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# WEST AFRICAN JOURNAL OF MEDICINE

## Clinical Correlates of Common Acute Heart Failure Syndrome

### Corrélats Cliniques de l'Insuffisance Cardiaque Aiguë Commune

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**ABSTRACT**

**BACKGROUND:** Acute heart failure (AHF) is a medical emergency with different clinical syndromes / presentations. The clinical syndrome guides management decisions, and stratifies prognosis. The most common clinical syndrome of AHF and its associates are not established in our practice.
**AIM:** To determine the most common clinical syndrome of AHF and its correlates.
**MATERIALS AND METHODS:** This was a prospective cross-sectional study of hospitalized AHF patients. It was conducted in the medical wards and emergency department of a tertiary hospital. Data on socio-demographic and clinical variables were obtained. Relevant data from electrocardiography and echocardiography were also documented. The data were managed as appropriate and p values less than 0.05 were considered statistically significant.
**RESULTS:** AHF constituted 159 (15.8%) of 1,006 medical hospitalizations. The mean age was 63.21years, and males constituted 84 (52.8**%**). The mean left ventricular ejection fraction and systolic blood pressure were 36.83% and 119.81mmHg, respectively. The frequency of acute decompensated chronic heart failure (ADCHF) and acute de novo HF (ADNVHF) were 120 (75.5%) and 39 (24.5%), respectively. Precipitating factors and comorbidities were detected in 111 (69.8%) and 84 (52.6%), respectively. The association of AHF with comorbidities, precipitants, and blood pressure gave p values of 0.000, 0.012, and 0.000, respectively.
**CONCLUSION:** AHF constitutes 15.8% of medical hospitalizations in our center. Acute decompensated chronic heart failure (ADCHF) is the most common AHF syndrome. It is associated with comorbidities, precipitating factors, and lower blood pressure. It should therefore be the first consideration in any patient presenting with AHF in the emergency. **WAJM 2023; 40(1): 11–16.**

**Keywords:** Acute heart failure, Clinical syndromes.

**RÉSUMÉ**

**CONTEXTE:** L'insuffisance cardiaque aiguë (ICA) est une urgence médicale avec différents syndromes/présentations cliniques. Le syndrome clinique guide les décisions de gestion et stratifie le pronostic. Le syndrome clinique le plus courant de l'AHF et ses associés ne sont pas établis dans notre pratique.
**OBJECTIF:** déterminer le syndrome clinique le plus fréquent de l'AHF et ses corrélats.
**MATÉRIEL ET MÉTHODES:** Il s'agissait d'une étude prospective transversale de patients hospitalisés pour une FHA. Elle a été menée dans les services de médecine et d'urgence d'un hôpital tertiaire. Des données sur les variables socio-démographiques et cliniques ont été obtenues. Les données pertinentes de l'électrocardiographie et de l'échocardiographie ont également été documentées. Les données ont été gérées de manière appropriée et les valeurs p inférieures à 0,05 ont été considérées comme statistiquement significatives.
**RÉSULTATS:** L'AHF a constitué 159 (15,8%) des 1.006 hospitalisations médicales. L'âge moyen était de 63,21 ans, et les hommes constituaient 84 (52,8%). La fraction d'éjection ventriculaire gauche et la pression artérielle systolique moyennes étaient respectivement de 36,83 % et de 119,81 mmHg. La fréquence de l'insuffisance cardiaque chronique décompensée aiguë (ICCA) et de l'insuffisance cardiaque de novo aiguë (ICNA) était de 120 (75,5 %) et 39 (24,5 %), respectivement. Les facteurs précipitants et les comorbidités ont été détectés chez 111 (69,8%) et 84 (52,6%), respectivement. L'association de l'AHF avec les comorbidités, les facteurs précipitants et la pression artérielle a donné des valeurs p de 0,000, 0,012 et 0,000, respectivement.
**CONCLUSION:** L'AHF constitue 15,8% des hospitalisations médicales dans notre centre. L'insuffisance cardiaque chronique décompensée aiguë (ICCA) est le syndrome d'AHF le plus fréquent. Il est associé à des comorbidités, des facteurs précipitants et une pression artérielle basse. Il devrait donc être la première considération chez tout patient se présentant aux urgences avec une IAH. **WAJM 2023; 40(1): 11–16.**

**Mots clés:** Insuffisance Cardiaque aiguë, Syndromes cliniques.

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## INTRODUCTION

Acute heart failure (AHF) is the rapid onset or worsening of symptoms and signs of heart failure (HF) which often results in hospitalization.[1,2] It is a heterogenous clinical syndrome with different pathophysiologic mechanisms and diverse clinical presentations. Despite advances in the management of HF, post-discharge outcomes remain poor with a rehospitalization rate of $\geq$ 50% within 6 months of discharge.[3,4] A 30-day and 1-year post-discharge mortality of 15% and 50%, respectively, have been reported.[5,6] Hospitalization for AHF contributes significantly (75%) to the economic burden of HF management.[7]

Classification of AHF into distinct clinical syndromes is a challenge because of the heterogeneous patient population. It was initially classified based on the underlying etiology/precipitant, but multiple etiologies can co-exist in a case, while another may have no detectable etiology.[8] Systolic blood pressure and hemodynamic parameters on admission (presence of congestion and or peripheral hypoperfusion) have also been used to classify HF, but each has its limitation.[9] Nevertheless, AHF can broadly be categorized into acute de novo (ADNV) which is the first diagnosis of HF, or acute decompensation of chronic HF (ADCHF) which is an exacerbation of a previously diagnosed case.[10]

The most common clinical syndrome of AHF and its associates are not well documented in our locale because the clinical presentations of AHF have not been well investigated. Ogah et al.[11] described the profile, characteristics and outcomes of contemporary AHF patients, while Sani et al.[12] assessed the clinical response to therapy during the course of hospitalization. But the most common clinical syndrome of AHF has not been well documented in Nigeria. Knowledge of the most common clinical syndrome of AHF will expedite the initial evaluation and decision-making in the emergency department. The prevalence of AHF among other medical emergencies also provides useful statistics for resource allocation and research. We hypothesized that acute decompensation of chronic heart failure (ADCHF) is the most common clinical syndrome of acute heart failure according to information from prior clinical observation.

Thus, the aim of this study was to determine the most common clinical syndrome of AHF and its correlates.

## MATERIALS AND METHODS

This was a prospective study of adults $\geq$ 18 years with AHF. It was conducted over 15 months in the medical emergency and wards of a tertiary health facility. The protocol was reviewed and approved by the hospital's research and ethics committee, and a protocol number (ADM/E22/A/VOL.VII/14744) was assigned. The study was conducted in accordance with the ethical principles of the Helsinki declaration.[13] The minimum sample size was determined with the Fisher statistical formula $Z^2P$ (1–P)/d.[2] A prevalence of 11% was used[14] with a confidence interval of 95% (1.96) and a degree of accuracy of 0.05. This gave a minimum sample size of 150.

### Inclusion Criteria

Adult patients with AHF who gave consent were enrolled into the study.

### Exclusion Criteria

Adult patients with AHF who refused to give consent were excluded.

Informed consent was obtained from each participant and those who met the inclusion criteria were consecutively enrolled into the study. Data were collected with a standard case report form. The age, gender, history of hypertension and diabetes mellitus were documented. The New York Heart Association (NYHA) class was determined and blood pressure was measured with a standard mercury sphygmomanometer. The etiology of HF, comorbidities, and precipitants of acute decompensation were documented. The duration of hospital stay was also documented.

A standard 12-lead ECG was performed with a Carl Novel ECG machine to determine the cardiac rhythm. Each subject had trans-thoracic echocardiography in order to determine to determine the left ventricular ejection fraction (LVEF), confirm the etiology of HF, and exclude other cardiac morbidities. The left ventricular internal dimensions in systole and diastole were measured based on the American Society of Echocardiography (ASE) convention, and LVEF was computed.

### Definition of Terms

*Heart failure:* HF was diagnosed in the presence of 2 major features or, 1 major and 2 minor features of Framingham's criteria for the diagnosis of HF.[15]

*Acute Decompensation of Chronic Heart Failure (ADCHF):* Worsening of HF symptoms in a previously stable HF patient.[10]

*Acute de Novo Heart Failure (ADNVHF):* First diagnosis of HF.[10]

*Hypertensive Heart Disease (HHD):* Left ventricular hypertrophy, with or without ventricular dysfunction, and arrhythmias in the absence of any other disease that can explain these changes. These may occur independently or in various combinations.[16]

*Rheumatic Heart Disease (RHD):* Pathologic regurgitation and/or stenosis in the presence of at least 2 of the morphologic features of RHD: focal or generalized valvular thickening, restricted leaflet mobility, and abnormal sub-valvular (chordae) thickening of the affected valves.[17]

*Cardiomyopathy: Dilated Cardiomyopathy:* Left or biventricular dilatation with global systolic dysfunction in the absence of coronary artery disease, hypertension or valvular disease.[18]

*Hypertrophic Cardiomyopathy:* Left ventricular hypertrophy $\geq$ 15mm (end diastolic diameter) in one or more myocardial segments that is not explained by loading conditions.[19]

*Restrictive Cardiomyopathy:* Normal sized ventricular chambers, with or without wall hypertrophy, and marked biatrial enlargement with restrictive diastolic dysfunction.[20]

*Cor pulmonale:* Right ventricular hypertrophy or dilation caused by

primary respiratory disease with pulmonary hypertension in the absence of left ventricular dysfunction.

**Pneumonia:** Fever, cough, and infiltrates on chest radiograph.[21]

**Atrial Fibrillation:** An irregularly irregular pulse. Absent P waves, irregular QRS complexes and fibrillar baseline on electrocardiography.[22]

**Sepsis:** Two or more of the following: Temperature >38°C or <36°C, heart rate >90/min, respiratory rate >20/min, white blood cell count >12/ 000/mm$^3$ or <4000/mm$^3$ or >10% immature bands.[23]

**Diabetes Mellitus:** Self-reported or fasting blood glucose of $\geq$ 7mmol/l or random blood glucose $\geq$ 11.1mmol/l. [24]

**Renal Impairment:** Estimated glomerular filtration rate < 60      ml/min/1.73m$^2$. [25]

**Anaemia:** Hemoglobin (Hb) levels <12.0 g/dL in women and <13.0 g/dL in men.[26]

**Chronic Obstructive Pulmonary Disease:** Forced expiratory volume in one second / forced vital capacity ratio of less than 0.70 on spirometry.[27]

**Heart Failure with Reduced Ejection Fraction:** Left ventricular ejection fraction $\leq$40%.[28]

**Heart failure with mildly reduced ejection fraction:** Left ventricular ejection fraction of 41% to 49%.[28]

**Heart failure with preserved ejection fraction:** Left ventricular ejection fraction $\geq$ 50%.[28]

Data were analyzed with statistical package for the social sciences (SPSS) version 21 (SPSS Inc Chicago, IL, USA. Normally distributed and skewed continuous data were summarized as means and medians, respectively. Independent (students) t test and one-way ANOVA were used to compare continuous variables in 2 and more than 2 groups, respectively. The frequencies of categorical variables were derived and associations determined with Chi-squared test. P values less than 0.05 were considered statistically significant.

## RESULTS

AHF constituted 159 (15.8%) of the 1,006 medical hospitalizations. The median age was 63.21yrs, and 84 (52.8%) were males while 75 (47.2%) were females. Ninety-six (60.4%) were elderly while 48 (30.2%) and 15 (9.4%) were middle-aged and young, respectively. Seventy-two (45.3%) had a history of hypertension. One hundred and forty-four (90.6%) were in NYHA class IV while 15 (9.4%) were in class III. Precipitants of acute decompensation were detected in one hundred and eleven (69.8%) while 48 (30.2 %) had no identifiable precipitants. The precipitating factors were pneumonia (66; 59.4%), poor drug adherence (45; 40.5%), arrhythmias (24; 15.1%), and sepsis (18; 16.2%). The frequencies of the etiologies of HF were hypertensive heart disease (HHD) 105 (66%), valvular heart disease 30 (18.9%), cardiomyopathies 18 (11.3%), and cor pulmonale 6 (3.8%). Co-morbidities were detected in 84 (52.8%) subjects and they included diabetes mellitus (27; 17.0%), renal impairment (23; 14.5%), COPD (12; 7.5%), and anemia (24; 15.1%). Heart failure with preserved, mildly reduced, and reduced ejection fraction constituted 39(24.5%), 36(22.6%) and 84 (52.8%), respectively. One hundred and eleven subjects (69.8%) had normal blood pressure while 27 (17.0%) and 21 (13.2%) had high and low blood pressure, respectively.

**Table 1: Demographic and Clinical Variables of Heart Failure Subjects**

| Variable | Mean | Std. Deviation |
|---|---|---|
| Age (years) | 63.21 | 15.33 |
| SBP (mmHg) | 119.81 | 21.21 |
| DBP (mmHg) | 80.57 | 15.27 |
| MAP (mmHg) | 93.65 | 16.61 |
| LVIDD (cm) | 5.54 | 1.42 |
| LVIDS (cm) | 4.56 | 1.40 |
| LVEF (%) | 36.83 | 13.73 |
| Days on admission | 6.26 | 3.31 |

*SBP, Systolic blood pressure; DBP, Diastolic blood pressure; MAP, Mean arterial blood pressure; LVIDD, Left ventricular internal diameter in diastole; LVIDS, Left ventricular internal diameter in systole, LVEF, Left ventricular ejection fraction.*



■ ACUTE DECOMPENSATED CHRONIC HEART FAILURE
■ ACUTE DENOVO HEART FAILURE
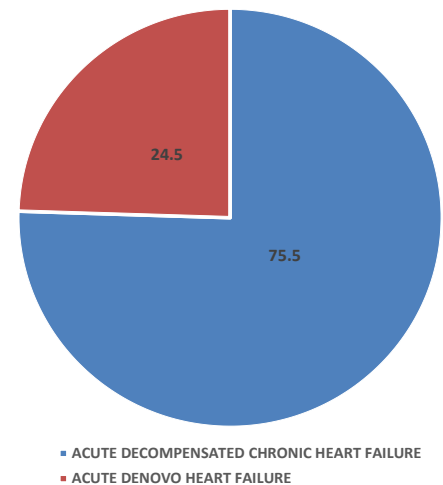
**Fig. 1: Frequency of Acute Heart Failure Syndromes.**

## DISCUSSION

This study has revealed that acute decompensated chronic heart failure (ADCHF) is the most common clinical presentation of AHF in our practice (Figure 1). This is not surprising because the rising prevalence of HF in the population has resulted in more HF hospitalizations. Patient-related factors such as non-compliance with medications/diet restrictions, poor self-monitoring and follow-up are also contributory factors.[29] The much lower prevalence of acute de novo HF (ADNVHF) is expected because ADNVHF represents the incidence of HF which is usually lower than prevalence. Besides, the diagnosis of HF is usually made in peripheral centers, before referral to tertiary facilities like the study center. The high prevalence of ADCHF indicates poor health - related quality of life in HF patients and may reflect suboptimal care in both out- and in-patient settings. Large scale HF registries such as OPTIMISE-HF and EHFS II HF in high income countries have also reported similar findings.[30,31] Acute exacerbations of HF is therefore a universal feature of HF in both high- and low-income countries.

The  mean age in the elderly range (Table 1) is surprising because previous HF studies reported a  lower mean in the middle age group.[32,33] The increasing proportion of elderly persons in our population can explain this trend.  HF is also a leading cause of hospitalization in the elderly.[34,35] The mean left ventricular

ejection fraction of 36.8% concurs with results from previous studies which reported heart failure with reduced ejection fraction as the most common subtype of heart failure in our population.[36] The observed lower mean blood pressure in ADCHF subgroup (Table 2) is expected because ADCHF is chronic and blood pressure, which is an index of cardiac output, declines over time with systolic function. Compensatory mechanisms such as increased total peripheral resistance which try to maintain blood pressure also wane over time. Besides, patients with ADCHF are already on HF medications which have a blood pressure lowering effect. The significantly lower mean LVEF in ADCHF is not surprising because the disease process in ADCHF is long-standing as mentioned above and systolic function usually declines as HF progresses.

The association of ADCHF with comorbidities (Table 3) is not surprising because HF is known to coexist with other chronic diseases which may be risk factors or complications of HF itself. Nieminen *et al.,*[37] in the Euro. Heart Failure Survey II (EHFS II), also observed that ADCHF is associated with comorbidities compared with acute de novo HF.

The association between ADCHF and precipitants corroborates the established role of acute precipitants (initiating factor) in the pathophysiology of AHF.[38] The lack of association between AF and AHF syndromes (Table 3) is not unexpected because AF can be the precipitant factor in both acute de novo or established HF. The duration of hospitalization was significantly longer in ADCHF compared with ADNV because patients with ADCHF are associated with more co-morbidities and complications which are usually challenging to management.

One of the limitations is that patients categorized as ADNV may have had preexisting cardiac dysfunction that had not been detected. Late presentation to hospital can account for this limitation. Also, the difference in the number of ADCHF and ADNV may have affected the comparisons. These limitations notwithstanding, the main objective of this study which was to determine the most common clinical syndrome of AHF and its correlates has been achieved.

The implications for further research include determination of common precipitants of ADHF, and an assessment of compliance with both pharmacological and non-pharmacological self-care practices for HF. The quality of care delivered to

**Table 2: Comparison of Means between Acute Decompensated Chronic Herat Failure and Acute Denovo Heart Failure**

| Variable | ADCHF | ADNVHF | P |
|---|---|---|---|
| Age (years) | 65.48 ± 14.72 | 56.23 ± 15.26 | 0.001 |
| SBP (mmHg) | 113.00 ± 17.85 | 140.77 ± 16.60 | 0.000 |
| DBP (mmHg) | 76.75 ± 15.13 | 92.31 ± 8.10 | 0.000 |
| MAP (mmHg) | 88.83 ± 15.35 | 108.45 ± 10.58 | 0.000 |
| LVIDD (cm) | 5.12 ± 0.61 | 5.39 ± 0.92 | 0.140 |
| LVIDS (cm) | 3.89 ± 1.04 | 4.34 ± 1.01 | 0.022 |
| LVEF (%) | 44.12 ± 9.01 | 35.77 ± 10.9 | 0.000 |
| Days on admission | 7.40 ± 2.87 | 5.77 ± 1.78 | 0.012 |

*SBP, Systolic blood pressure; DBP, Diastolic blood pressure; MAP, Mean arterial blood pressure; LVIDD, Left ventricular internal diameter in diastole; LVIDS, Left ventricular internal diameter in systole, LVEF, Left ventricular ejection fraction.*

**Table 3: Comparison of Frequencies of Comorbidities and Precipitants between Acute Heart Failure Syndromes**

| Variables | Categories | ADCHF | ADNVHF | P |
|---|---|---|---|---|
| Age group | Elder | 81(84.4) | 15(15.6) | 0.005 |
|  | Middle age | 30(62.5) | 18(37.5) |  |
|  | Young | 9(60.0) | 6(40.0) |  |
| Gender | Female | 57(76.0) | 18(24.0) | 0.884 |
|  | Male | 63(75.0) | 21(25.0) |  |
| Blood pressure | High | 6(22.2) | 21(77.8) | 0.000 |
|  | Low | 21(100.0) | 0(0.0) |  |
|  | Normal | 93(83.8) | 18(16.2) |  |
| Comorbidity | Non identified | 45(60.0) | 30(40.0) | 0.000 |
|  | Identified | 75(89.3) | 9(10.7) |  |
| Precipitant | Detected | 90(81.1) | 21(18.9) | 0.012 |
|  | None detected | 30(62.5) | 18(37.5) |  |
| COPD | COPD | 9(75.0) | 3(25.0) | 0.968 |
|  | No COPD | 111(75.5) | 36(24.5) |  |
| Diabetes mellitus | Diabetes | 21(77.8) | 6(22.2) | 0.489 |
|  | No diabetes | 99(75.0) | 33(25.0) |  |
| Renal Impairment | No renal impairment | 99(72.8) | 37(27.2) | 0.137 |
|  | Renal impairment | 20(86.9) | 3(13.1) |  |
| Pneumonia | Absent | 60(71.4) | 24(28.6) | 0.210 |
|  | Present | 60(80.0) | 15(20.0) |  |
| Sepsis | No sepsis | 111(78.7) | 30(21.3) | 0.150 |
|  | Sepsis | 9(50.0) | 9(50.0) |  |
| Anemia | Anemia | 21(87.5) | 3(12.5) | 0.198 |
|  | No Anemia | 99(73.3) | 36(26.7) |  |
| Atrial fibrillation | Absent | 101(72.6) | 38(27.4) | 0.131 |
|  | Present | 19(79.2) | 5(20.8) |  |

*ADCHF, Acute decompensation of chronic heart failure; ADNVHF, Acute de novo heart failure; HFrEF, Heart failure with reduced ejection fraction; HFmrEF, Heart failure with mildly reduced ejection fraction; HFpEF, Heart failure with preserved ejection fraction; COPD, Chronic obstructive pulmonary disease.*

hospitalized and ambulatory HF patients also needs to be evaluated.

In conclusion, AHF is a medical emergency and it constitutes 15.8% of medical hospitalizations in our center. Acute decompensated chronic heart failure (ADCHF) is the most common clinical syndrome. It should therefore be the first consideration in any patient presenting with AHF in the emergency. ADCHF is associated with comorbidities, precipitants of acute decompensation, and lower blood pressure compared with acute de novo HF. These factors should therefore be actively sought for during initial evaluation in the emergency. The management of ambulatory HF patients in the clinics should also be optimized to reduce the repeated episodes of HF exacerbations and consequent hospitalizations.

## REFERENCES

1. McMurray JJ, Adamopoulos S, Anker SD, Auricchio A, Böhm M, Dickstein K, *et al*. ESC Committee for Practice Guidelines. ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC. *Eur Heart J.* 2012; **33:** 1787–847.

2. Gheorghiade M, Filippatos G, Felker M. Diagnosis and management of acute heart failure syndromes. In: Braunwald's heart disease: a textbook of cardiovascular medicine. 9th ed. Philadelphia: Elsevier, Saunders; 2012.

3. Cleland JG, Swedberg K, Follath F, Komajda M, Cohen-Solal A, Aguilar JC, *et al.* For the Study Group on Diagnosis of the Working Group on Heart Failure of the European Society of Cardiology. The Euro Heart Failure Survey Programme: A survey on the quality of care among patients with heart failure in Europe, part 1: patient characteristics and diagnosis. *Eur Heart J.* 2003; **24:** 442–463.

4. Desai AS, Stevenson LW. Rehospitalization for heart failure: predict or prevent? *Circulation.* 2012; **126:** 501–506.

5. Donkor A, Cleland J, McDonagh T, Hardman S. National Heart Failure Audit 2016 11.07.2016.

6. Felker GM, Leimberger JD, Califf RM, Cuffe MS, Massie BM, Adams KF Jr, *et al.* Risk stratification after hospitalization for decompensated heart failure. *J Card Fail.* 2004; **10:** 460–466.

7. Stewart S, Jenkins A, Buchan S, McGuire A, Capewell S, McMurray JJ. The current cost of heart failure to the National Health Service in the UK. *Eur J Heart Fail.* 2002; **4:** 361–371.

8. Nieminen MS, Bohm M, Cowie MR, Drexler H, Filippatos GS, Jondeau G, *et al*. Executive summary of the guidelines on the diagnosis and treatment of acute heart failure: the Task Force on Acute Heart Failure of the European Society of Cardiology. *Eur Heart J.* 2005; **26:** 384–416.

9. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, *et al.* 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *Eur Heart J.* 2016; **37:** 2129–2200.

10. Gheorghiade M, Zannad F, Sopko G, *et al.* Acute heart failure syndromes: current state and framework for future research. *Circulation.* 2005; **20:** 3958–3968.

11. Ogah OS, Stewart S, Falase AO, Akinyemi JO, Adegbite GD, Alabi AA, *et al*. Contemporary profile of acute heart failure in Southern Nigeria: data from the Abeokuta heart failure clinical registry. *JACC Heart Fail.* 2014*;* **2:** 250–259.

12. Sani MU, Cotter G, Davison BA, Mayosi BM, Damasceno A, Edwards C, *et al.* Signs of heart Failure at Admission and Discharge and Outcomes in the Sub-Saharan Acute Heart Failure (THESUS-HF) Registry. *Journal of Cardiac Failure.* 2017; **23:** 739–742.

13. World Medical Association "Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects". *JAMA*. 2013; **310:** 2191–2194.

14. Adeoti AO, Ajayi EA, Ajayi AO, Dada SA, Fadare JO, Akolawole M. Pattern and outcome of medical admissions in Ekiti State University Teaching Hospital, Ado-Ekiti – A 5year review. *Am J Med Med Sci.* 2015; **5:** 92–98.

15. Pinsky KK, Kannel JL, Levy WB, D The epidemiology of heart failure: The Ho Framingham Study. *J Am Coll Cardiol.* 1993; **22:** 6A–13A.

16. Frohlich ED, Apstein C, Chobanian AV, Devereux RB, Dustan HP, Dzau V, *et al* The heart in hypertension. *N Engl J Med.* 1992; **327:** 998–1008.

17. Reményi B, Wilson N, Steer A, Ferreira B, Kado J, Kumar K, *et al.* World Heart Federation criteria for echo-cardiographic diagnosis of rheumatic heart disease – An evidence-based guideline. *Nature reviews. Cardiology*, 2012; **9:** 297–309.

18. McKenna WJ, Maron BJ, Thiene G. Classification, epidemiology, and global burden of cardiomyopathies. *Circ Res.* 2017; **121:** 722–730.

19. Authors/Task Force members, Elliott PM, Anastasakis A, Borger MA, Borggrefe M, Cecchi F, Charron P, *et al.* 2014 ESC Guidelines on diagnosis and management of hypertrophic cardiomyopathy: the Task Force for the Diagnosis and Management of Hypertrophic Cardiomyopathy of the European Society of Cardiology (ESC). *Eur Heart J.* 2014; **35:** 2733–2779.

20. Nihoyannopoulos P, Dawson D, Restrictive cardiomyopathies, *European Journal of Echocardio-graphy*, 2009; **10:** iii23–iii33.

21. Niederman MS, Mandell LA, Anzueto A, Bass JB, Broughton WA, Campbell GD, *et al.* American Thoracic Society. Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy and prevention. *Am J Respir Crit Care Med.* 2001; **163:** 1730–1754.

22. Dewar RI, Lip GY. Guidelines Development Group for the NICE clinical guideline for the management of atrial fibrillation. Identification, diagnosis and assessment of atrial fibrillation. *Heart.* 2007; **93:** 25–28.

23. American College of Chest Physicians/ Society of Critical Care Medicine Consensus Conference: definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. *Crit Care Med.* 1992; **20:** 864–874.

24. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care.* 1997; **20:** 1183–1197.

25. Levey AS, Stevens LA, Schmid CH, Lucy ZY, Castro AF, Feldman HI, *et al.* A new equation to estimate glomerular filtration rate. *Ann Intern Med.* 2009; **150:** 604–612.

26. World Health Organization (WHO). Iron Deficiency Anaemia: Assessment, Prevention and Control. A Guide for

Programme Manager. Geneva, Switzerland: WHO; 2001.

27. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD). 2011. http://www.goldcopd.org/guidelines-global-strategy-for-diagnosis-management.html. 'Last accessed September 16, 2013.

28. Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE, Drazner MH, *et al.* 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Journal of the American College of Cardiology.* 2013; **62:** e147–239.

29. Tsuyuki RT, McKelvie RS, Arnold JMO, *et al.* Acute Precipitants of Congestive Heart Failure Exacerbations. *Arch Intern Med.* 2001; **161:** 2337–2342.

30. O'Connor CM, Abraham WT, Albert NM, Clare R, Gattis Stough W, Gheorghiade M, *et al.* Predictors of mortality after discharge in patients hospitalized with heart failure: an analysis from the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients with Heart Failure (OPTIMIZE-HF). *Am Heart J.* 2008; **156:** 662–673.

31. Maggioni AP, Dahlstrom U, Filippatos G, Chioncel O, Crespo Leiro M, Drozdz J, *et al.* EURObservational Research Programme: regional differences and 1-year follow-up results of the Heart Failure Pilot Survey (ESC-HF Pilot) *Eur J Heart Fail.* 2013; **15:** 808–817.

32. Ogunmodede JA, Kolo PM, Bojuwoye MO, Dele-Ojo BF, Ogunmodede AJ, Omotoso AB. Characteristics of patients with acute heart failure in North Central Nigeria. *Research Journal of Health Sciences.* 2021; **9:** 221–235.

33. Ojji DB, Alfa J, Ajayi SO, Mamven MH, Falase AO. Pattern of heart failure in Abuja, Nigeria: an echocardiographic study. *Cardiovasc J Afr.* 2009; **20:** 349–352.

34. Mosterd A, Hoes AW. Clinical epidemiology of heart failure. *Heart.* 2007; **93:** 1137–1146.

35. Mebazaa A, Yilmaz MB, Levy P, Ponikowski P, Peacock WF, Laribi S, *et al.* Recommendations on pre-hospital and early hospital management of acute heart failure: a consensus paper from the Heart Failure Association of the European Society of Cardiology, the European Society of Emergency Medicine and the Society of Academic Emergency Medicine – short version. *Eur Heart J.* 2015; **36:** 1958–1966.

36. Adebayo SO, Olunuga TO, Durodola A, Ogah OS. Heart failure: Definition, classification, and pathophysiology – A mini-review. *Nig J Cardiol.* 2017; **14:** 9–14.

37. Nieminen MS, Brutsaert D, Dickstein K, Drexler H, Follath F, Harjola VP, *et al.* EuroHeart Failure Survey II (EHFS II): a survey on hospitalized acute heart failure patients: description of population. *Eur Heart J.* 2006; **27:** 2725–2736.

38. Damasceno, A., Cotter, G., Dzudie, A., Sliwa, K. and Mayosi, B.M. Heart Failure in Sub-Saharan Africa: Time for Action. *Journal of the American College of Cardiology.* 2007; **50:** 1688-1693.