

Compendium of cardiac diseases among children presenting in tertiary institutions in southern Nigeria: a rising trend

Awoere T. Chinawa^a and Josephat M. Chinawa^b

^aDepartment Of Community Medicine, Enugu State University Teaching Hospital, Enugu State, Nigeria; ^bDepartment of paediatrics, University of Nigeria/University of Nigeria Teaching Hospital (UNTH), Ituku- Ozalla, Enugu State, Nigeria

ABSTRACT

The burden of children with cardiovascular disease is on a rising trend. These rising trends are enhanced by the development of new technology in the diagnosis of cardiac lesions. This article is aimed at documenting the current trends in the occurrence of cardiac disease among children attending tertiary hospitals in Southern Nigeria. This is a descriptive study which involved four hundred and thirty-nine (439) children who had cardiac disease confirmed with echocardiography from four health institutions, namely; Niger Delta University, Bayelsa, Nigeria; University of Nigeria Teaching Hospital, Enugu, Nigeria; Triple care hospital, Enugu, Nigeria and; Blessed children hospital, Enugu, Nigeria over a five-year period from July 2016- July 2020. The prevalence of congenital heart disease was 83.6% and only 16.4% being acquired heart disease. Many of the children with congenital cardiac defects have associated features of Down syndrome (trisomy 21) and the frequency was related to the type of defect; 6.4% (28/439). These features of Down syndrome are seen mainly in children with AV canal defect 33.3% (14/42) and least in children with TOF 2.0% (1/51). Zero-point two nine percent (1/439) had dextro-cardia and 0.2% (1/340) had VACTERAL (ano-rectal malformation) association, 0.2% (1/439) had cleft lip, 1.8% (8/439) had dysmorphism other than down syndrome. Five 62.5% (5/8) of such dysmorphic features were associated with VSD. The majority of the children with cardiac disease were from the middle class 63.6% followed by the higher class 21.9% and the least is from the lower class 14.5%. The prevalence values of heart disease were quite higher than that documented in previous studies. There is a rising prevalence of congenital heart disease (83.6%) and acquired heart disease (16.4%) among children with cardiac disease in southern Nigeria. Extracardiac anomalies were also associated with these trends.

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1. Introduction

Cardiac diseases are those diseases that affect the cardiac structure and function. It could be acquired or congenital. About 15 million children are noted to die yearly from cardiac disease. Cardiac disease in children evokes a lot of financial burdens. For instance, in western countries, where the demands for children with heart diseases are met, it has been documented that almost 450 interventional treatments or surgical procedures for heart diseases are done yearly per 5 million inhabitants [1]. The converse is true among developing sub-Saharan African countries and Nigeria in particular, with 3–4 times the birth rate, and with a high burden for acquired heart disease like rheumatic heart diseases, the need for cardiac intervention and cardiovascular services is much more [1,2].

Significant efforts, over the years, in curbing and ameliorating morbidity and mortality in children under the age of five, have been a major focus of the Millennium Development Goals MDG (MDG4) [3].

Regrettably, cardiac diseases in children (congenital and acquired) with an alarming mortality rate have been neglected and usually left for non-governmental organisations to tackle alone [4].

It has been reported that congenital heart disease constitutes about 28% of all congenital anomalies [5]. However, there are so many variations in the report of the world prevalence of congenital heart disease. For instance, Van der Linde et al., in their meta-analysis, noted the Asian continent as having a prevalence of 9.3 per 1000 live births and Africa with the lowest prevalence of 1.9 per 1000 live births [5]. Furthermore, congenital heart disease, a subset of cardiac disease, presents a global prevalence of between 3 and 14 per 1000 live births [6–8]. Nevertheless, data on the overall spectrum of all cardiac diseases in our locale is hazy with wide variations.

Congenital heart diseases (CHD) contribute a very huge percentage of the burden of all cardiac diseases. It is seen in some studies that a lot of attention is given only to this variety of heart lesions [9–11].

CONTACT Josephat M. Chinawa  maduabuchichinawa@yahoo.com  Department of Paediatrics, University of Nigeria/University of Nigeria Teaching Hospital (UNTH), Ituku- Ozalla, Enugu State, Nigeria

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Granted that acquired heart disease constitutes a smaller percentage of cardiac disease in Nigeria, yet they constitute a menace to child health, especially in regions where environmental health and infectious disease remain a bane. Although appropriate use of antibiotics has reduced the incidence of rheumatic heart disease, however, cardiomyopathy (CMP) is becoming a commonplace among children with cardiac disease in our society [9–14].

A search in the literature has shown that most studies focused mainly on the pattern of congenital and acquired heart disease without highlighting any trends or associated factors. Extra-cardiac correlates of cardiac disease and trends are also discussed in a snapshot. This study is exceptional in that it discussed current trends of structural cardiac diseases and all associations in a stratum. The study is therefore aimed at determining the trends and patterns of cardiac disease among children attending four health institutions.

2. Materials and methods

2.1. Study area

This is a descriptive study, involving four health institutions, namely,

1. Niger Delta University, Bayelsa, Nigeria;
2. University of Nigeria Teaching Hospital, Enugu, Nigeria;
3. Triple Care Hospital, Enugu, Nigeria; and
4. Blessed Children's Hospital, Enugu, Nigeria, over a five-year period from July 2016 to July 2020.

Four hundred and thirty-nine children who had either congenital or acquired heart disease were confirmed with echocardiography.

2.2. Study population

The paediatric cardiology sections of the University of Nigeria and Niger Delta University are referral centers for children with cardiac disease. Meanwhile, Triple Care Hospital and Blessed Children's Hospital are private hospitals that see all paediatric cases including children with cardiac diseases. Children recruited are those with cardiac disease from the age of 1 day to 18 years.

2.3. Study design

It is a descriptive study that assessed current trends of structural cardiac diseases and associated factors. Children with cardiac disease, who attended the four health institutions and fulfilled the inclusion criteria, were recruited into the study. The questionnaire contains details such as demographic variables, socioeconomic variables, extracardiac correlates, syndromic

correlates, weight and height of the subjects, and diagnosis of the particular cardiac lesion.

2.4. Study tool

Echocardiography was done with the Hewlett-Packard (HP) model SONO 2000 which was used for collecting echocardiographic data from University of Nigeria Teaching Hospital from 2016 to 2018 and the E2-model Sonoscape Medical Corp 2019 Cardiac Ultrasound Imaging used for echocardiographic data from Blessed Children's Hospital from 2018 to 2020, while a portable MyLab Gamma Esaote® cardiac ultrasound machine was used at NDUTH from 2018 to 2020 and the Versana Premier 2019 Cardiac Ultrasound Imaging was used for echocardiographic data from Triple Care Hospital from 2019 to 2020. Both 2D echo and Doppler with all cardiac measurements were taken. Diagnosis of cardiac disease was also made following the standard definition [14].

2.5. Social class

Each family of children with the cardiac disease was assigned a socio-economic class using a recommended method, modified by Oyedeji [15]. Parents' occupations and the highest level of education were assigned a score from 1 (highest) to 5 (lowest). The mean score for both parents provided a score for a social class that fell within the 1–5 range. Those with a mean score 1–2 were further grouped into the upper class and 2.1–3.0 as a middle class, while those with a mean score of 3.1–5.0 were grouped into a lower social class.

2.6. Data analysis

The data were analysed with IBM SPSS Statistics for windows, version 20 (IBM Corp., Chicago). Categorical variables were analysed in the form of proportions and percentages and presented in tables. Discrete variables including age were analysed and summarized as means and standard deviations.

3. Result

3.1. Demographic characteristics

Four hundred and thirty-nine children were diagnosed with cardiac diseases during the study period. Table 1 illustrates the demographic characteristics of the patients. The subjects consisted of 52.4% (230/439) males, and the majority (41.7% (183/439)) were infants. The mean age was 41.3 (51.8) months.

Table 1. Demographic characteristics of patients with cardiac disease.

Sex	<i>n</i>	%
Male	230	52.4
Female	209	47.6
Total	439	100.0
Age group	<i>N</i>	%
Infant	183	41.7
Preschool	128	29.2
School age	60	13.7
Adolescents	68	15.4
Total	439	100.0

Infants (≤ 1 year), preschool (>1 year to 5 years), school age (>5 years to 10 years), and adolescents (>10 years to 18 years).

Table 2. Frequency of various cardiac diseases.

Cardiac disease	Frequency	Percent
ASD	39	8.9
VSD	151	34.4
PDA	70	15.9
TOF	51	11.6
AVCD	42	9.6
TGA	7	1.6
DORV	3	0.7
PS	2	0.5
AS	1	0.2
CMP	19	4.3
RHD	37	8.4
IE	16	3.7
Cor triatrium sinistrum	1	0.2
Total	439	100.0

ASD, atrioventricular defect; VSD, ventricular septal defect; PDA, patent ductus arteriosus; TOF, tetralogy of Fallot; TGA, transposition of great arteries; CMO, cardiomyopathy (CMP); AVCD, atrio-ventricular cardiac defect; RHD, rheumatic heart disease. IE, infective endocarditis.

3.2. Prevalence of cardiac diseases

The prevalence of the various cardiac diseases is as shown in Table 2, with 83.6% being congenital cardiac defects and only 16.4% being acquired heart disease. The acquired heart diseases were cardiomyopathy (CMP) and rheumatic heart disease.

3.3. Epidemiology of extra-cardiac correlates

Many of the children with congenital cardiac defects have associated features of Down syndrome (trisomy 21), and the frequency was related to the type of defect (6.4% (28/439)). These features of Down syndrome are seen mainly in children with AV canal defect (33.3% (14/42)) and least in children with TOF 2.0% (1/51). Zero-point two 9% (1/439) had dextrocardia and 0.2% (1/340) had VACTERAL (ano-rectal malformation) association, 0.2% (1/439) had a cleft lip, and 1.8% (8/439) had dysmorphism other than Down syndrome. Five 62.5% (5/8) of such dysmorphic features were associated with VSD.

3.4. Social class

The majority of the children with cardiac disease were from the middle class (63.6%) followed by the higher class (21.9%) and the least was from the lower class (14.5%).

4. Discussion

This study has shown a piece of very important information on current trends and patterns of cardiac diseases in children. This is the very first time in this region where patterns of cardiac diseases and associated factors were undertaken in a snapshot. Among children with cardiac disease, 83.6% had congenital cardiac defects and only 16.4% had acquired heart disease.

Chelo [16] and colleagues in Cameroon noted a prevalence of 73.8% and 25.8%, respectively, for congenital and acquired heart disease in a sample of 16,666 subjects, while Nadia et al. [17] noted a prevalence of 89.3% and 10.7%, respectively. The differences in prevalence could be due to the duration of the study and sample size.

Ventricular septal defect is noted as the most prevalent congenital disease in this study, with a rising trend of 34.4% compared to previous studies [18,19]. Furthermore, Tetralogy of Fallot was noted to occur with a frequency of 11.6%, which was higher than 9.2% obtained by Chinawa et al. [20] in Enugu. There has been a similar increase in the occurrence of other congenital heart diseases obtained in this study when compared with other studies. For example, the prevalence of PDA, ASD, and AV canal defects obtained in this study was higher than that seen in other studies [21–25].

This increase in trends in congenital heart disease could be explained by the availability of the facility and manpower in the diagnosis of cardiac disease. Increased awareness and health education are also contributory factors.

Rheumatic heart disease and cardiomyopathy (CMP) are the most common acquired heart diseases seen in this study with a rising prevalence rate of 8.4% and 4.3%, respectively.

Rheumatic heart disease was seen in 6% of cases of cardiac disease in a study in Mozambique [26] and 5.1% [27] seen in India. However, the prevalence in our study is higher compared to the studies above. This rising trend could be explained by regression in the campaign for hygiene, health promotion, early detection and treatment of tonsillar infections, and environmental sanitation [28]. The most common type of cardiomyopathy (CMP) seen in this study is dilated cardiomyopathy (CMP). There is also a rising prevalence of cardiomyopathy (CMP) as seen in this study. Likewise, the incidence of CMP from 1998 to 2006 in Korean children was noted as 0.28 per 100,000 [29]. In the USA, it is found to be 1.13 per 100,000 [30], while prevalence rates of 1.24 per 100,000 children were reported in Australia [31].

The use of new facilities and increased awareness of cardiac disease may explain the rise in cardiac disease. Extra-cardiac features, noted in this study, are expressed more among children with congenital heart disease. Commonly seen extra-cardiac features are those with syndromic correlates. The prevalence of Down syndrome

seen in this study is 6.4% and is very common in children with AV canal defects with a prevalence of 33.3% among them. Pfitzer et al. [32], on assessment of dynamics of children with Down syndrome born between 1980 and 2014, also noted atrioventricular septal defect as the most common congenital heart disease in children with Down syndrome. Other extracardiac associations noted in this study are anorectal malformation and dextrocardia, but with a very low prevalence rate. Dextrocardia was seen in 0.29% of children with cardiac disease in this study. Dextrocardia is a rare congenital malformation with a prevalence of 0.40–0.83 per 10,000 births in various studies. The prevalence obtained in our study is similar to the 0.14% seen by Epcacan et al. [33] among children admitted to the paediatric cardiology department. Situs inversus dextrocardia was the most common type of dextrocardia documented in our study. This is also obtainable in other studies [34]. The prevalence of VACTERL association which presented as anorectal anomaly was noted in 0.29% of children in this study. The increased trends of dysmorphic features in children with congenital heart disease when compared with the general population is suggestive of the importance of these landmarks for early diagnosis and management of these cases [35]. It has long been documented that there exists an association between major gastrointestinal (GI) malformations in children with congenital heart disease. Prevalence as high as 65% in those GI malformation cases was usually seen in children with syndromes. Chéhab et al. [36] from Lebanon reported the prevalence of congenital cardiac anomaly malformations in 38% of 105 patients with GI malformations. Genetic variants, race, and sample size may contribute to these differences in the prevalence of dextrocardia and VACTERAL syndrome.

There was a male preponderance in our study, and the majority of children with cardiac disease were from the middle socioeconomic class. Mughal et al. also noted a male preponderance with the majority of families belonging to the middle socioeconomic class [37]. Their study was carried out among 211 patients undergoing treatment for cardiac disease. The effects of cardiovascular diseases are not restricted to morbidities alone but could infiltrate into the socio-economic well-being of children with cardiac disease. Heart diseases due to their chronicity could affect children holistically. Even affected children from a very high social class could change the socioeconomic status of the parents to a downward level due to the heavy financial burden involved in the management of the disease [38–41].

5. Conclusion

There is a rising prevalence of congenital heart disease (83.6%) and acquired heart disease (16.4%) among children with cardiac disease in southern

Nigeria. Extracardiac anomalies were also associated with these trends.

Availability of data and materials

The data will not be shared in order to protect the participants' anonymity.

Consent for publication

Not applicable.

Ethics approval and consent to participate

This complies with national guidelines. All procedures performed in studies involving human participants were per the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standard. Ethical approval was obtained from the Ethics and Research Committee of the University of Nigeria Teaching Hospital Enugu (IRB number of 00002323) and the issue date was on 14 April 2020.

Disclosure statement

The author(s) declare that they have no competing interests.

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Author contributions

JMC conceived and designed this study, while CAT helped in critical revision of the article. All authors have read and approved the manuscript.

References

- [1] Qu Y, Liu X, Zhuang J, et al. Incidence of congenital heart disease: the 9-year experience of the Guangdong Registry of Congenital Heart Disease, China. *PLoS One*. 2016;11:7–12.
- [2] Yacoub MH. Establishing paediatric cardiovascular services in the developing world: a wake-up call. *Circ*. 2007;116:1876–1878.
- [3] Progress towards millennium development goals 4, 5 and 6 obtainable from. https://www.euro.who.int/__data/assets/pdf_file.
- [4] Ndidiamaka M, Vibeke E, Bistra Z, et al. The global burden of paediatric heart disease. *Card Young*. 2017;27:3–8.
- [5] Van der Linde D, Konings EEM, Slager MA, et al. Birth prevalence of congenital heart disease worldwide. *J Am Coll Cardiol*. 2011;58:2241–2247.
- [6] Allen HD, Driscoll DJ, Shaddy R, et al. *Moss & Adams' heart disease in infants, children, and adolescents: including the fetus and young adult*. 8th. Philadelphia: Lippincott Williams & Wilkins; 2013.
- [7] Bernstein D. Congenital heart disease. In: Kliegman RM, Stanton BF, St-Geme J, et al., editors. *Nelson textbook*

- of pediatrics. 19th ed. Philadelphia: Saunders; 2011. p. 1549–1605.
- [8] Tchoumi JCT, Butera G, Giamberti A, et al. Occurrence and pattern of congenital heart diseases in a rural area of sub-Saharan Africa: cardiovascular topics. *Cardiovasc J Afr.* 2011;22:63–66.
- [9] Gupta B, Antia AU. Incidence of congenital heart disease in Nigerian children. *Br Heart J.* 1967;29:906–909.
- [10] Bode-Thomas F, Ige OO, Yilgwan C. Childhood acquired heart diseases in Jos, north central Nigeria. *Niger Med J.* 2013;54:51–58.
- [11] Sadoh WE, Uzodimma CC, Daniels Q. Congenital heart disease in Nigerian children: a multicenter echocardiographic study. *World J Pediatr Congenit Heart Surg.* 2013;4:172–176.
- [12] Kennedy N, Miller P. The spectrum of paediatric cardiac disease presenting to an outpatient clinic in Malawi. *BMC Res Notes.* 2013;6:53.
- [13] Okoromah CA, Ekure EN, Ojo OO, et al. Structural heart disease in children in Lagos: profile, problems and prospects. *Niger Postgr Med J.* 2008;15:82–88.
- [14] David JS. Moss and Adams' heart disease in infants, children, and adolescents, including the fetus and young adults. *Circ.* 2001;104:139–1404.
- [15] Animasahun BA, Itiola JO, Adekunle MO, et al. Sociodemographic determinants and anthropometric characteristics of the iron status of Lagos children with cyanotic congenital heart disease. *J Xiangya Med.* 2019;4:29.
- [16] Chelo D, Nguefack F, Menanga AP, et al. Spectrum of heart diseases in children: an echocardiographic study of 1,666 subjects in a pediatric hospital, Yaounde, Cameroon. *Cardiovasc Diagn Ther.* 2016;6(1):10–19.
- [17] Nadia M, Salma S, Shazia M, et al. Spectrum of heart disease in children under 5 years of age at Liaquat University Hospital, Hyderabad, Pakistan. *Indian Heart J.* 2014;66:145–149.
- [18] Ibadin MO, Sadoh WE, Osarogiabon W. Congenital heart diseases at the University of Benin Teaching Hospital. *Niger J Paediatr.* 2007;32(2):29–32.
- [19] Abdulkadir M, Abdulkadir Z. A systematic review of trends and patterns of congenital heart disease in children in Nigeria from 1964–2015. *Afr Health Sci.* 2016;16(2):367–377.
- [20] Chinawa JM, Eze JC, Obi I, et al. Synopsis of congenital cardiac disease among children attending University of Nigeria Teaching Hospital Ituku Ozalla, Enugu. *BMC Res Notes.* 2013;6:475.
- [21] Tripathi A, Black GB, Park YM, et al. Prevalence and management of patent ductus arteriosus in a pediatric Medicaid cohort. *Clin Cardiol.* 2013;36(9):502–506.
- [22] Wikto DM, Carroll JD. ASD closure in structural heart disease. *Curr Cardiol Rep.* 2018;20:37.
- [23] Waqar T, Riaz MU, Shuaib M. Surgical repair of partial atrioventricular septal defect. *Pak J Med Sci.* 2017;33(2):285–289.
- [24] Beaton A, Okello E, Lwabi P, et al. Echocardiography screening for rheumatic heart disease in Ugandan schoolchildren. *Circ.* 2012;125(25):3127–3132.
- [25] Grimaldi A, Ammirati E, Mirabel M, et al. Challenges of using ultrasounds for subclinical rheumatic heart disease screening. *Int J Cardiol.* 2013;167(6):3061.
- [26] Kane A, Mirabel M, Toure K, et al. Echocardiographic screening for rheumatic heart disease: age matters. *Int J Cardiol.* 2013;168(2):888–891.
- [27] Grover A, Dhawan A, Iyengar SD, et al. Epidemiology of rheumatic fever and rheumatic heart disease in a rural community in northern India. *Bull World Health Organ.* 1993;71(1):59–66.
- [28] Padmavati S. Present status of rheumatic fever and rheumatic heart disease in India. *Indian Heart J.* 1995;47(4):395–398.
- [29] Oh JH, Hong YM, Choi JY, et al. Idiopathic cardiomyopathies in Korean children. 9-Year Korean Multicenter Study. *Circ J.* 2011;75:2228–2234.
- [30] Lipshultz SE, Sleeper LA, Towbin JA, et al. The incidence of pediatric cardiomyopathy in two regions of the USA. *N Engl J Med.* 2003;348:1647–1655.
- [31] Nugent AW, Daubeney PE, Chondros P, et al. The epidemiology of childhood cardiomyopathy (CMP) in Australia. *N Engl J Med.* 2003;348:1639–1646.
- [32] Pfitzer C, Helm PC, Rosenthal LM, et al. Dynamics in prevalence of Down syndrome in children with congenital heart disease. *Eur J Pediatr.* 2018;177:107–115.
- [33] Evans WN, Acherman RJ, Collazos JC, et al. Dextrocardia: practical clinical points and comments on terminology. *Pediatr Cardiol.* 2010;31:1–6.
- [34] Epcacan S, Sisli E. Congenital cardiac malformations associated with dextrocardia: analysis of 75 patients in a tertiary center. *Osmangazi J Med.* 2020;42(1):61–66.
- [35] Gokhroo RK, Gupta S, Arora G, et al. Prevalence of congenital heart disease in patients undergoing surgery for major gastrointestinal malformations: an Indian study. *Heart Asia.* 2015;7(1):29–31.
- [36] Chéhab G, Fakhoury H, Saliba Z, et al. Congenital heart disease associated with gastrointestinal malformations. *J Med Liban.* 2007;55:70–74.
- [37] Mughal AR, Sadiq M, Hyder SN, et al. Socioeconomic status and impact of treatment on families of children with congenital heart disease. *J Coll Physicians Surg Pak.* 2011;21(7):398–402.
- [38] Settin A, Almarsafawy H, Alhussieny A, et al. Dymorphic features, consanguinity and cytogenetic pattern of congenital heart diseases: a pilot study from Mansoura locality, Egypt. *Int J Health Sci (Qassim).* 2008;2:101–111.
- [39] Catherine K, Sonia SA. The impact of social determinants on cardiovascular disease. *Can J Cardiol.* 2010;26(SupplC):8–13.
- [40] Almesned S, Al-Akhfash A, Mesned AA. Social impact on families of children with complex congenital heart disease. *Ann Saudi Med.* 2013;33(2):140–143.
- [41] Bernier PL, Stefanescu A, Samoukovic G, et al. The challenge of congenital heart disease worldwide: epidemiologic and demographic facts. *Semin Thorac Cardiovasc Surg Pediatr Card Surg Annu.* 2010;13:26–34.