UKR Journal of Medicine and Medical Research (UKRJMMR)
Homepage: https://ukrpublisher.com/ukrjmmr/
Email: submit.ukrpublisher@gmail.com
Volume 2, Issue 4, July-August 2026
ISSN: 3107-5061 (Online)

Seasonal and Gender Variations in Echocardiographic Referral Indications among Patients Undergoing Cardiac Evaluation in Southern Nigeria: A Retrospective Cross-Sectional Study

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DOI: *https://doi.org/10.5281/zenodo.21201756*

Article History
Original Research Article
Received: 10-05-2026
Accepted: 13-06-2026
Published: 05-07-2026

Citation: Ule, A. A., Osaretin, J. O., & Okparayote, L. (2026). *Seasonal and gender variations in echocardiographic referral indications among patients undergoing cardiac evaluation in Southern Nigeria: A retrospective cross-sectional study. UKR Journal of Medicine and Medical Research, 2*(4), 3-6.

Abstract

Introduction
Cardiovascular diseases (CVDs) represent the leading cause of death globally, accounting for approximately 20.5 million deaths annually and posing a growing public health challenge in low- and middle-income countries. In sub-Saharan Africa, rapid urbanization, population aging, changing lifestyles, and increasing prevalence of cardiovascular risk factors have contributed to a rising burden of hypertension, ischemic heart disease, heart failure, and cardiomyopathies

Aims
To assess the impact of gender and seasonal variation on indications for echocardiography

Methods
This retrospective cross-sectional study analyzed echocardiographic referral records of 381 patients undergoing transthoracic echocardiography in Southern Nigeria. Data collected included gender, season of presentation, and clinical indications for referral

Results
A total of 381 patients were included, comprising 292 males (76.6%) and 89 females (23.4%). Referrals were slightly higher during the rainy season (53.0%) than the dry season (47.0%). The most common indications for echocardiography were fitness assessment (29.1%), hypertensive heart disease (26.0%), hypertension (15.2%), and ischemic heart disease (10.0%).

Conclusion
Gender significantly influences clinical indications for echocardiographic referral in Southern Nigeria, whereas seasonal variation appears to exert minimal effect on referral patterns. Hypertension-related cardiovascular disorders remain the predominant disorder induced reason for echocardiographic evaluation

Keywords: *Echocardiography; Cardiovascular Disease; Hypertensive Heart Disease; Gender.*

INTRODUCTION

Cardiovascular diseases (CVDs) represent the leading cause of death globally, accounting for approximately 20.5 million deaths annually and posing a growing public health challenge in low- and middle-income countries (Virani *et al.,* 2023). In sub-Saharan Africa, rapid urbanization, population aging, changing lifestyles, and increasing prevalence of cardiovascular risk factors have contributed to a rising burden of hypertension, ischemic heart disease, heart failure, and cardiomyopathies (Mensah *et al.*, 2019).

Echocardiography has become an indispensable component of contemporary cardiovascular practice because of its

ability to provide comprehensive, non-invasive evaluation of cardiac anatomy, ventricular function, valvular pathology, and hemodynamic status. In Nigeria, the expansion of echocardiographic services has significantly enhanced the diagnosis and management of hypertensive heart disease, which remains the most common form of acquired cardiovascular disease among adults.

Nigeria experiences two major climatic seasons: the rainy season and the dry season. In Southern Nigeria, the rainy season typically extends from April to October and is characterized by increased rainfall and humidity, while the dry season occurs between November and March and is associated with lower humidity and Harmattan winds (Odekunle, 2004; NiMet, 2023). Seasonal changes have been shown to influence cardiovascular morbidity and mortality through alterations in ambient temperature, physical activity patterns, blood pressure variability, and healthcare-seeking behavior (Stewart *et al*., 2017).

Gender differences in cardiovascular disease presentation and healthcare utilization have also been documented. Men and women differ in their cardiovascular risk profiles, symptom presentation, disease progression, and referral patterns, factors that may influence indications for echocardiographic evaluation (Manghera, P. S. and None, J. L. 2025).

Despite the increasing utilization of echocardiography in Nigeria, limited information exists regarding demographic and seasonal determinants of referral patterns. Understanding these relationships may facilitate better resource allocation, workforce planning, and cardiovascular disease surveillance. Therefore, this study aimed to evaluate the association between gender, seasonality, and clinical indications for echocardiographic assessment among patients undergoing cardiac evaluation in Southern Nigeria.

AIMS

To assess the impact of gender and seasonal variation on indications for echocardiography

METHODS

This retrospective cross-sectional study analyzed echocardiographic referral records of 381 patients undergoing transthoracic echocardiography in Southern Nigeria. Data collected included gender, season of presentation, and clinical indications for referral. Seasons were categorized as rainy and dry according to the Nigerian climatic classification. Descriptive statistics were used to summarize demographic and clinical characteristics, while Pearson's Chi-square test assessed associations between categorical variables. Statistical significance was defined as $p < 0.05$.

Statistical Analysis

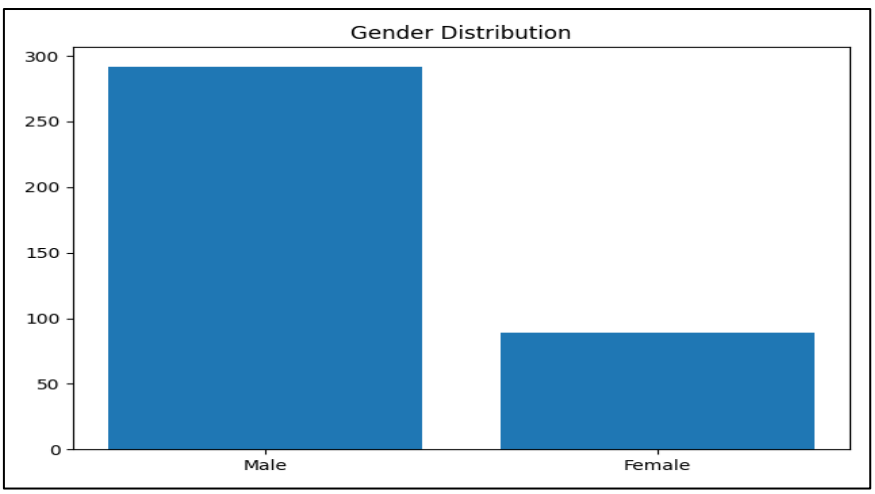
Data were analyzed using SPSS version 26. Continuous variables were summarized using means and standard deviations, while categorical variables were presented as frequencies and percentages. Associations between categorical variables were assessed using Pearson's Chi-square test. Statistical significance was established at $p < 0.05$.

RESULTS

Demographic Characteristics

Table 1. Demographic Distribution of Participants

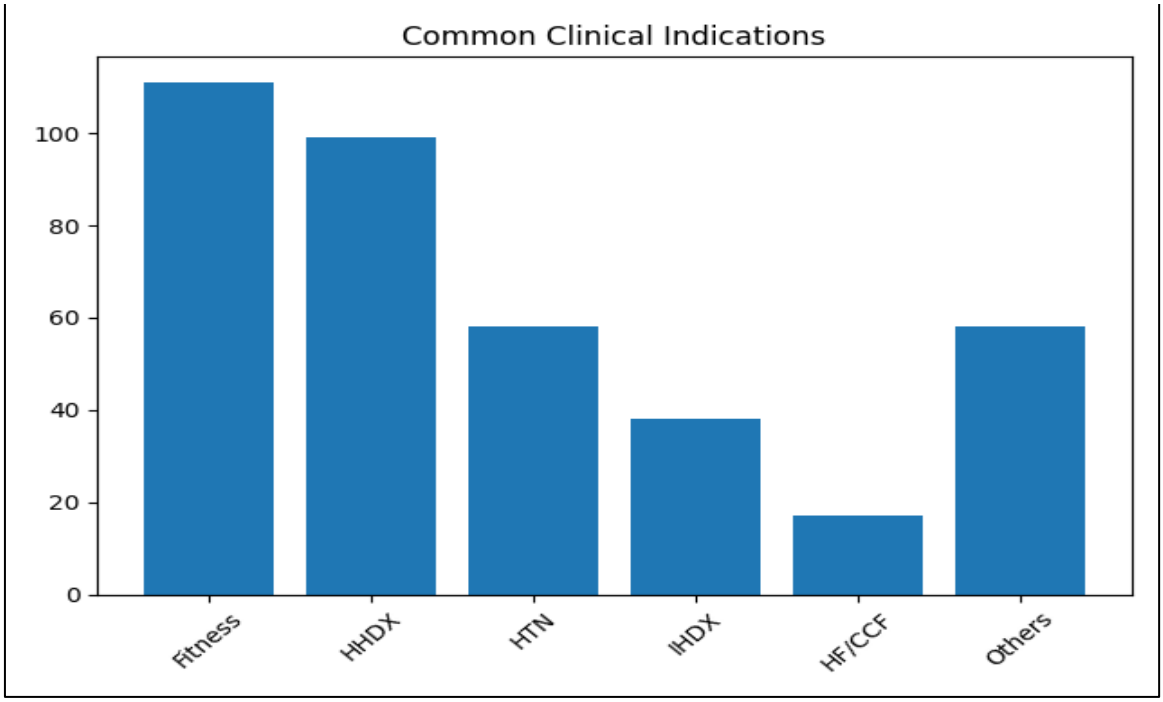
Variable	Frequency (n)	Percentage (%)
Male	292	76.6
Female	89	23.4
Rainy Season	202	53.0
Dry Season	179	47.0



Distribution of Echocardiographic Indications

Table 2. Clinical Indications for Echocardiography

Indication	Frequency	Percentage (%)
Fitness Assessment	111	29.1
Hypertensive Heart Disease	99	26.0
Hypertension	58	15.2
Ischemic Heart Disease	38	10.0
Heart Failure	17	4.5
Others	58	15.2



Association Between Gender and Season

Table 3. Gender versus Season

Variable	χ^2	p-value
Gender vs Season	0.10	0.750

No statistically significant association was observed between gender and season of presentation.

Association Between Gender and Indication

Table 4. Gender versus Clinical Indication

Variable	p-value
Gender vs Indication	<0.001

A statistically significant association existed between gender and clinical indication for echocardiography.

Association Between Clinical Indication and Season

Table 5. Indication versus Season

Variable	p-value
Indication vs Season	0.166

No statistically significant relationship was found between season and referral indication.

DISCUSSION

The present study demonstrates a significant relationship between gender and echocardiographic referral indications, while seasonal variation showed no measurable influence on referral patterns. Males constituted over three-quarters of the study population, a finding consistent with previous Nigerian cardiovascular studies that reported male predominance among patients undergoing cardiac investigations (Ogah et al., 2012).

Hypertension-related cardiovascular disorders represented the most common indications for echocardiography. This observation aligns with reports from Nigeria and other African countries identifying hypertensive heart disease as the leading cause of cardiovascular morbidity and heart failure (Sani et al., 2007; Sliwa et al., 2018).

The absence of seasonal variation may reflect the relatively stable tropical climate of Southern Nigeria compared with temperate regions where seasonal cardiovascular fluctuations are more pronounced. Previous studies have demonstrated increased cardiovascular events during winter months in Europe and North America, but evidence from tropical environments remains inconsistent (Stewart et al., 2017).

The significant association between gender and referral indications suggests sex-specific differences in cardiovascular disease manifestation and healthcare utilization. This finding highlights the importance of incorporating gender-sensitive approaches into cardiovascular prevention and screening programs.

CONCLUSION

Gender significantly influences clinical indications for echocardiographic referral in Southern Nigeria, whereas seasonal variation appears to exert minimal effect on referral patterns. Hypertension-related cardiovascular disorders remain the predominant disorder induced reason for echocardiographic evaluation. Strengthening hypertension control strategies and promoting gender-sensitive cardiovascular interventions may contribute to reducing the growing burden of cardiovascular disease in Nigeria.

Conflict of Interest

The authors declare no conflict of interest.

Funding

No external funding was received for this study.

Authors' Contributions

All authors contributed substantially to the conception, design, data analysis, interpretation, drafting, and revision of the manuscript and approved the final version.

Ethical Approval

Ethical approval was obtained from the appropriate institutional ethics committee before commencement of the study. Patient confidentiality was maintained throughout the study.

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