.1982	47.3 (20.4)	0.8037
Oxygen saturation, mean (SD)	93.3 (6.4)	93.3 (5.5)	93.2 (7.0)	0.8442	93.1 (7.4)	0.6671

Values reported as mean (SD) for continuous variables and n (%) for categorical. Median, 25th, and 75th percentiles given for skewed data

[a] Orthopnea scored as 0-none, 1–1 pillow (10 cm), 2–2 pillows (20 cm), 3–3 pillows (>30 cm)

[b] Peripheral edema scored as 0-complete absence of skin indentation with mild digital pressure in all dependent areas, 1-indention of skin that resolves over 10–15 s, 2-indention of skin is easily created with limited pressure and disappears slowly (15–30 s or more), 3-large areas of indentation easily produced and slow to resolve (>30 s)

[c] Rales scores as 0-no rales after clearing with cough, 1-moist or dry rales heard in lower 1/3 of 1 or both lung fields that persist after cough, 2-moist or dry rales heard throughout the lower half to 2/3 of 1 or both lung fields, 3-moist or dry rales heard throughout both lung fields

* (Chi Square for categorical, t test for continuous) male versus female

** (Chi Square for categorical, t test for continuous) male versus female (excluding peripartum CM)

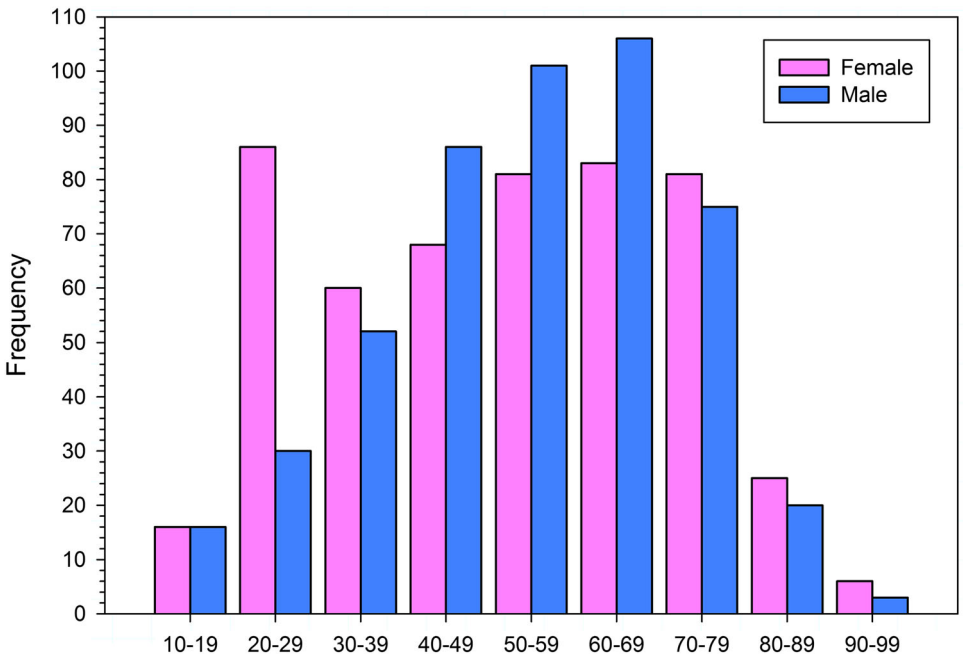

Fig. 1 Age distribution of the subjects by gender

[5, 6, 8, 18]. For example, in the Japanese HF registry, female patients were a mean of 5.7 years older than the men [8]. In the acute heart failure database (AHEAD), the mean age of men and women was 68–70 and 73–75 years, respectively [19]. The finding of greater frequency of de novo HF in women in this study is consistent with the observation in the Euro-HF survey; however, our finding may have been driven by the frequency of PPCM [18]. The differences may also be related to the population structure in Africa compared to that of high-income countries of the world. The African population is very young compared to high-income countries where the age of onset of heart disease is generally after the age of 65 years [20, 21].

Cardiovascular risk factors such as, hypertension, cigarette smoking, coronary artery disease and chronic obstructive pulmonary disease (COPD) were seen more in

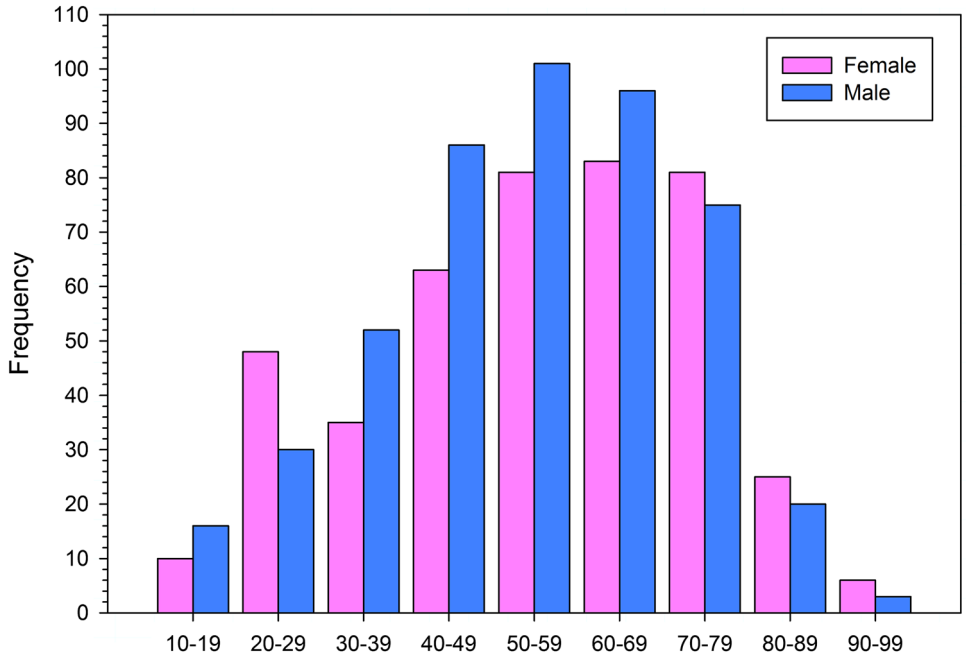

Fig. 2 Age distribution of the subjects by gender (females excluding peripartum CM)

Table 2 Baseline laboratory profile of the subjects on admission according to gender

Variable	Total (n = 1,006)	Male (n = 494)	Female (n = 511)	P value*	Female (excluding peripartum CM) (n = 437)	P value**
Blood tests						
Sodium (mmol/L), mean (SD)	946, 135.1 (6.6)	463, 134.9 (6.5)	482, 135.3 (6.8)	0.3294	416, 135.4 (6.8)	0.2818
Glucose (mg/dl), mean (SD)	878, 109.7 (49.7)	442, 109.7 (44.0)	435, 109.5 (54.9)	0.9420	380, 112.5 (57.6)	0.4453
Hemoglobin (g/dl), mean (SD)	967, 12.2 (2.4)	476, 12.6 (2.6)	490, 11.7 (2.2)	<0.0001	418, 11.8 (2.2)	<0.0001
Total white cell count/mm^3, mean (SD)	963, 7,699.3 (4,091.7)	472, 7,484.1 (3,505.0)	490, 7,914.2 (4,580.9)	0.1015	418, 7,972.0 (4,743.4)	0.0847
Lymphocytes (%), mean (SD)	839, 30.3 (13.4)	417, 29.8 (12.9)	421, 30.9 (13.8)	0.2497	366, 30.3 (13.7)	0.6222
Blood urea (mg/dl), mean (SD)	951, 35.6 (33.1)	466, 41.0 (37.2)	484, 30.4 (27.7)	<0.0001	417, 31.9 (29.2)	<0.0001
Creatinine (mg/dl), mean (SD)	964, 1.39 (1.05)	471, 1.53 (1.11)	492, 1.26 (0.97)	<0.0001	421, 1.3 (1.0)	0.0005
Total cholesterol (mg/dl), mean (SD)	649, 157.6 (54.2)	318, 160.0 (59.0)	331, 155.2 (49.1)	0.2648	279, 157.8 (50.3)	0.6208
Triglyceride (mg/dl), mean (SD)	640, 106.2 (53.9)	316, 109.8 (56.7)	324, 102.7 (50.9)	0.0918	274, 103.5 (53.5)	0.1678
Peak creatine kinase (IU/L), mean (SD)	245, 232.2 (447.7)	108, 259.4 (412.6)	137, 210.8 (473.9)	0.4004	121, 222.5 (501.0)	0.5423
Peak CK- MB (IU/L), mean (SD)	175, 37.4 (76.0)	83, 39.1 (83.9)	92, 35.9 (68.6)	0.7831	88, 36.0 (70.1)	0.7960

* (t test) male versus female

** (t test) male versus female (excluding peripartum CM)

men. The higher rates of COPD in men may be related to higher rate of smoking. Occupations related to the development of COPD such as mining are also associated with men in Africa. Higher frequency of anemia in women may be related to menstruation as well as poorer nutrition.

In the Euro-HF survey, hypertension (67.4 vs. 59.4 %), diabetes (35 vs. 31.4 %) and anemia (18.5 vs. 12.4 %) were commoner in women [18]. As has been observed by other AHF registries [5 8 18], renal impairment is more frequent in men. This may be related to longer duration of CV risk factors such as hypertension, higher frequency of acute or chronic HF as well as higher burden of peripheral vascular disease in men compared to women.

Men also had higher frequency of severe symptoms (New York Heart Association (NYHA) classes III and IV),

Table 3 Echocardiography by gender (excluding PPCM)

Echocardiography	All ($n = 954$)	Men ($n = 469$)	Female (excluding peripartum CM) ($n = 413$)	OR (95 % CI) for categorical, mean difference (95 % CI) for continuous	P value (Chi square for categorical, t test for continuous)
LA diameter (mm), mean (SD)	47.1 (9.1)	47.8 (8.6)	47.2 (9.7)	−0.55 (−1.80, 0.71)	0.3922
LA area (mm^2), mean (SD)	2,776.1 (934.7)	2,880.2 (872.3)	2,703.8 (1,012.4)	−176.40 (−343.90, −8.93)	0.0390
IVSTd (mm), mean (SD)	11.2 (3.2)	11.7 (3.2)	11.2 (3.1)	−0.49 (−0.91, −0.06)	0.0250
PWTd (mm), mean (SD)	10.7 (2.9)	11.2 (2.9)	10.7 (2.7)	−0.50 (−0.88, −0.16)	0.0106
LVIDd (mm), mean (SD)	57.7 (11.6)	59.6 (11.4)	55.0 (11.7)	−4.55 (−6.08, −3.01)	<0.0001
LVIDs (mm), mean (SD)	46.1 (13.2)	48.2 (12.9)	42.5 (13.1)	−5.73 (−7.46, −4.00)	<0.0001
EA_ratio, mean (SD)	2.02 (2.33)	2.26 (3.00)	1.73 (1.16)	−0.53 (−0.89, −0.17)	0.0039
E-wave deceleration time (ms), mean (SD)	150.2 (92.9)	147.5 (98.2)	162.0 (92.0)	14.49 (0.22, 28.76)	0.0466
A-wave duration (ms), mean (SD)	126.1 (45.0)	124.3 (42.0)	132.8 (48.8)	8.53 (0.30, 16.77)	0.0423
Aortic stenosis (n/%)[a]	24 (2.6 %)	15 (3.3 %)	9 (2.2 %)	1.51 (0.65, 3.48)	0.3339
Aortic regurgitation (n/%)[a]	83 (8.9 %)	50 (10.9 %)	31 (7.6 %)	1.49 (0.93, 2.38)	0.0961
Mitral stenosis (n/%)[a]	51 (5.5 %)	19 (4.2 %)	32 (8.0 %)	0.51 (0.28, 0.91)	0.0206
Mitral regurgitation (n/%)[a]	366 (38.7 %)	178 (38.5 %)	170 (41.4 %)	0.89 (0.68, 1.17)	0.3932
Tricuspid regurgitation (n/%)[a]	266 (28.2 %)	136 (29.4 %)	114 (27.8 %)	1.08 (0.81, 1.45)	0.5947
Pericardial effusion (n/%)	31 (3.3 %)	13 (2.9 %)	16 (4.0 %)	0.71 (0.34, 1.51)	0.3748
Ejection fraction, mean (SD)	39.4 (16.2)	37.5 (15.7)	43.4 (16.1)	5.85 (3.69, 8.01)	<0.0001
LVEF ≥45 % (n/%)	317 (33.2 %)	134 (28.6 %)	180 (43.6 %)	0.52 (0.39, 0.68)	<0.0001
LVEF 30–44 % (n/%)	299 (31.3 %)	155 (33.1 %)	128 (31.0 %)	1.10 (0.83, 1.46)	
LVEF <30 % (n/%)	278 (29.1 %)	152 (32.4 %)	85 (20.6 %)	1.85 (1.36, 2.52)	

Subset of patients with echocardiography within 4 weeks prior to 2 weeks after admission

Mean (SD) or n (%) provided for continuous and categorical variable, respectively. t test used to compare genders for continuous variables and Chi square test provided for categorical comparisons

[a] Percentages reported as those with moderate/severe vs. mild/none

higher rates of left atrial dilatation, LVH and LV systolic and diastolic dysfunction.

On the other hand, HF with normal EF was reported more often in women. This is consistent with previous reports. In the Euro-HF survey II, HF with preserved EF was observed twice as often in women than in men [18]. In another report, HF with normal EF was noted in up to 73 % of women [22]. In high-income countries, this was attributed to higher frequency of hypertension and older age in women. This is not the case in our study. The reason for our observation may be related to higher burden of CV risk factors as well as advanced heart disease in men compared to women.

In terms of etiological risk factor for HF, except for valvular heart disease, all the other factors were more frequent in men. Higher burden of valvular heart disease in women has been reported by other workers [5, 18, 22]. This suggests that in men more emphasis should be placed on modification of risk factors while in women prevention of rheumatic heart diseases and improved nutrition should be addressed vigorously.

ECG abnormalities such as atrial fibrillation, ventricular extrasystoles and bundle-branch block were commoner in women while LVH, Q-waves and ST-T changes were more frequent in men.

The higher rates of arrhythmias especially atrial fibrillation in women may be related to the higher frequency of valvular heart disease [23, 24]. Hypertension and ischemic heart disease which are diagnosed more frequently in men may explain the higher burden of LVH and ST-T abnormalities in them [25–28].

On admission but not discharge, digitalis compounds were prescribed more in women, probably because of the higher prevalence of atrial fibrillation within this group. On the other hand, aspirin was prescribed more to men, possibly because of the greater frequency of ischemic changes on ECG. This picture has been documented by other workers [5, 8, 18].

Health outcomes such as length of stay (LOS), intra-hospital mortality rates, 30-day, 90-day and 180-day mortality were slightly higher in men compared to women. This, however, did not reach statistical significance. This is similar to the observation in the Japanese HF registry and

Table 4 Primary etiology by gender

Etiology	Total (n = 1,006)	Male (n = 494)	Female (n = 511)	Female (excluding peripartum CM) (n = 437)
Hypertensive CMP (n/%)	396 (40.4 %)	219 (45.3 %)	176 (35.6 %)	176 (41.8 %)
Idiopathic dilated CMP (n/%)	136 (13.9 %)	89 (18.4 %)	47 (9.5 %)	47 (11.2 %)
Rheumatic heart disease (n/%)	140 (14.3 %)	54 (11.2 %)	86 (17.4 %)	86 (20.4 %)
Ischemic heart disease (n/%)	77 (7.9 %)	48 (9.9 %)	29 (5.9 %)	29 (6.9 %)
Peripartum cardiomyopathy (n/%)	74 (7.7 %)	0	74 (15.0 %)	–
Pericardial effusion/tamponade (n/%)	47 (4.8 %)	25 (5.2 %)	22 (4.4 %)	22 (5.2 %)
HIV cardiomyopathy (n/%)	23 (2.4 %)	12 (2.5 %)	11 (2.2 %)	11 (2.6 %)
Endomyocardial fibrosis (n/%)	13 (1.3 %)	3 (0.6 %)	10 (2.0 %)	10 (2.4 %)
Other (n/%)	73 (7.5 %)	33 (6.8 %)	40 (8.1 %)	40 (9.5 %)

Table 5 Outcome variables according to gender

Outcome	All (n = 1,006)	Men (n = 494)	Women (n = 511)	P value	Female (excluding peripartum CM) (n = 437)	P value**
Length of hospital stay[a]	9.22 (9.29)	9.39 (10.37)	9.07 (8.14)	0.6081	9.00 (8.08)	0.5468
Intrahospital mortality rate[b]	42 (4.2 %)	24 (4.9 %)	18 (3.5 %)	0.2930	15 (3.4 %)	0.2817
All-cause mortality through 30 days[c]	54 (5.7 %)	30 (6.4 %)	24 (5.0 %)	0.3481	20 (4.9 %)	0.3311
All-cause mortality through 90 days[c]	115 (13.1 %)	59 (13.5 %)	56 (12.6 %)	0.6483	44 (11.7 %)	0.3914
All-cause mortality through 180 days[c]	151 (17.8 %)	77 (18.3 %)	74 (17.4 %)	0.6393	60 (16.6 %)	0.4399
All-cause readmission through 30 days[c]	24 (2.8 %)	12 (2.8 %)	12 (2.7 %)	0.9308	11 (2.9 %)	0.9293
All-cause readmission through 90 days[c]	111 (14.1 %)	56 (14.4 %)	55 (13.8 %)	0.7473	50 (14.7 %)	0.9866
All-cause readmission through 180 days[c]	157 (20.8 %)	74 (19.9 %)	83 (21.8 %)	0.6405	77 (23.6 %)	0.3221
All-cause death or readmission through 60 days[c]	138 (15.6 %)	73 (16.6 %)	65 (14.5 %)	0.3732	54 (14.2 %)	0.3208

[a] Mean (SD). P value provided from t test

[b] N (%). P value provided from χ^2 test

[c] N (KM %). P value provided from log-rank test

* Male versus female

** Male versus female (excluding peripartum CM)

in the Euro-HF survey II [18] and the United States registries [5, 29]. However, adjusted mortality was better in women in the AHEAD registry [19] and some other studies [30, 31].

Limitations

The fact that our registry was conducted in tertiary hospitals may indicate that our findings may not reflect what happens in the secondary or primary healthcare services in these African countries. The data may not, therefore, be inclusive and could only represent what happens in these tertiary institutions.

Confirmation of final diagnoses as well as echocardiographic parameters was done locally which is also a limitation. Invasive cardiac procedures were not available in many of the centers. Many cases of ischemic heart disease may have been missed. In addition, standard cardiac procedures performed in these subjects were not captured by our study.

In conclusion, there are unique gender differences in the presentation of HF in sub-Saharan Africa. Male subjects are generally older than women which are the reverse in high-income countries where women are about 6 years older than men. Before the age of 50 years, HF was diagnosed more often in women, but thereafter in men. Except for valvular heart disease and peripartum cardio-

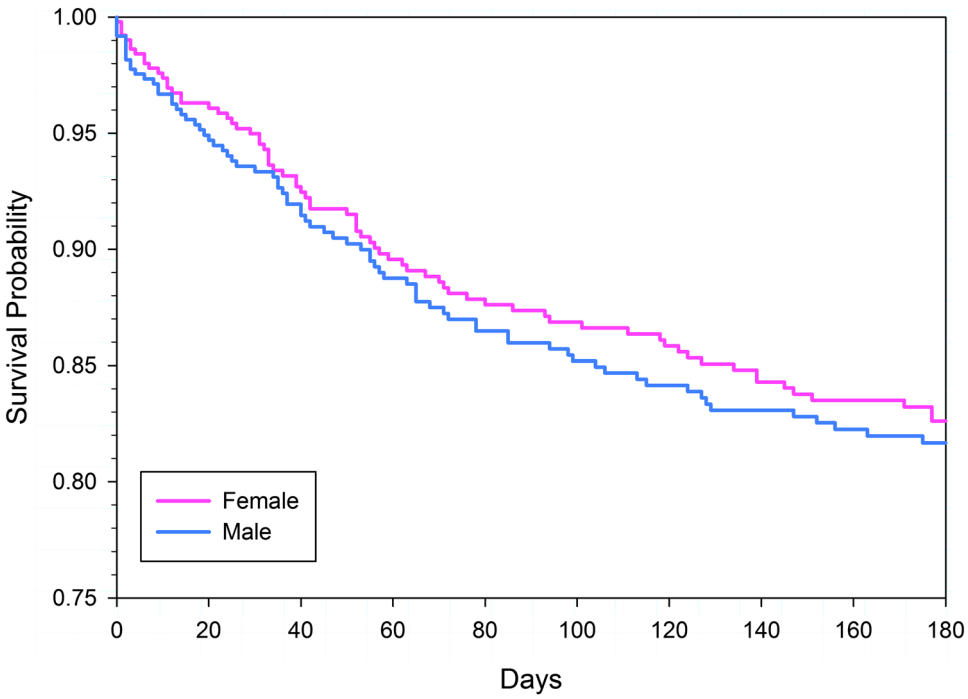

Fig. 3 Kaplan–Meier survival plot for outcome death to day 180 comparing the two genders

myopathy, other etiological risk factors were commoner in men. Men also had higher frequency of systolic HF, renal dysfunction, but lower frequency of anemia than women. Drug prescriptions at admission or discharge were relatively similar. Outcomes were slightly worse in men, but these were not statistically significant.

These findings call for individualized care for patients in the region especially the male gender that is likely to have multiple cardiovascular risk factors.

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Conflict of interest None.

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