

**PATTERN OF CARDIAC DISEASES AT MUHIMBILI
NATIONAL HOSPITAL DAR ES SALAAM, 2007.**

By

Tulizo Shemu Sanga, MD (Dar)

**A Dissertation Submitted in Partial Fulfillment of the Requirements for
Degree of Master of Medicine (Internal Medicine) of the Muhimbili
University of Health and Allied Sciences.**

November 2008

CERTIFICATION

The undersigned certify that he has read and hereby recommend for the examination of a dissertation entitled *Pattern of cardiac diseases, at Muhimbili National Hospital Dar Es Salaam, 2007*, in fulfillment of the requirements for the degree of Master of Medicine (Internal Medicine) of the Muhimbili University of Health and Allied sciences




Dr Johnson M.Lwakatare- MB ChB (Makerere), MRCP (UK)

(SUPERVISOR)

Date:.....12.1.2009.....

DECLARATION AND COPYRIGHT

I, Dr Tulizo Shemu Sanga, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature:  _____

This dissertation is copyright material protected under the Berne Convention, the Copyright Act 1999 and other international and national enactments, in that behalf, on intellectual property. It may not be reproduced by any means, in full or part except for short extracts in fair dealings, for research or private study, critical scholarly review or discourse with an acknowledgement, without permission of the Directorate of Postgraduate Studies, on behalf of both the author and the Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGEMENTS:

I wish to express my heart felt and sincere gratitude to my teacher and Supervisor Dr. Johnson Lwakatare for a watchful eye and guidance. His constructive support and encouragement throughout the entire stages of my dissertation has made this work possible.

I would like to thank Professor F. Mugusi the head of department of Internal medicine (MUHAS) and all other members of the department who in one way or another made the development of this dissertation a possibility. Special thanks go to Dr. Maro E, Dr. Janabi M and Dr. Mwandolela H for continued guidance at doing Echocardiography and their comments. I would like to acknowledge the work done by Dr. Mwita J, who spent his invaluable time to critique this work throughout its development.

I am grateful to the head of department of Internal medicine, Muhimbili National Hospital Dr. E. Aris for allowing me accessing patients and hospital facilities for the study, the entire staff of Muhimbili National Hospital cardiac unit, especially Ms Zakayo, Ms Magreth and Mr. Peter for their tireless cooperation during the entire process of collecting data performing Echocardiograms and electrocardiograms.

I thank Mrs. C. Moshiro for reading through statistics and her constructive advice.

I extend my thanks to MNH and NIMR who partly supported my research.

My wife Sada, son Emmanuel and family deserve a lot! Missing me most of the time, continued support and natural optimism!

Lastly I would like to glorify the name of the Almighty God, for giving me life, health and power to accomplish this task.

DEDICATION

This work is dedicated to my parents, my late father Shemu Sunguruma Sanga who passed away in the mid of this work and my mother Rehema Mwangafya for sending me to school and never stopped sacrificing in my education. May the Almighty God be with you!

ABSTRACT

Background Cardiac diseases are on a global rise, emerging as diseases of public health importance in Sub Saharan Africa today. The majority of the conditions are attributable to changing life styles in rural and rapid trends towards urbanization and globalization. The diseases include Coronary heart diseases, Cardiomyopathies, Rheumatic valvular heart diseases, pericardial diseases, congenital heart diseases and hypertensive heart diseases. The patterns of these diseases have been changing over time. The current pattern of these conditions is not known and need to be described and stand as a starting point for disease intervention and priority setting in Tanzania, by the Ministry Of Health and Social Welfare and other Organizations.

Objective: To describe the pattern of cardiac diseases among patients Aged 7 years or older attending cardiac clinics and medical wards at Muhimbili National Hospital, Dar es Salaam Tanzania 2007.

Settings: Medical wards and cardiac clinic at Muhimbili National Hospital.

Study subjects: Patients aged 7 years or older attending cardiac clinic and those with features of heart diseases admitted to medical wards.

Methods: A descriptive cross sectional study was done from 1st July to 31st November 2007. During the five months period, a total of 250 cardiac patients attending at cardiac clinic and those admitted in medical wards at Muhimbili National hospital were evaluated. Each patient had history and demographic information taken, physical examination, chest roentgenography, Electrocardiography and Echocardiography done.

Main outcome measure: Cardiac diagnosis

Results:

Of the 250 patients evaluated, 76 (48.7%) of cases were females. The median age of the study subjects was 32.5(\pm 21.8) years. 66% were below 41 years of age. Rheumatic valvular heart disease was the predominant diagnosis detected in 115(46%) patients. There was female dominance with 76 (66.1%) being affected. Mitral valve stenosis was seen predominantly in females. Other diagnoses were: Hypertensive heart disease 53(21.3%), cardiomyopathies 28 (11.2%), Mitral valve prolapse 26(10.4%), pericardial disease 15 (6.0%) and Congenital heart diseases 11 (4.4%). Ischaemic heart disease 3 (1.2%) were the least diagnosed. Majority of patients attended were at advanced stages of heart failure, had low level of education and social economic status.

Conclusion:

Rheumatic valvular heart diseases still ranks high among the preventable cardiac diseases, affecting a younger population mainly females than males. Many arrive late and are diagnosed in advanced stages of the disease at a referral hospital. Appropriate clinical and early Echocardiographic assessment should be made available even at Regional hospitals for early diagnosis. The magnitude of ischaemic heart diseases is still low in this population.

TABLE OF CONTENTS

Content	Page
Certification.....	ii
Declaration.....	iii
Copyright.....	iii
Acknowledgement.....	iv
Dedication	v
Abstract	vi
Table of contents.....	viii
List of tables and figures.....	x
Acronyms.....	xi
CHAPTER ONE	
1.0 Introduction and literature review.....	1
1.2 The problem of cardiac diseases	4
1.3 Patterns of cardiac diseases	11
1.4 Problem statement and Rationale.....	15
CHAPTER TWO	
2.0 Study objectives.....	16
CHAPTER THREE	
3.0 Methodology.....	17
3.1 Study Design.....	17
3.2 Study Setting.....	17
3.3 Study Population.....	17
3.4 Study Duration.....	18
3.5 Inclusion criteria.....	18
3.6 Exclusion criteria	18
3.7 Sample size calculation and Data Collection Procedures.....	18
3.8 Investigations.....	21
3.9 Ethical consideration.....	22

3.10	Disposal of patients.....	22
3.11	Data processing and statistical analysis.....	23
CHAPTER FOUR		
4.0	Results.....	24
CHAPTER FIVE		
5.0	Discussion.....	35
CHAPTER SIX		
6.0	Conclusion and limitations.....	43
6.3	Recommendations.....	44
7.0	References.....	45
 APPENDICES		
8.0	Questionnaire (English).....	56
9.0	Questionnaire (Kiswahili)	61
10.0	Informed consent (English).....	65
11.0	Informed consent (Kiswahili).....	67

LIST OF TABLES AND FIGURES

Table/figure	Page
Table 1: Socio-demographic and clinical characteristics of the Study Population.....	25
Figure 1: Age distribution of study population.....	26
Table 2: Clinical symptoms and signs of the study population.....	27
Figure 2 New York Heart Association classification classes of the study population.....	28
Table 3: Abnormal Roentgenographic findings of the study Population.....	29
Table 4: Common electrocardiographic findings of the study Population.....	30
Table 5: Echocardiographic diagnosis of the study population....	31
Table 6: Distribution of cardiac diseases by age among the study population	32
Table 7: Distribution of rheumatic valvular heart diseases among the study population.....	33
Table 8: Types of cardiomyopathies diagnosed among the study Population.....	34

ACRONYMS:

AHD	-	Acquired Heart Disease
ASD	-	Atrial Septal Defect
CHD	-	Congenital Heart Disease
ECG	-	Electrocardiography
ECHO	-	Echocardiogram
EMF	-	Endomyocardial fibrosis
ESHF	-	End stage Heart failure
HF	-	Heart failure
HHD	-	Hypertensive Heart Disease
HIV	-	Human Immunodeficiency Virus
IHD	-	Ischaemic heart disease
LVEDD	-	Left ventricular End diastolic diameter
LVEF	-	Left Ventricular Ejection Fraction
MNH	-	Muhimbili national Hospital
MOHSW	-	Ministry of health and Social welfare
MVP	-	Mitral valve prolapse.
NYHAC	-	New York Heart association class
PDA	-	Patent Ductus Arteriosus
PPCM	-	Post partum cardiomyopathy
VSD	-	Ventricular Septal Defect
UK	-	United Kingdom
USA	-	United States of America
WHF	-	World Health Federation
WHO	-	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

Cardiovascular diseases comprise the most prevalent serious disorders world wide. Although age adjusted death rates for coronary heart disease have declined by 2/3 from their peak in 1965, cardiovascular diseases remain the most common causes of deaths, responsible for 40% of all deaths, almost 1 million each year.¹ The American heart association has reported that in 2002, sixty two million Americans 51.6% being females had a cardiovascular disease including hypertension. The prevalence rises progressively with age from 5% at the age of 20 years to 75% at age 75 years.²

Over three decades, premature morbidity and mortality attributable to cardiovascular diseases will almost double globally from 85 million Disability Adjusted Life Years (DALY) in 1990, to 140-160 million DALY in 2020, with about 80% of this burden occurring in developing countries.¹

Nowadays, cardiovascular diseases account for 7% to 10% of all medical admissions to hospital, with heart failure contributing to 3% to 7%. The increase in cardiovascular diseases in developing countries are probably a result of a decreased mortality from infectious diseases and improved life expectancy resulting in a higher proportion of individuals reaching middle and old age. Lifestyle and socioeconomic changes associated with urbanization in developing countries has led to higher levels of risk factors for cardiovascular diseases and special susceptibility of certain populations^{4,5}

1.2 CARDIAC DISEASES

Cardiac diseases comprise a number of conditions affecting the heart muscles, valves, vessels and the conducting system. It also includes benign and malignant tumors of the heart. These conditions may be congenital or acquired and include congenital heart diseases, Coronary heart diseases, Cardiomyopathies, Rheumatic heart diseases/valvular heart diseases, pericardial diseases and Hypertensive heart diseases.⁵

Congenital heart diseases

Approximately 35,000 children are born each year in USA with some form of a congenital heart defect. Although the disease is prevalent in Africa, specific data on the magnitude as is lacking due to poor diagnostic facilities and diversity of delivery care.⁶

The cyanotic heart diseases constitute the most severe forms of diseases where as the lesser severe forms comprises acyanotic heart diseases, majority of which are benign and escape detection during childhood to be encountered in adulthood uncorrected.⁷ Although mostly isolated, congenital heart diseases may occur as a part of the various genetic and chromosomal syndromes as Down, Trisomy 13 and Turner's syndrome among others.⁸

According to the National Heart Lung and Blood institute, currently in the United States about 1 million adults are living with congenital heart defects. Congenital defects accounts for about 2% of heart disease in adults. Most children with cyanotic heart diseases do not survive to adulthood without surgical intervention, the most common being Tetralogy of Fallot and Eisenmenger's syndrome⁸. In developed nations where congenital heart diseases are diagnosed, corrected and cared well during childhood the magnitude in adulthood is high.⁹ In sub Saharan Africa the prevalence of congenital heart diseases is found high in some settings studied; with advancing diagnostic facilities the presentation is likely to be higher than what is seen now.⁶

In Tanzania the actual prevalence of congenital heart diseases and its burden is not known. There are currently no published studies done to determine the magnitude of congenital heart diseases in Tanzania, however in one survey¹⁰ in areas around Mugana Hospital Kagera region (North Tanzania) while studying childhood valvular cardiopathies 551 young patients of school age were screened by performing a cardiac physical examination. The authors assumptions were, the causes of childhood valvular cardiopathies are congenital heart diseases for the under 9 and rheumatic heart diseases for the over 9years. 15.2% of this population showed clinically significant valvular abnormalities. If aided by echocardiogram the magnitude of both congenital anomalies and RHD would be higher than what was found..

Rheumatic heart diseases

In poor and developing nations, rheumatic valvular heart diseases remains a major cause of morbidity and premature death and imposes a substantial burden on health care systems with limited budgets.¹¹ Rheumatic fever and its important outcome of chronic rheumatic valvular heart disease remain widespread in Africa.¹²

In industrialized countries rheumatic heart disease is on significant decline and very few cases are reported.¹² on the contrally it remains the commonest cardiovascular disease in young people in developing countries.¹¹ Eradication of rheumatic fever depends on social changes, including improved primary health-care services, elimination of poverty, better housing, and application of existing knowledge on primary and secondary prevention of the disease.¹³ Of the 2.4 million children with rheumatic heart disease living in developing countries, nearly half live in sub-Saharan Africa, making the continent the major hotspot of the disease.¹⁴

In the diagnosis of rheumatic heart diseases in addition to clinical evaluation, cardiac ultrasonography is known to be more sensitive than auscultation for the detection of pathologic valve disease.¹⁵ The recent availability of high-quality portable ultrasound

equipment makes it possible to screen large numbers of children at schools in developing nations. Furthermore, the 2004 World Health Organization Expert Consultation Report states that echocardiographically diagnosed, clinically silent rheumatic valve involvement should be managed as rheumatic heart disease until proved otherwise.¹⁶

In Tanzania as in other sub Saharan countries Rheumatic heart disease is common accounting significantly high to the causes of heart failure in this community.²⁶ Population based surveys shows the current prevalence rate of rheumatic heart disease of approximately 1 to 5 cases per 1000 among school age children in developing countries the highest rate in sub Saharan Africa.¹ Poor housing, infections and lack of access to health facility are contributory.¹²

Those who are diagnosed, majority still do not get definitive surgical cure due to limited resources.^{18, 19} On this context primary and secondary prevention efforts are highly cost-effective and most sustainable ways through appropriate control.¹¹ Secondary prevention relies on accurate case detection for the appropriate use of prophylactic antibiotics and regular medical surveillance aided by prevalence data to facilitate health care planning.¹⁶

Cardiomyopathies

The WHO/WHF defines cardiomyopathies as diseases of the myocardium associated with cardiac dysfunction.²⁰ It is a rare disease in other parts of the world but endemic in Africa.^{20, 21} Cardiomyopathy of undetermined cause has been known to be endemic in Africa for over 60 years.²¹

The major forms in Africa are dilated cardiomyopathy (DCM) and endomyocardial fibrosis (EMF). While DCM is being a major cause of heart failure in all age groups and all the regions of Africa accounting for 10 to 17% of cardiac conditions encountered at autopsy, and for 17 to 48% of patients who are hospitalized for heart failure, EMF is a disease of children and young adults confined to the tropical regions of equatorial Africa.^{22, 23} The advent of human immunodeficiency virus infection and its association with cardiomyopathy has emphasized the role of inflammatory agents in the pathogenesis of DCM (inflammatory viral cardiomyopathy).²⁴ HIV cardiomyopathy is an increasing aetiological cause of heart failure among HIV patients.^{21, 25}

In Tanzania cardiomyopathy is common affecting all age groups, Makene et al²⁶ 30 years ago found it to be the second most common cause of heart failure in Dar es salaam and in recent years found to be the leading underlying cause of re admission due to heart failure 50.7%. Dilated cardiomyopathy was found to be the commonest among the cardiomyopathies detected (81.6%).²⁵ Others were hypertrophic, restrictive and peripartum cardiomyopathies.²⁷

Maro et al (2006) while evaluating 6680 patients referred for echocardiography at Muhimbili National Hospital between June 1998 and October 2002 found that 134 (0.19%) patients had HCM. Due to the diverse clinical features only six (5.9%) patients had a correct diagnosis of HCM prior to their ECHO. It is further revealing the important

role of echocardiography in the diagnosis of HCM, with a plea for the increasing availability of this non-invasive technique for early and accurate diagnosis²⁸

Hypertensive heart diseases

Uncontrolled and prolonged elevation of blood pressure (BP) can lead to a variety of changes in the myocardial structure, coronary vasculature, and conduction system of the heart as a consequence of cardiac compensation for the excessive workload imposed by increased systemic pressure.²⁷ Hypertensive heart disease is a complex interplay of various haemodynamic, structural, neuroendocrine, cellular, and molecular factors.³⁰
^{29,30 31 32}

There is higher prevalence of hypertension in the urban black population of South Africa and USA in comparison to whites living in the same geographical areas, several factors including urbanization and socioeconomic status contributes to differences in hypertension between whites and blacks, but in addition there may be a genetic element, and the good understanding of it will help to institute effective treatment and control measures.³³

Urbanization is found to be associated with increasing levels of hypertension in Tanzania and it is strongly linked to the adapted life style changes with urbanization as sedentary life and inactivity, dietary habits and overweight, A community based study in Tanzania on the coronary risk factors for cardiovascular diseases found the prevalence of hypertension to be lower in the rural than urban citizens.³⁴ In other areas of Africa similar findings were obtained in a population-based survey.³⁵

Coronary Heart Disease

Coronary heart disease is the single leading cause of death in America today in both males and females. According to the American heart association, more than 15million people have some form of the condition. In 2004 it has claimed 451, 320 lives in USA. Men in their 40s have a higher risk than women, but as women get older their risk increases equaling men's risk.³⁶ Despite substantial progress in the primary and secondary prevention of coronary heart disease, approximately 9.1 million Americans suffer from angina pectoris and more than 8 million experiences a myocardial infarction each year of which approximately 73 million are hypertensive.³⁷

In sub-Saharan Africa, the anticipated epidemic of atherosclerotic cardiac disease has, however, not yet manifested in most of the population.³⁸ In the INTERHEART study, researchers investigated ethnic differences in risk factors in patients with myocardial infarction and showed that risk factors are the same in all individuals irrespective of ethnic origin.³⁹ It was however revealed that "atherosclerotic coronary disease at least in its most striking and most clinically obvious manifestation of acute myocardial Infarction is not common in most black African people on the continent; hence primordial prevention of atherosclerotic cardiovascular disease still has an opportunity in sub-Saharan Africa."^{36, 38, 40, 41}

In Tanzania with few studies done, lower prevalence of risk factors for coronary heart diseases has been observed.³⁴

Pericardial diseases

Tuberculous pericarditis is the most common among the chronic pericardial diseases, with high prevalence in areas where tuberculous infection is also high; it is less in the United States of America than other parts of the world. .^{42, 43}

Other causes of pericarditis common elsewhere includes those from pyogenic infections, neoplasms, chronic anaemia, rheumatoid arthritis, mycotic infections, radiation therapy and trauma^{44 45}

In Sub Saharan Africa Tuberculous pericarditis is very common and has been found rising to alarming levels in the current era of HIV with TB/HIV co infections⁴⁶. In a study⁴⁸ done in 2005 at a large academic hospital in South Africa on establishing the prevalence of pericardial effusion, Tuberculosis (TB) was the leading cause of pericarditis (69.5%). The prevalence of which confounded by HIV co-infection is steadily increasing, burdening the health care facilities.

In another study⁴⁹ in Tanzania heavily hit by HIV pandemic and Tuberculosis, among patients admitted with a large pericardial effusion confirmed Echocardiographically, Tuberculosis was found to be the predominant cause of large pericardial effusion in HIV infected patients, non HIV infected patients may have other etiologies. It was recommended that in settings where microbiological studies are not routinely available, HIV infected patients with pericardial effusions may be treated empirically for tuberculosis and monitored for improvement.

1.3 DIAGNOSIS OF CARDIAC DISEASES

The diagnosis of cardiac diseases is vested in the absence of uniform criteria and in different ways which a condition is defined and presents, however as outlined by the New York Heart Association, the elements of complete cardiac diagnosis include: the underlying Aetiology, the anatomic abnormalities physiologic disturbances and functional disability.⁵⁰

The establishment of a correct and complete cardiac diagnosis commences with history and physical examinations⁵¹ supplemented by laboratory tests Electrocardiography,⁵² chest roentgenography, non invasive graphic examinations Echocardiography, radionuclide and imaging techniques.⁵³ Under occasional circumstances do specialized invasive examinations as angiography, cardiac catheterizations and coronary angiography employed.⁵⁴ In the diagnostic process, the results obtained from each of these several modalities should be analyzed independently of one another as well as together.

The European Society of cardiology guidelines on the diagnosis and treatment of heart failure recommends:⁵⁵

1. Demonstration of symptoms and signs of heart failure.
2. Objective evidence of cardiac dysfunction preferably by imaging studies like echocardiogram and radionuclide study.

The recommendations go on to suggest an algorithm with four levels of diagnosis.

Level 1 - clinical symptoms and signs, when positive lead to level 2.

Level 2 - basic investigations – electrocardiogram, chest x-ray and natriuretic peptides.

Level3- Imaging studies-echocardiography, magnetic resonance imaging and/ or radionuclide angiography.

Level 4- asses the severity of failure, precipitating factors and type of cardiac dysfunction.

Echocardiographic diagnoses of cardiac diseases

Echocardiographic approaches provide fundamental morphological, functional and physiological data in excess of chest radiographs or even routine electrocardiograms in the diagnosis and evaluation of cardiac conditions. It is currently a favoured diagnostic tool though there limitations like limited availability, costs and expertise.^{53, 56}

Using standard techniques trans-thoracic and Trans-esophageal approaches on a two dimensional (2D) or motion mode (M mode) plus Doppler studies with continuous (CW) and pulsed wave (PW) and colour flow (CF) mappings the structures and functions of the heart are figured out at a single sitting. Different studies done else where in Africa⁵⁷ and the rest of the world comparing ECHO and cardiac catheterization as gold standard has revealed that if thoroughly done, at times coupled with cooperative or adequately sedated patients by an experienced operator using an efficient echocardiographic machine might improve the accuracy of trans-thoracic echocardiography in the diagnosis of congenital heart diseases.⁵⁸

Comprehensive echocardiographic screening programs could also enhance effective prevention strategies for rheumatic heart disease. Early detection of "sub clinical" rheumatic valve disease is vital, as it presents an opportunity for case detection at a time when prophylactic penicillin can prevent progression to clinical valve disease and heart failure in young adult life⁵⁹.

1.4 PATTERNS OF CARDIAC DISEASES

Distribution and the burden of heart disease change over time as a country undergoes economic development. Developing countries begin with a disease profile that is dominated by nutritional, perinatal and infectious diseases and, in the process of development, make the transition to one dominated by non-communicable diseases, such as cardiovascular disease and cancer^{60, 61}.

Risk-factor interventions in populations living in industrialized countries have been associated with large reductions in cardiovascular mortality over the past 30 years.⁶¹ These dramatic shifts in the pattern of disease within a few generations in populations of the same genetic stock highlights the dominant role of environmental factors in the causation of common forms of heart disease, with hereditary factors playing only a minor role. Indeed, the modest effect of inherited factors has been quantified at an epidemiological level in INTERHEART, which has shown that family history (a combined measure of inherited factors) probably accounts for 1% of the overall population-attributable risk of the myocardial infarction⁶²

In Sub Saharan Africa majority of heart failure are due to non ischaemic causes such as RHD, HHD and DCM accounting for over 75% in most series. IHD remains uncommon cause of heart failure over the past 60yrs.⁶³ Although ischaemic heart disease such as myocardial infarction and angina are relatively uncommon in most parts of Africa, heart failure is seen often.^{64, 65} WHO reports showed that; the number of disability adjusted life years lost to cardiovascular disease in sub-Saharan Africa rose from 5.3 and 6.3 million in 1990 to 6.5 and 6.9 million in 2000 for men and women respectively and could rise to 8.1 million and 7.9 million in 2010. CVS has higher mortality in developing than in developed countries affecting younger people and women disproportionately.^{65, 66}

Africa has witnessed increasing urbanization and changing life styles factor which have in turn, raised the incidence of non-communicable chronic diseases, especially cardiovascular diseases. Response towards non communicable diseases is seriously interfered by poverty and social disintegration, with the burden of communicable diseases still high exhausting health resources.⁶⁷ Cardiovascular disease has reached near epidemic proportions in Africa. Accounting for 9.2% of total deaths in the African region in 2001, hypertension, stroke, cardiomyopathies and rheumatic heart disease were the most prevalent causes.^{64, 66} In Nigeria reported barriers to managing cardiovascular risk included inadequate financing, low competence among health workers, and poor laboratory support.⁶⁸

A study in Kenya, Oyoo and Ogola (1989) did what was probably the first echo based study of the etiology of HF in 91 consecutive patients who were admitted to the Kenyatta National Hospital. The main etiology of heart failure was found to be RHD (32%), DCM (25%) and HHD (17%). Ischaemic heart disease accounted for only 2% of cases, a proportion that is similar to other parts of Africa.⁶⁹

Africa is challenged by more than 30 million people infected with HIV. HIV cardiac related pathologies, DCM&TB pericarditis are important causes of HF. HIV-associated DCM has the worst prognosis. The rapid urbanization has increased the prevalence of CVS risk factors, e.g. HT, DM, and obesity, changing the trend towards IHD⁷⁰

In Tanzania the MOH report indicates that heart failure accounted for 0.3% of all Hospital admissions and 2.85% of all Hospital Deaths for patients aged ≥ 5 yrs in 1995.⁷¹ countrywide. At MNH heart failure accounted for 11.5% of all admissions to the Medical wards between June 1999 and May 2000.²⁵ The previously observed lower prevalence rate of heart diseases at MNH and other referral hospitals in Tanzania compared to the western countries is attributable to the lower life expectancy in

Tanzania, under diagnosis and poor survival of those with congenital heart diseases who die early due to inadequate surgical and cardiovascular services in the country.⁷¹

Unfortunately both prevalence and incidence of heart diseases are on the rapid rise worldwide and becoming more common among elderly.⁷³ The incidence is expected to continue rising as the population continues to age and a pool of congenital and acquired heart diseases successfully treated surviving childhood, early and middle adulthood increases.⁷³

In the Framingham study the incidence of both cardiovascular disease and heart failure increased steeply with age doubling by decade effect on incidence observed. It also observed the lower prevalence among women compared to men 2.5 per 1,000 and 3.7 per 1,000 respectively.⁷⁴ Schoken et al observed a 15yr total mortality rate of 39.1% and 71.8% among women and men aged less than 55 years respectively.⁷⁵

Regional variation of Cardiac conditions is also seen as for example the occurrence of Endomyocardial fibrosis in the west Nigerian south and dry north expresses an obvious climatic variation which is also observed in South and West Uganda.⁷⁶

Makene et al found heart failure to be the commonest presentation of heart disease in Dar es Salaam with the underlying causes being, Rheumatic valvular heart diseases 41.0%, cardiomyopathy 31%, hypertensive heart disease 18.7%, and congenital heart diseases 4.5%.²⁶

Nigerian studies has listed as hypertensive heart disease, primary cardiomyopathies, pulmonary heart diseases as causes of heart failure in the elderly >65years where as rheumatic heart diseases, peripartum cardiac failure and EMF in the young population.⁷⁷
⁷⁸ Rheumatic heart disease is common in Africa, and its occurrence is strongly associated with, low socioeconomic status, chronic tonsillitis, positive family history of acute rheumatic fever/RHD and paternal consanguinity⁷⁹

Parameshwar et al in their district hospital study in UK, found Hypertension accounting for only 6.4% while coronary heart diseases accounted for 41%, valvular heart disease 9% and cardiomyopathy 1%. This contrasts with conditions found by Makene 1971/72 in Dar es salaam²⁶, exemplifying a vivid picture of pattern reversal when cardiac services are adequately offered in advanced Cardiovascular medicine and due to economic changes which leads to westernization as a consequence of globalization.

There is a need for large-scale epidemiological studies of the incidence, prevalence, determinants, and outcome of cardiomyopathy in Africa to inform strategies for the treatment and prevention of heart muscle disease on the continent.^{81, 82}

1.5 PROBLEM STATEMENT AND RATIONALE OF THE STUDY

Despite higher prevalence of the cardiac diseases in Africa, research in this area has not been a priority. A study done in Gambia revealed poor recording of demographic data which grossly interfered the smooth execution of a project for people with cardiovascular disease. Unsurprisingly, Africa has the lowest output in the world of cardiovascular research.⁸³

It is well established that the types and the burden of heart disease change over time as a country undergoes economic development. Developing countries begin with a disease profile that is dominated by nutritional, perinatal and infectious diseases and, in the process of development, make the transition to one dominated by non-communicable diseases, such as cardiovascular disease and cancer.⁶¹ The emergency of new diseases such as AIDS in our era may also be responsible for the changes in the distribution of certain diseases especially in the Sub Saharan Africa where HIV/AIDS is at its peak level.

In Tanzania 1971, Makene et al²⁶ described a pattern of heart diseases in Dar es Salaam which was similar to other African countries then.

No information is available on the current pattern of cardiac diseases in Tanzania in the era when echocardiography is available and particularly at Muhimbili national hospital which is a tertiary hospital receiving patients from all over the country.

This study therefore aimed at describing the current pattern of cardiac conditions which will enlighten the policy makers on where to put emphasis during planning in a limited resource situation.

CHAPTER TWO

2.0 OBJECTIVES

2.1 BROAD OBJECTIVE

To describe the pattern of cardiac diseases among patients attending cardiac clinics and medical wards at Muhimbili National Hospital 2007.

2.2 SPECIFIC OBJECTIVES

1. To determine the Echocardiographic types of cardiac diseases among patients with heart diseases in medical wards and cardiac clinics at Muhimbili National Hospital.
2. To describe the presenting clinical features and severity of heart disease among patients with cardiac diseases in medical wards and cardiac clinics at Muhimbili national hospital
3. To describe the distribution of cardiac diseases by age and sex among patients with heart diseases in medical wards and cardiac clinics at Muhimbili National Hospital

CHAPTER THREE

3.0 METHODOLOGY

3.1. Study Design: It was a descriptive cross-sectional study involving cardiac patients aged 7 years and above, attending cardiac clinic and Medical wards at Muhimbili National hospital.

3.2. Study Area: Cardiac clinic and medical wards Muhimbili National Hospital, Dar es Salaam Tanzania.

Muhimbili National Hospital (MNH) is in the City of Dar es Salaam, which is the country's largest city, with estimated population of 3.5 million.

It has three municipals, each with a municipal hospital. There is no regional hospital in the city. MNH therefore serves as a referral hospital for these municipal hospitals as well as being the country's tertiary referral and teaching Hospital. It serves about 1,000 outpatients per day and admits about 1, 000 patients a week.

At MNH administratively patients aged 7 years and above are admitted or attended at adult Internal medicine facilities. The medical outpatient clinics are run everyday during the weekdays. There is a specialized cardiac clinic on each Friday afternoon.

Medical wards admit a variety of medical patients daily. Many of the admitted patients are referred from the surrounding hospitals and from regional hospitals upcountry, a few are self referrals from home.

3.3. Study population

Patients with features of heart diseases in medical wards and those attending cardiac clinic, Muhimbili National Hospital 2007

3.4. Sampled population and duration:

All patients who attended Muhimbili National Hospital inpatient and outpatient's medical department for 5 months, between July 1st and November 31st 2007.

3.5. Inclusion criteria:

1. Patients with features of heart diseases who are admitted in medical wards and those attending cardiac clinics at Muhimbili National Hospital during the study period
2. Willingness to participate in the study and signing a written informed consent or by the parent/guardian, for those below 18 years of age.

3.6. Exclusion criteria

1. Patients who died within 24 hours of admission
2. Patients who were discharged upon arrival at the admitting wards
3. The unconscious patients.

3.7. Sample size and sampling technique

Sample size for this study was calculated using the formula for cross-sectional study;

$$\text{(single proportion). } n = Nz^2 p (1-p) / \epsilon^2 (N-1) + z^2 p (1-p)$$

Where n = expected minimum sample

N = Total population (number of patients with cardiac diseases attending MNH for 5 months- 1300)

z = standard, corresponding to 95% confidence; 1.96

P = lowest prevalence among cardiac diseases from the previous study by Makene et al
= 4.5%

ϵ = maximum likely error taken as 2.5%

Hence, minimum sample size calculated was 220.

This study enrolled a total of 250 subjects, Patients who were seen in medical wards and those attending cardiac clinics who were consecutively recruited into the study after an informed consent. For conveniences of resources and investigation facilities these patients were evenly spaced to be enrolled for the period of 5 months by systematic sampling taking every fifth clinic attendant and ward admissions.

Outpatients

The investigator attended every cardiac outpatient clinic which runs every Friday afternoon during the study period. Every fifth patient who attended the clinic was selected and assessed for study eligibility by the investigator. Those who were eligible had to sign an informed consent for the study,

A standard questionnaire (appendix I) was used to collect sociodemographic data (age, sex, residence, level of education) and presenting cardiac symptoms. Each patient underwent a thorough clinical examination and important parameters were recorded.

All the study patients had a Chest X-ray, Electrocardiogram and Echocardiogram Venous blood samples were taken for FBP and ELISA for HIV screening after pre test counseling. For those with chest x-rays, ECG and ECHO done at MNH and reported by radiologist or cardiologist in the past three months, these were accepted for the study provided they were of acceptable quality.

Chest x-rays were reported by the author under supervision of a consultant radiologist. Standard Echocardiographs were done by the investigator under supervision of a cardiologist using HP 7500, 3.5MHz transducer.

Inpatients

The investigator visited each admitting ward on the next day and revisited the patients' notes to identify those with cardiac symptoms and signs.

Every fifth admission among those identified to have cardiovascular symptoms and signs were recruited into the study after meeting the eligibility criteria. Detailed history and

physical examinations were done. Results of the investigations and clinical data were filled into a structured questionnaire.

Similarly other investigations were done as for outpatients described above.

The following were the screening symptoms for cardiac disease:

(At least 4 of the following should be present)

1. Shortness of breath on exertion
2. Awareness of heart beats
3. Fainting attacks
4. Precordial chest pain
5. Easy fatigability
6. Swelling of lower extremities

Physical examination

Body weight

Body weight was measured using weighing scale, (UK made **Sae ADAM**) with a subject without shoes or heavy clothing. Recorded to the nearest 0.5kg

Height

Height was measured using a vertical scale, (UK made **Sae ADAM**) taken with subjects wearing no shoes or caps recorded to the nearest decimal points in centimeters.

Body mass index (BMI) was calculated using the formula:

$$\text{BMI} = \text{Weight (in Kg)} / \text{Height}^2 \text{ (in M)} \text{ recorded in Kg/M}^2$$

Four categories of weight were used according to BMI (Kg/m²) (adults' ≥ 18 years)

Normal weight - 18 – 24.9

Underweight - < 18

Overweight - 25 – 29.9

Obesity - ≥ 30



Patients' classification

Their recent symptoms were also recorded and patients were categorized into their respective; **New York Heart Association functional classes (NYHA) as:**

Class I: patients with no limitations of activities, they suffer no symptoms from ordinary activities

Class II: patients with slight, mild limitations of activity; they are comfortable with rest or with mild exertion.

Class III: patients with marked limitation of activity, they are comfortable only at rest.

Class IV: Confined to bed, any physical activity brings on discomfort and symptoms occur at rest.

BP- measurement

BP was recorded with a standard mercury sphygmomanometer, using a 22-26cm cuff for small adults and 27-34 cm x for average adults.

3.8. INVESTIGATIONS

Roentgenographic examination of the chest

Each patient enrolled had a postero-anterior chest radiography done at the Radiology department. This was used to determine the cardiac size (Cardiomegally was considered when the C/T ratio was above 0.5), pericardial, pleural and pulmonary pathologies. X-rays were reported by a consultant radiologist.

Electrocardiograph

Standard 12 lead ECG were done using a USA made PHILIPS ECG model page writer ECGs were interpreted by the investigator and verified by a cardiologist. For the purpose of this study Information on presence of Left ventricular hypertrophy (by voltage criteria) arrhythmias and ischaemic changes was recorded in a questionnaire.



Echocardiogram

Were done by investigator under supervision of a cardiologist using a USA made PHILIPS echo machine (SONOS 7500) with a 2.5 MHz transducer to assess cardiac chamber size and function by Ejection fraction using standard views. Measurements were done during 2D, M-Mode and Doppler studies, to assess flow dynamics across the mitral, tricuspid, pulmonary and aortic valves to assess and grade of regurgitant or stenotic lesions. Also assessed were cardiac chamber dimensions, LV ejection fraction, presence of LVH was considered when the measured wall thickness during systole exceeded 12mm.

3.9. ETHICAL CONSIDERATION

A written informed consent was obtained from the patient or parent/guardian for the under 18s following understanding of the contents of the information sheet

No financial gain was obtained by the participants from a researcher.

Participants were free to leave from the study at any time if they wished.

Ethical clearance was sought from ethical clearance board of the Muhimbili University of Health and Allied sciences (MUHAS). Permission was sought from MNH management to use MNH medical wards, cardiac clinic and ECHO room for the study.

3.10. DISPOSAL OF PATIENTS

Those who were found to have Cardiac diseases were treated as per Muhimbili national hospital standard practice.

Special arrangements through the ministry of health and social welfare were done to refer abroad those who required open heart surgeries.

3.11. DATA PROCESSING AND STATISTICAL ANALYSIS

The reported data were entered into the computer using Epi-info version 6.0. After data cleaning was done and verified of coverage and consistency, were analyzed using Statistical Package for Social Sciences (SPSS/PC+ version 15.

Frequencies and percentages were used in description of variables

All the significant tests were run simultaneously by the same computer programs.

Continuous data were expressed in form of \pm SD,

Pearson's χ^2 was used to determine the associations for categorical variables. Where

Pearson's χ^2 was not applicable due to small numbers in the cells, fisher's exact test was used.

For statistical tests a two tailed p- value < 0.05 was considered significant.

3.12. DEESCRPTION OF TERMS

Pattern of cardiac diseases –Distribution of cardiac diseases

Cardiomegally – enlarged cardiac size with measured cardiothoracic ratio of more than 0.5 on the posteroanterior view of the chest roentgenography.

CHAPTER FOUR

4.0 RESULTS

Patient's social –demographic characteristics

A total of two hundred and fifty (250) patients with cardiac diseases were recruited during the study period, During the 5 months of the study 3342 patients were admitted in medical wards of these 144 out of 723 with cardiac symptoms were recruited into the study. One hundred and six of the 531 patients who attended to the cardiac clinics were also recruited. Of the total patients recruited 62.4 % were females.

The median age of the subjects was 32.5 (± 21.8) years; range (7 to 86 years). About two thirds of the patients (66%) were below 41 years of age. Males (mean age 36.2 years) were older than females (mean age 35.8 years (Fig. 1). However the difference between the sexes was not statistically significant. ($p = 0.20$).

The majority (60.4%) of the participants had primary education or below. Those who never went to school/formal education constituted 22.8% with majority being females; 28.2% versus 13.5% for males ($p = 0.008$). Only 13.2 % had the level above secondary education, which was vocational training and a few university graduates. (Table1). Males had higher level of post primary education than females ($p < 0.001$)

Peasants/petty traders, jobless, pupils constituted the majority of the patients attending MNH cardiac clinics and medical wards comprising around three quarters of all studied (72.8%). Thus majority of those utilizing MNH services were of low socioeconomic status. (Table 1)

Clinical Characteristics

Over two thirds of the adult patients had normal body weight BMI of 25-29.9Kg/m² (64.7%). Obese patients constituted 13.6% of the adults, with a high proportion of them being females (16.7%) versus (8.1%) males. No significant differences between the sexes were seen. ($p = 0.11$) (Table 1)

Blood glucose level was found to be elevated in 4.8%, many of them known to be diabetic attending diabetic clinics elsewhere. Where as some had incidental results which were followed for further investigations. Twenty seven percent of the patients had Microcytic hypochromic anaemia. On the ELISA test for HIV 20(8.0%) of the patients were tested positive No significant sex differences were found. (Table 1)

Table 1: Socio-demographic, clinical and laboratory Characteristics of cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital by sex-2007

Characteristic	Male n=94		Female n=156		Total n=250		p-value
	N	(%)	N	(%)	N	(%)	
Education							
No formal education	13	(13.8)	44	(28.2)	57	(22.8)	0.008
Primary	33	(35.1)	66	(42.3)	99	(39.6)	0.53
Secondary	27	(28.7)	34	(21.8)	61	(24.4)	0.21
Post Secondary	21	(22.4)	12	(7.7)	33	(13.2)	<0.001
Occupation							
Government. E*	15	(16.0)	14	(8.9)	29	(11.6)	0.09
Private employ	13	(13.8)	29	(18.9)	42	(16.8)	0.33
Pupils /children	35	(37.2)	39	(25.0)	74	(29.6)	0.04
Peasants/petty	18	(19.2)	42	(26.9)	60	(24.0)	0.32
Jobless	13	(13.8)	32	(20.5)	45	(18.0)	0.26
Laboratory							
HIV-ELISA-positive	9	(9.6)	11	(7.1)	20	(8.0)	0.55
Anaemia- Hb<11.5g/dl	28	(29.8)	50	(32.1)	78	(31.2)	0.46
Body Mass Index							
	Male n=62		Female n=108		Total n=170**		p-value
	N	(%)	N	(%)	N	(%)	
Underweight	2	(3.2)	0	(0)	2	(1.2)	
Normal weight	41	(66.1)	68	(63.0)	109	(64.1)	0.68
Overweight	14	(22.6)	22	(20.3)	36	(21.2)	0.73
Obese	5	(8.1)	18	(16.7)	23	(13.5)	0.11

*Government employees

** BMI n= 170 for only adults (age ≥18years)

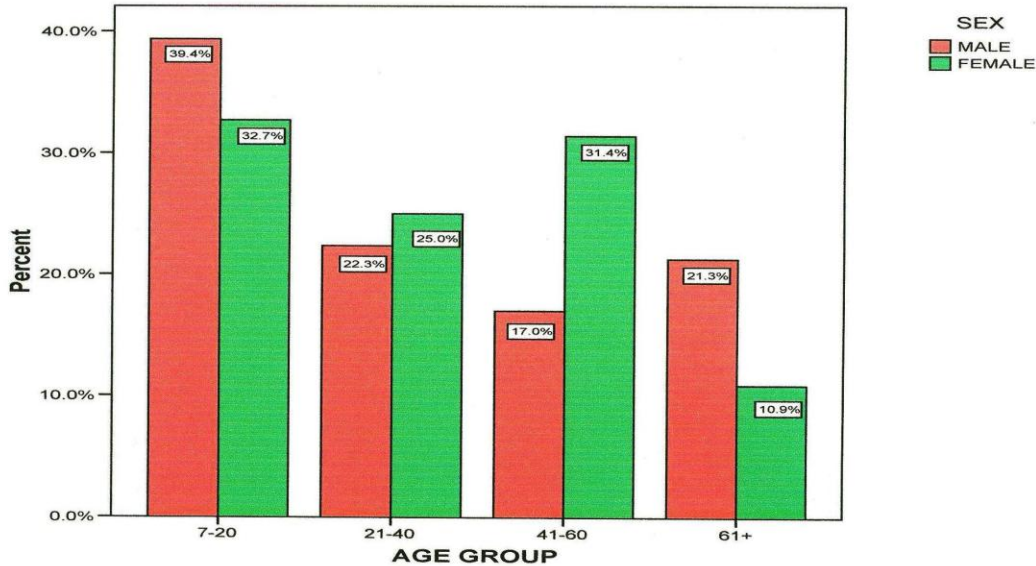


Figure 1: Age distribution of the cardiac patients attending MNH cardiac clinic and medical wards by sex.

Clinical presentations

The most frequent presenting symptoms were exertional dyspnoea in (94.8%), palpitations (92.8%) and easy fatigability (92.8%); syncope was the least common presenting symptom (34.4%), (96%) of patients had both shortness of breath and easy fatigability where as 93.7% had shortness of breathe together with awareness of heart beats

Presence of heart murmurs constituted the highest 43% among the signs; the least being pericardial rub 0.8%. Of those with murmurs 97.2% had awareness of heart beat. Ninety percent presented with both shortness of breath and awareness of heart beat, 95% of patients with shortness of breath had non specific precordial chest pain. (Table 2).

percent presented with both shortness of breath and awareness of heart beat, 95% of patients with shortness of breath had non specific precordial chest pain. (Table 2).

Table 2: Common Presenting clinical symptoms and signs among cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital -2007 (N=250)

Clinical Features	Frequency	(%)
Exertional dyspnoea	237	(94.8)
Syncope	86	(34.4)
Palpitations	232	(92.8)
Precordial pain	170	(68)
Easy fatigue	232	(92.8)
Swelling of Lower Limbs	124	(49.6)
Tachycardia	25	(2.0)
Elevated JVP	42	(16.0)
Murmur	108	(43.0)
Cyanosis	7	(2.8)
Finger clubbing	10	(4.0)
Pericardial rub	2	(0.8)
Basal crepitations	35	(14)

At presentation majority of patients were in New York Heart classes II and III (70%) with almost half of the study population (48.5%) presenting in New York Heart Association classes III and IV, there was no statistically significant sex differences ($p = 0.6$). Majority of patients admitted in medical wards (86%). presented in advanced heart failure (Figure 2)

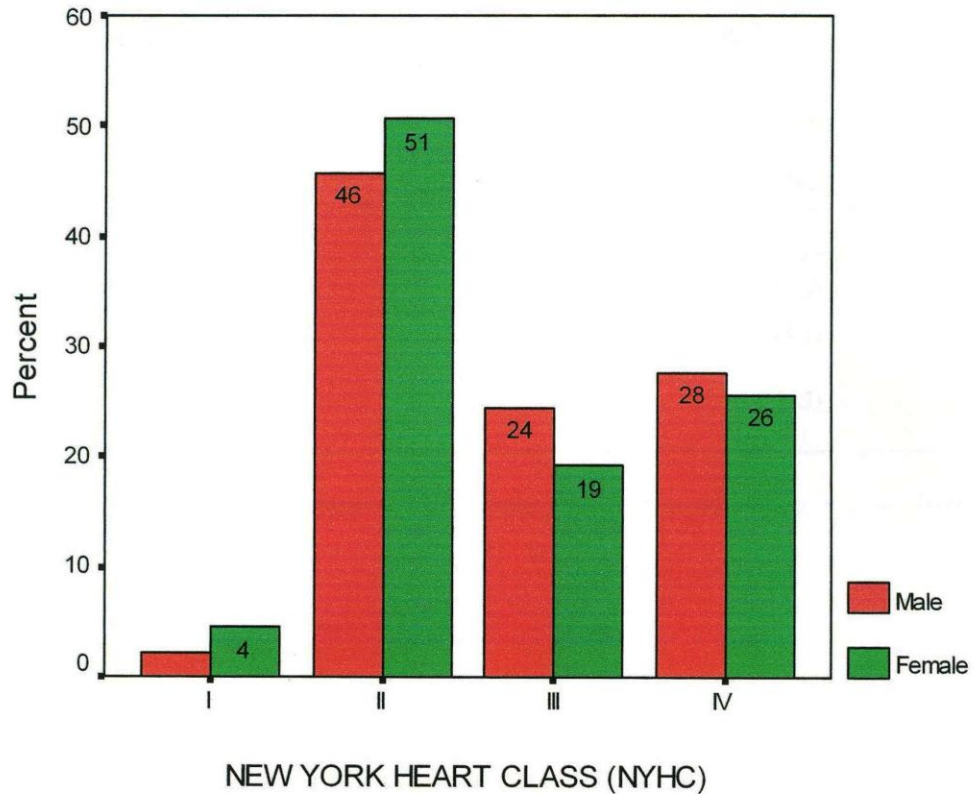


Figure 2: New York Heart Classification at presentation among cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital -2007

Roentgenographic findings

Cardiomegaly was the main Roentgenographic finding among the cardiac patients constituting (86.9%). The least was pulmonary edema (3.4%) One patient presented with dextrocardia among others.

Table 3: Abnormal Roentgenographic findings among cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital -2007

X-RAY DESCRIPTION	Total N=206	
	N	(%)
CARDIOMEGALLY	179	(86.9)
PULMONARY EDEMA	7	(3.4)
PLEURAL EFFUSION	9	(4.4)
OTHERS*	11	(5.3)

*Parenchyma diseases (pneumonia, TB), dextrocardia, pleural thickening, and fibrotic changes

Common Electrocardiographic findings

Seventy eight percent of patients had abnormal ECGs with the rest having normal ECGs. Hypertrophic Changes (left ventricular and atrial enlargement) were the commonest ECG presentations seen among the study patients (50.8%). The least presented were the ischaemic changes (9.6%), suggesting that coronary artery disease is still rare in the study population.

Table 4: Common ECG findings among cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital -2007

Findings	Total N=250	
	N	(%)
Hypertrophic changes	127	50.8
Dysrhythmias	31	12.4
Conduction defect	38	15.2
Ischaemic changes	24	9.6
Normal ECGs	54	21.6

Echocardiographic diagnosis of cardiac diseases

Rheumatic heart diseases constituted the most frequent diagnosis (46.0%) with 48.7% of females and 41.7% of males affected, ($p = 0.26$). Mitral valve prolapse was predominantly diagnosed among females (14.1%) than males (4.2%) $p= 0.01$.

Hypertensive heart disease constituted the second most diagnosis in this study (21.3%)

Ischemic heart disease was the least common diagnosis (1.2%). Cardiomyopathies (11.2%) constituted dilated, peripartum, hypertrophic and restrictive. (Table5).

Table 5: Echocardiographic diagnosis of diseases among cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital -2007

DISEASE	Males n=94		Females n=156		Total N=250		P value
	N	(%)	N	(%)	N	(%)	
Rheumatic valvular heart diseases	39	(41.5)	76	(48.7)	115	46.0	0.26
Hypertensive heart diseases	25	(26.6)	28	(17.9)	53	21.3	0.73
Cardiomyopathies	13	(13.8)	15	(9.6)	28	11.2	0.45
Mitral valve prolapse	4	(4.3)	21	(13.5)	25	10.4	0.01
Pericardial diseases	5	(5.3)	10	(6.4)	15	6.0	0.72
Congenital heart diseases	7	(7.4)	4	(2.6)	11	4.4	0.13
Ischemic heart diseases	1	(1.1)	2	(1.3)	3	1.2	0.65

Age distribution

More than two thirds (71.4%) of Rheumatic heart diseases were among patients below 61 years, with a statistically significant decrease in proportions with increasing age ($p < 0.001$). Hypertensive heart disease was the disease seen more with advancing age, more than 2/3 of those with HHD (67.9%) were 41 years and above ($p=0.01$). No Congenital heart disease was detected above 40 years.

Table 6: Distribution of Cardiac diseases by age among cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital -2007.(N=250)

AGE YRS→	7-20	21-40	41-60	61+	TOTAL	P-value
RHD N (%)	53 (46.1)	28 (24.4)	20 (17.4)	14 (12.2)	115 (46.0)	<0.001*
HHD N (%)	6 (11.3)	11(20.7)	19 (35.8)	17 (32.1)	53 (21.2)	0.001
D CMP I N (%)	1 (3.6)	6 (21.4)	11 (39.3)	10 (35.7)	28 (11.2)	0.008
S MVP E N (%)	13 (52.0)	8 (32.0)	4 (16.0)	0 (0)	25 (10.4)	0.01*
A Pericardial S Diseases E N (%)	9 (60.0)	2 (13.3)	3 (20.0)	1 (6.7)	15 (6.0)	0.01
S Congenital heart d'ses N (%)	6 (54.5)	5 (45.5)	0 (0)	0 (0)	11 (4.4)	0.14
IHD N (%)	0 (0)	0 (0)	2 (66.7)	1 (33.3)	3 (1.2)	
TOTAL	88 (35.2)	60 (24.0)	59 (23.6)	43 (17.2)	250 (100)	

*P-value for trend

Distribution of rheumatic heart diseases

Mitral valve involvement was the commonest with regurgitant lesions occurring in 61% of the patients. Occurring together mitral regurgitation and stenosis were seen in 5.2 % of the study population. Aortic valves were the least affected. In this study significantly absent were the pulmonary lesions. Mitral stenosis proportions were high, among female than male patients, no statistical significance was noted ($p=0.57$) (Table 7).

Table 7: Distribution of rheumatic heart diseases diagnosed among cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital -2007 by the type of valvular lesion and sex.

Valvular lesion	Males N=39		Females N=76		Total N=115		P-value
	N	%	N	%	N	%	
MR	24	(61.5)	47	(61.8)	71	(61.7)	0.97
MS*	3	(7.6)	11	(13.2)	14	(11.3)	*0.57
AR	4	(10.2)	3	(3.9)	7	(6.0)	*0.35
AS	2	(5.1)	3	(3.9)	5	(4.3)	*0.04
TR	3	(7.6)	7	(9.2)	10	(8.6)	*0.93
MR/MS	3	(7.6)	3	(3.9)	6	(5.2)	*0.68
AR/AS	1	(2.6)	1	(1.3)	2	(2.6)	

*Fisher's exact test

Cardiomyopathies, pericarditis and Congenital heart diseases

Dilated Cardiomyopathy was the commonest type (64.3%), among patients with cardiomyopathies. Restrictive cardiomyopathies were the least presented in this population presenting in 7.2%. 50% of these were endomyocardial fibrosis.

Of the 15 patients who presented with pericardial disorders 12 (80%) had pericardial effusions. Vivid floaters and pericardial thickening suggesting tuberculous Pericarditis was found in (50%) of those with pericardial effusion

Of the congenital heart diseases diagnosed ventricular septal defect was the leading, seen in 54.5%. (Table 8)

Table 8: Types of Cardiomyopathies, pericardial disorders and congenital heart diseases among cardiac patients in medical wards and cardiac clinic Muhimbili National Hospital -2007

Condition		N	(%)
Cardiomyopathies N = 28	Dilated	18	64.3
	Peripartum	4	14.3
	Hypertrophic	4	14.3
	Restrictive	2	7.2
Pericardial disorders N =15	Pericardial effusion	12	80.0
	Pericarditis	3	20.0
Congenital heart diseases N = 11	TOF	2	18.2
	VSD	6	54.5
	Ebstein's anomaly	2	18.2
	PDA	1	9.1

Surgical recommendations

Thirty seven of the patients with rheumatic heart disease were recommended for surgery which is usually done abroad. Other recommendations for surgery included patients with congenital heart diseases.

The rest of the patients were followed on medical treatment for some had insignificant lesions for surgery and others were found unfit for surgery for the advanced heart failure. Thirteen patients were seen during the study postoperatively after undergoing surgery for repair or replacement of different valvular lesions.

CHAPTER FIVE

5.0 DISCUSSION

Administratively medical wards and cardiac clinics at Muhimbili national hospital receives and manages patients aged 7 years and above. In this study patients were recruited from outpatient cardiac clinic and medical admissions wards

In this study the majority of cardiac conditions were seen at younger age with median age of 32 years. Previous studies^{77, 78} in Tanzania, Nigeria and other developing countries have shown similar patterns. This could possibly be due to the fact that majority of the cardiac conditions in this country are those of infectious origin like rheumatic heart diseases and cardiomyopathies which were more prevalent. Another explanation could be a shorter life expectancy in this country which averages 45.9 years,⁸⁴ thus majority of the patients die earlier due to overwhelming HIV and TB infections before they could develop heart diseases related to ageing process as seen in developed world⁸⁵ Similar findings were seen in South African where it was seen that patterns of diseases as rheumatic heart diseases, pericarditis were attributable to poverty (illiteracy, socioeconomic status and poor housing) the common situation in Sub Saharan Africa.^{19, 21, 70}

Majority (66%) of the study subjects had informal or primary education, while minority (12%) had post secondary education. About half (47.9%) of study subjects were students or jobless while about a quarter of the participants (24%) were peasants or petty traders in the present study. Overall the patients seen were of low socio economic status: low education, petty jobs reflecting Muhimbili National Hospital by social divide is preferred by those with low income for low costs of health services offered. Where do others go for health services, would be answered by the mushrooming of the private hospitals contributing up to 10% of health care in Tanzania. The costs of service in the private hospitals are relatively higher so probably those who are economically better-off attend.

Tanzania like some other third world countries has more than half of a population living in absolute poverty with 57.8% surviving on less than 1 US dollar a day.⁸⁴

In the present study mitral valve prolapse was predominantly seen among females while hypertensive heart disease predominated among males, similar findings were seen in other studies⁸⁶. However the overall pattern revealed that RHD was the commonest followed by HHD and cardiomyopathy, while ischaemic heart diseases was the least. A similar study²⁶ in Dares salaam ,observed an almost similar pattern of cardiac diseases as major contributors to heart failure as RHD 41%, Cardiomyopathy 31%, HHD 17% and Congenital heart diseases 4.5%. There were no cases of pericardial diseases and ischaemic heart diseases seen,⁷⁶ probably these were not detected as diagnostic facilities including ECHO were not yet available in Tanzania. Improved diagnostic facilities, especially availability of ECHO allows specific diagnoses to be made. The slow rate of changes from the previous patterns seen in the current study is contrary to the fact that as we fight infectious diseases in Tanzania change in the pattern of cardiac diseases away from the infectious type was expected, it may be signifying that we have not yet achieved the standards that most of the developed countries have in the fight against infectious diseases, however the finding concurs with the overall low levels of literacy and social well being among patients involved in the current study. More over with the emergence of HIV/AIDS infectious related cardiac diseases such as myocardial and pericardial disorders are emerging to the peak levels.

In another prospective clinical study in Malawi it was found that rheumatic heart diseases were the commonest diagnosed, followed by hypertensive heart disease while ischaemic heart disease was not seen.⁸⁶ The two studies^{26, 86} done almost 30 years ago showed an overall similarity with minor differences in the pattern of the diseases to the current studies⁹⁵ done in Sub Saharan Africa. This means that the pattern has not changed much. The differences seen in the new diseases not formerly diagnosed including the mitral valve prolapse pericardial diseases and various congenital heart

diseases reflect the availability of diagnostic facilities which has improved diagnostic power and clinical decision making today.

The findings from this study reflect similar patterns seen in other parts of Sub Saharan Africa with minute variations accounted for by the design, setup and characteristics of the study subjects. It is still a fact that rheumatic heart diseases, hypertensive heart diseases, cardiomyopathies, mitral valve prolapse, pericardial, congenital and ischaemic heart diseases are all prevalent in Tanzania. Ischaemic heart diseases are still uncommon though on the increase in Africa. RHD is sustained by high profile of risk factors for acute rheumatic fever especially poverty, low educational level and poor access to health facilities.^{79, 81, 82, 85}

The present study has revealed that rheumatic heart disease is the leading cause of hospital attendances and admissions due to cardiac diseases at a tertiary referral hospital in Tanzania. RHD was predominantly seen at a young age of 41 years or younger. This young age group affected constitutes a population most vulnerable to rheumatic fever following sore throat infections prevalent in childhood.⁷⁷ A Study in a similar population in Africa have revealed similar findings.⁷⁹ The outcome of the young age being affected adds an extra economic burden to a nation as a consequence of the amount of active years lost for productive tasks in these patients.

In the present study mitral valve was found to be the commonest valve affected by rheumatic heart disease with regurgitant lesions predominating. Mitral valve lesions were commoner among females than males with mitral stenosis having higher proportions among females than males. Other studies⁸⁶ in different parts of the world have found similar predominance. No clear explanation as to why females are more affected.

Hypertensive heart disease was the second commonest cardiac disease seen in this study. About two thirds of the subjects were above 41 years of age with a statistically significant trend of increase in prevalence with advancing age. Almost all had left

ventricular hypertrophy and diastolic dysfunction as detected by ECG and echocardiography. Probably these patients had a history of long standing hypertension. In Tanzania though the literature on prevalence of hypertension is scanty, there are some reports that it has been increasing in prevalence from 2-4.9% 1969-70^{87, 88} to 16% in 1996. A tendency of increasing prevalence was seen from rural to urban areas of Tanzania, Dares salaam the capital city having the highest prevalence.³⁴ Findings in the present study of higher levels of hypertensive heart diseases conform to other studies done on hypertension. In the blacks hypertension is highly associated with earlier onset, increased severity, and accelerated course of the disease^{89, 90} with LVH among others being demonstrated to occur more frequently in black hypertensives.⁹¹ Although the population studied in the current study was relatively young, a significant number of patients with hypertensive heart diseases were seen, showing an accelerated progress to complications among black hypertensives. Similar studies,^{89, 91} found this pattern. Another study⁸⁴ in South Africa found higher prevalence of complications in over 60 years black hypertensives.

The current study found cardiomyopathies as a third leading cause of heart diseases at Muhimbili National Hospital. Of the cardiomyopathies, dilated cardiomyopathy was the most prevalent while endomyocardial fibrosis was the least. Cardiomyopathy is a common disease in Africa, endemic for the past 60 years. Both genetic and environmental factors being implicated in its causation.⁶³ The pattern however differs from those seen in some studies done in Uganda,⁹¹ where endomyocardial fibrosis was a more predominant diagnosis. This could be explained by the strong environmental association with the aetiology of the disease only reported in certain regions of Africa. In the equatorial Africa, (Tropical region of East Central and West Africa) endomyocardial fibrosis is endemic, where some geographically distributed factors and diet are implicated to play role in its aetiology.¹⁷ Peripartum cardiomyopathy on the other hand was seen in 14% among the cardiomyopathies detected in this study. Peripartum cardiomyopathy is also common in Tanzania.²⁷ Probably more than this would have been seen if patients admitted in postnatal wards were also included. The disease is so

prevalent among the Hausa and Fulani groups of Northern Nigeria where it is a recognized cause of maternal morbidity among this population, the reason for the higher prevalence being some customary puerperal practices exhibited in this culture.⁹³

In the present study pericardial diseases were found in 6% of the patients, of these 80% had pericardial effusion with a half having visible floaters and thickening on echo suggesting TB pericarditis. Sixty six percent of those with tuberculous pericarditis were HIV positive. The rest had non effusive pericarditis. HIV related cardiac disorders are increasingly detected as causes of pericardial diseases. In the current HIV era, in a country like Tanzania where tuberculosis is also prevalent such findings as tuberculous pericarditis are increasingly becoming common. In a study⁴⁹ done in Dar es salaam Tanzania 14 years ago, significant association was found between tuberculous pericardial effusion and HIV infection. Other studies^{94, 95} in South Africa had findings of similar patterns of HIV/TB commobidities with pericardial diseases.

Congenital heart diseases accounted for 4.4% of the patients in the current study, ventricular septal defect was the most diagnosed, followed by Tetralogy of Fallot and Ebstein's anomaly; all of the congenital heart diseases were seen in patients below 41 years old. Common congenital heart diseases especially the acyanotic are usually encountered in the age above infancy with many of the cyanotic diseases dying in early infancy unless corrected surgically.⁷ Majority die undiagnosed because of inadequate facilities for antenatal screening. Many of the congenital heart diseases diagnosed in childhood, and adulthood, with symptoms and some as incidental findings on Echocardiography are the acyanotic group of congenital anomaly as VSD seen in this study.

Not finding any of these condition beyond 40 years of age as seen in this study, concur with the natural history of the disease with premature mortalities, but if antenatal diagnosis , counseling, early detection, referral and surgical treatment is done timely, then normal life span for correctable cardiac defects could be offered.⁷² The pattern seen

in the present study is Contrally to what is seen in developed countries where majority of the patients with congenital heart diseases reach adulthood even with rare complicated cases.⁹

Diagnosis of cardiac diseases

With regard to clinical disease stage of presentation this study found almost half of the patients presented in New York Heart Association class III and IV revealing that a good number were seen in advanced heart failure. These were admitted in the wards for immediate work up presenting with shortness of breath and lower limb swelling with additional signs of bi basal crepitations, elevated jugular venous pressure in some. These features of advanced heart failure are what necessitated hospital admissions of such patients. On the other hand majority of patients who attend cardiac clinics were those seen in NYHAC I and II. Many of these were relatively stable, presented with occasional awareness of heart beats and exertional dyspnoea. Patients admitted in wards would have been in a more advanced level of failure, if the author would have been examining them the moment they are admitted. As for this study, these patients were visited the next morning following admission when already had received, aggressive initial treatment for heart failure on admission.

Ogola EN etal, (1999) in his analysis of the underlying aetiology, precipitating factors and certain sociodemographic determinants in 91 patients admitted to Kenyatta National hospital, Nairobi, he found 62% of the patients were in (NYHA) functional class IV, 31.9% in class III and 5.5% in class II ⁶⁹

The slight differences seen in their study could be explained by the differences in types of patients recruited, as they recruited only patients admitted in wards, the present study took inpatients and outpatients. Many of the patients necessitating admission into wards for stabilization and care are in advanced heart failure.

Following chest Roentgenographic examinations the most striking radiological feature seen was cardiac enlargement which was universal reported in 86.9% of the patients. Similar pattern of cardiomegaly has been reported in a study in Nigeria.⁸⁷ Also noted was a minimal pleural effusion in 43% of their patients. In the present study pleural effusion was seen in 4.4% of the patient investigated, half of these were among known patients with tuberculosis on antituberculous therapy the rest had congestive heart failure on treatment. In one patient co existent tuberculosis or heart failure could not be established. In many parts of the world the most common cause of exudative pleura effusion is pulmonary tuberculosis, other pulmonary causes are suggested by lung parenchyma abnormalities. However right sided pleura effusions, with cardiomegaly or pulmonary edema are significant of disordered cardiac function seen in heart failure.

Pulmonary edema was seen in 4.4% of the patients investigated; this could probably be an underestimation of the reality because of the transient nature of the edema as most of these patients undergo active treatment on arrival to hospital long before they are taken for x-rays when much of the typical x-ray findings have disappeared.

Pericardia effusion was suspected in only one third of patients with pleural effusion from the chest X-rays of the study patients and were confirmed by echocardiography. The findings of the current study compare with a study⁹⁴ done in South Africa; where it was revealed Chest roentgenography is a useful screening tool, although echocardiography will still be required for a definite diagnosis.

The Electrocardiography done to all patients in the present study, revealed 21.6% of the ECGs to be normal. The abnormalities seen included right and left atrial enlargements, and left ventricular hypertrophy. LVH was the commonest findings conforming to hypertensive changes and valvular lesions which were revealed in the study.

Although a 12 lead ECG recorded at rest is normal in about half of the patients with typical angina pectoris, but there may be signs of an old myocardial infarction. In this study features comprising typical QRS, ST segment and T/u wave changes with regional wall low voltages were observed in only the minority suggesting coronary artery diseases.

Despite being rare in our setup coronary artery disease typical electrocardiographic patterns may be masked by the higher prevalence of comorbid cardiomyopathies. However Stress testing electrocardiography was not done in this study pointing towards one of its limitation in diagnosing Ischaemic heart diseases.

During the study period there were 5 echocardiographs which were done as emergence with the intention to rescue hemodynamic compromises. Three of them were due to cardiac tamponade where therapeutic pericardiocentesis were done, the rest were of one patient with acute myocardial infarction and another with atrial fibrillation.

CHAPTER SIX

6.0 CONCLUSION

Cardiac diseases are common in Tanzania affecting a relatively younger population among patients attending at Muhimbili National Hospital. Majority of the affected were females, of low socioeconomic status. The magnitude of Rheumatic heart disease in the young population is high. Hypertensive heart diseases are remarkably commonly with advancing age. Cardiomyopathies with HIV and Tuberculous pericardial diseases are common where as Ischaemic heart diseases are still rare in this population. Many of the patients reach the health facility in advanced disease in New York heart association classes III and IV low educational level, socioeconomic status and access to diagnostic facilities at regional levels contribute to the late presentation and diagnosis hence likely to lead to poor prognosis of cardiac patients in Tanzania.

The pattern of the heart diseases seem to have not been changed much for the past 3 decades signifying slow socioeconomic transition among other reasons, however since echocardiography started working in Tanzania, advancement in diagnostic power is verified as more diseases are diagnosed with certainty.

6.1 STUDY LIMITATIONS

Being a hospital based study at a referral hospital in Tanzania, highly selected group of patient was studied hence results from the study should be extrapolated to the general population cautiously.

Some of the asymptomatic patients with cardiac diseases might have been missed since the criteria for diagnosis involved symptoms

During echocardiographic tests only the Trans-thoracic approach was used, hence structures like left atrial appendage vegetations and other lesions were likely to be missed.

6.2 RECOMMENDATIONS

1. It is high time for cardiac diseases to be given a desired priority by the ministry of health as is seen with other diseases of public health importance in personnel and finance
2. Diagnostic facilities, especially echocardiograms need to be centered up county (in regional hospitals) to assist early diagnosis of cardiac diseases with strategies for intervention being in place.
3. It is time to establish a big cardiac surgery hospital {Centre in Tanzania}
5. Call upon doing another study which may have a larger sample size and use other invasive investigations such as cardiac catheterization to describe well the types of cardiac lesions and prognostic evaluations.

7.0 REFERENCES

1. Murray CJ, Lopez AD. The Global Burden of Diseases: A comprehensive Assessment of Mortality and Disability from Diseases, Injuries and Risk Factors in 1990 and Projected to 2020. USA, Havard School of Health, 1996.
2. Braunwald E. Approach to the patient with cardiovascular disease. In: Kasper DL, Braunwald E, Fauci AS. Harrison's Principles of Internal Medicine, 16th Ed. The Mc Graw-Hill Companies, Inc; 1301-1304.
3. Reddy KS, Yusuf S. Emerging epidemic of cardiovascular disease in developing countries. *Circulation* 1998; 97: 596-601.
4. World Health Organization. Atlas of heart disease and stroke (Chapter Global burden of coronary heart disease). Geneva' World Health Organization; 2005.
5. World Health Organization. World health report 2002. Reducing risks, promoting healthy life. Geneva: WHO, 2002. www.who.int/whr/2002/en/index.html (Accessed on 6th Nov.2006).
6. Sani MU, Mukhtar-Yola M, Karaye KM . Spectrum of congenital heart disease in a tropical environment: an echocardiography study. *J Natl Med Assoc.* 2007; 99(6): 665-669.
7. John S. Child, William F. Friedman. Congenital heart disease in the adult. In: Harrison's principles of internal medicine 16th edition Mc Graw-Hill Companies, Inc; 2005:1381-1382.

8. Soto B, Mc Connell ME. Tetralogy of Fallot angiographic and pathological correlation. *Semin Thoracic Cardiovasc Surg* 1990; 2:12-26.
9. Webb G. Philadelphia Adult Congenital Heart Center, Philadelphia, USA *Can J Cardiol*. 2005 21(10):833-838. Links Comment in: *Can J Cardiol*. 2006; 22(2):157.
10. Bregan, et al. *Giornale Italiano di Medicina Tropicale*, 2005 (Vol. 10) (No. 1/2) 29-32.
11. Carapetis JR, McDonald M, Wilson NJ. Acute rheumatic fever. *Lancet* 2005; 366:155-168.
12. Mayosi BM, Robertson K, Volmink J, et al. The Drakensberg declaration on the control of rheumatic fever and rheumatic heart disease in Africa. *S Afr Med J* 2006; 96: 246.
13. Robertson KA, Volmink JA, Mayosi BM. Towards a uniform plan for the control of rheumatic fever and rheumatic heart disease in Africa: the Awareness Surveillance Advocacy Prevention (ASAP) Programme. *S Afr Med J* 2006; 96: 241–245.
14. Carapetis JR, Steer AC, Mulholland EK, Weber M. The global burden of group A streptococcal disease. *Lancet Infect Dis* 2005; 5: 685–694.
15. Veasy LG. Time to take soundings in acute rheumatic fever. *Lancet* 2001; 357:19945.
16. World Health Organization. Rheumatic fever and rheumatic heart disease: report of a WHO Expert Consultation, Geneva, 29 October–1 November 2001.
17. Commerford P, Bongani M. An appropriate research agenda for heart disease in Africa. *Lancet* 2006; 367:1884–886.

18. Benatar SR, et al. Health care reform and the crisis of HIV and AIDS in South Africa. *N Engl J Med* 2004; 351: 81–92.
19. Commerford PJ. Valvular heart disease in South Africa in 2005. *S Afr Med J* 2005; 95: 568–574.
20. Herz, Maisch B, Richter A, Sandmüller A, Portig I, Pankuweit S. Inflammatory dilated cardiomyopathy (DCMI). *BMBF-Heart Failure Network*. 2005; 30(6): 535-544.
21. Sliwa K, Damasceno A, Mayosi BM. Epidemiology and etiology of cardiomyopathy in Africa. *Circulation* 2005; 112: 3577–3583.
22. Mayosi, BM, Somers K. Cardiomyopathy in Africa: versus environment. *Cardiovascular J Afr* 2007; 18: 175-179.
23. Dalla Volta S, Battaglia G, Zerbini E. Auricularization on the right ventricular pressure curve. *Am Heart J* 1961; 61:25-33.
24. Mangula.NP, Mayosi BM, Cardiac involvement in HIV- infected people living in Africa; *Cardiovascular J south Afr* 2003; 14:231-237.
25. Makule, EL. Causes of re- admission for heart failure at Muhimbili National Hospital heart failure. Dissertation submitted in partial fulfillment for the degree of Master of Medicine (Internal Medicine). University of Dar es salaam; 2002.
26. Makene WJ, Muindi JR. Some observations on congestive cardiac failure in African patients in Dares salaam: *EAMJ*: 1976, Vol. 53, 6:326 – 331.

27. Mwandolela, HM. Types of cardiac diseases in women in their third trimester of pregnancy and in puerperium with features suggestive of heart disease and their outcomes, Dar es Salaam. Dissertation submitted in partial fulfillment for the degree of Master of Medicine (Internal Medicine) Muhimbili University of health and allied Sciences; 2007.
28. Maro EE, Janabi M, Kaushik R. Clinical and echocardiographic study of hypertrophic cardiomyopathy in Tanzania. *Trop Doct.* 2006; 36(4):225-227
29. Naomi DL, Fisher, Gordon H, Williams. Hypertensive vascular disease. In: Kasper DL, Braunwald E, Fauci AS. *Harrison's principles of internal medicine 16th edition* McGraw-Hill Companies, Inc; 2005: 1463-1466.
30. Burke AP, Farb A, Liang AP, Farb A, Liang YH, et al. Effect of hypertension and cardiac hypertrophy on coronary artery morphology in sudden cardiac death. *Circulation.* 1996; 94(12): 3138-3145
31. Levy D, Larson MG, Vasan RS, et al. The progression from hypertension to congestive heart failure. *JAMA.* 1996;275(20): 1557-1562.
33. Akinkugbe, O.O. The Nigerian hypertension programme. *Journal of Human Hypertension.* 1996; (10 Suppl 1) :S43-46.
34. Swai ABM, Mc Larty OG, Kitange HM, Kilima PM, Tatala.S, Keen N et al. Low prevalence of risk factors for coronary heart disease in rural Tanzania. *Int.J Epidemiology* 1993; 22 (4) 651-659.
35. Seedat YK, Hypertension in black South Africans. *J Hum Hypertens.* 1999; 13(2): 96-103.

36. Seftel HC. The rarity of coronary heart disease in South African blacks. *S Afr Med J* 1978; 54: 99–105.
37. De. Spectrum of congenital heart disease in a tropical environment: an echocardiography study. *J Natl Med Assoc.* 2007; 99(6):665-669.
38. Steyn K, Sliwa K, Hawken S, et al. Risk factors associated with myocardial infarction in Africa: the INTERHEART Africa study. *Circulation* 2005; 112:3554–3561.
39. Yusuf S, Hawken S, Ounpuu S, on behalf of INTERHEART Study Investigators. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004; 364: 937–952.
40. Steyn K, Jooste PL, Bourne L, et al. Risk factors for coronary artery disease in the black population of the Cape Peninsula: the BRISK study. *S Afr Med J* 1991; 79: 480–485.
41. Hakim JG, Odwee MG, Siziya S, Ternouth I, Matenga J. Acute myocardial infarction in Zimbabwe: the changing scene of coronary artery disease. *Cent Afr J Med* 1995; 41: 303–308.
42. Maisch B, Ristic AD. The classification of pericardial disease in the age of modern medicine, *Curr Cardiol Rep* 2002; 4(1):13-21
43. Braunwald E. Pericardial disease. In: Kasper DL, Braunwald E, Fauci AS. *Harrison's Principles of Internal Medicine*, 16th Ed. The Mc Graw-Hill Companies, Inc; 2005: 1417-1418
44. Shahbaz SCM, Fatimi S. Characteristics of recurrent pericardial effusions. *Singapore Med J.* 2007; 48(8):725-728.

45. Ling LH et al: Constrictive pericarditis in the modern era: Evolving clinical spectrum and impact on outcome after pericardiectomy. *Circulation* 1999; 100:1380.
46. Hoit BD, management of effusive and constrictive pericardial heart diseases. *Circulation* 2002; 105:2939.
47. Reuter H, Burgess LJ, Louw VJ, Doubell AF. The management of tuberculous pericardial effusion: experience in 233 consecutive patients. *Cardiovasc J S Afr.* 2007; 18(1):20-25.
48. Reuter H, Burgess LJ, Doubell AF. Epidemiology of pericardial effusions at a large academic hospital in South Africa. *Epidemiol Infect.* 2005; 133(3):393-399.
49. Cegielski JP, Lwakatara J, Dukes CS, Lema LE, Lallinger GJ, Kitinya J et al. Tuberculous pericarditis in Tanzanian patients with and without HIV infection. *Tuber Lung Dis.* 1994 Dec; 75(6):429-434.
50. Levick JR. An introduction to cardiovascular physiology. 3rd edn. London. Arnold. 2000
51. Robert A, O'Rourke/ Harrison's principles of Internal medicine 16th edition McGraw-Hill Companies, Inc; 2005:1301-302.
52. Aryl L. Goldberger. Electrocardiography. In: Harrison's principles of Internal medicine 16th edition McGraw-Hill Companies, Inc; 2005:1311-1312.
53. Rick A. Nishimura, Raymond J. Gibbons, James F, Glockner A. et al. Non invasive cardiac imaging: Echocardiography, nuclear cardiology and MRI/ CT imaging. In: Harrison's principles of Internal medicine 16th edition McGraw-Hill Companies, Inc; , 2005:1320-1323.

54. Donald S, Baim, William Grossman. Diagnostic cardiac catheterization and angiography. In: Harrison's principles of Internal medicine 16th edition McGraw-Hill Companies, Inc; 2005:1327-1332.
55. Cowie MR, Mendez GF. BNP and congestive heart failure; prog. Cardiovasc. Dis.2002; 44(4):293-325.
56. Kaddoura S. Echocardiogram made easy. Main ed. London: Churchill livingstone 2002.
57. Daniel W, Rathsack P, Walpurger G, Kahle A, Gisbertz R, Schmitz J, et al. Value of M-mode echocardiography for non-invasive diagnosis of Ebstein's anomaly. Br Heart J. 1980;43(1): 38-44.
58. Attenhofer Jost CH, Turina J, Mayer K, Seifert B, Amann FW, Buechi M, et al Echocardiography in the evaluation of systolic murmurs of unknown cause. Division of Cardiology, University Hospital, Zurich, Switzerland. Am J Med. 2000; 108(8):669-671.
59. Marijon E, Ou P, Celermajer DS, et al. Prevalence of rheumatic heart disease detected by echocardiographic screening N Engl J Med 2007; 357:470-476.
60. Omram AR. The epidemiological transition: a theory of the epidemiology of population change. Milbank Mem Fund Quart 1971; 49: 509-538.
61. Olshansky SJ, Ault AB. The fourth stage of the epidemiologic transition: the age of delayed degenerative disease. Milbank Mem Fund Quart 1986; 64: 355-391.

62. Yusuf S, Hawken S, Ounpuu S, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004; 364: 937-952.
63. Mayosi BM, Avery PJ, Baker M, et al. Genotype at the -174G/C polymorphism of the interleukin-6 gene is associated with common carotid artery intimal-medial thickness. Family study and meta-analysis. *Stroke* 2005; 36: 2215-2219.
64. Brownwood E: cardiovascular disease- A textbook of cardiovascular medicine, 444-509
65. L. H. Opie and B. M. Mayosi Cardiovascular Disease in Sub-Saharan Africa *Circulation*, 2005; 112(23): 3536 -3540.
66. Bradshaw D. What do we know about the burden of cardiovascular disease in South Africa? *Cardiovasc J South Afr* 2005; 16: 140-141.
67. World Health Organization. World health report 2002. Reducing risks, promoting healthy life. Geneva: WHO, 2002. www.who.int/whr/2002/en/index.html. (Accessed on 6th Nov. 2006)
68. Kobal SL, Czer LSC, Czer P, et al. Making an impossible mission possible. *Chest* 2004; 125: 293-296.
69. Oyoo GO, Ogola EN. Clinical and socio demographic aspects of congestive heart failure patients at Kenyatta National Hospital, Nairobi. *East Afr Med J* 1999; 76:23-27
70. Commerford P, Mayosi B. An appropriate research agenda for heart disease in Africa. *Lancet* 2006; 367:1884-1886
71. Ministry of health: National annual statistics- past reports 2002]

72. Ong'uti SK, Obonyo NG. Management pathway for congenital heart disease at Kenyatta National Hospital, Nairobi. *East Afr Med J.* 2007;84(7):312-317.
73. Damasceno et al: Heart failure in sub Saharan Africa. Time for action. *JAM coll.cardiol.*2007; 50:1688-1693
74. Kennel WB- the Framingham study, historical insight on the impact of cardiovascular risk factors in men versus women. *J.Gend. specific med* 2002; 5(2): 27-37.
75. Schoken DD, Arrieta MI, Leaverton PE et al.: Prevalence and mortality rate of congestive heart failure in the United states: *JACC* 1992; 20 (2): 301-306
76. Owor R. Rwemushena, RJ, Familial congestive cardiomyopathy in Uganda E. *Afr. Med. J* 1975; 52(7): 372-375
77. Ladipo G, Froude JR, Pany EH, Pattern of heart diseases in adults of Nigerian Savanna a prospective study. *Afr J Med Scien* 1977; 6(4) :185-192
78. Agomuoh DI. Pattern of cardiac diseases diagnosed by echocardiography in the cardiology unit of the University of Port Harcourt Teaching hospital. *Niger J Med.* 2006;15(2):132-136.
79. Abdel-Moula AM. Prevalence of rheumatic heart disease among school children in Alexandria, Egypt: a prospective epidemiological study. *J Egypt Public Health Assoc.* 1998; 73(3-4):233-254.

80. Rutakingirwa M, Ziegler JL, Newton R, Freers J. Poverty and eosinophilia are risk factors for endomyocardial fibrosis (EMF) in Uganda. *Trop Med Int Hlth* 1999; 4: 229–235.
81. Moolman-Smook JC, Mayosi BM, Brink PA, Corfield VA. Molecular genetics of cardiomyopathy: changing times, shifting paradigms. *Cardiovasc J South Afr* 2003; 14: 145–155.
82. Marijon E, Tivane A, Voicu S, Vilanculos A, Jani D, Ferreira B, et al. Prevalence of congenital heart disease in schoolchildren of sub-Saharan Africa, Mozambique. *Int J Cardiol* 2003; 113 (3): 440 - 441
83. Rosmarakis ES, Vergidis PI, Soteriades ES, et al. Estimates of global production in cardiovascular diseases research. *Int J Cardiol* 2005; 100: 443-449
84. UNFPA (2007) United Nation Population Fund .Health and socioeconomic indicators. 2007; 120-136
85. Steyn K, Sliwa K, Hawken S, et al. Risk factors associated with myocardial infarction in Africa: the INTERHEART Africa study. *Circulation* 2005; 112: 3554–3561.
86. Brown KG, Willis WH. Cardiac disease in Malawi. *S Afr Med J*. 1975; 49(23):926-930.
87. Anthony KK: Pattern of cardiac failure in Northern Savanna Nigeria. *Trop. Georg. Med*. 1980; 32(2): 118-125
88. Forsythy DM. Hypertension in Tanzania E .*Afrika Med. J* 1969; 46:309-312.

89. Fallcer B. Differences in blacks and whites with essential hypertension. *Biochemistry and endocrine hypertens* 1990; 15part 2; 681-687
90. Edwards R, Unwin N, Mugusi F, Whiting D, Rashid S, Kissima J, Aspray TJ, Alberti KG. Hypertension prevalence and care in an urban and rural area of Tanzania. *J Hypertens*. 2000; 18: 145–152.
91. Wright J. Profile of systemic hypertension in black patients. *AMJ Cardiol* 1988; 61:41-45.
92. Amoah AGB, Kallen C. Aetiology of Heart Failure as Seen from a National Cardiac Referral Centre in Africa. *Cardiology* 2000; 93:11-18.
93. Isezuo SA, Abubakar SA. Epidemiologic profile of peripartum cardiomyopathy in a tertiary care hospital. *Ethn Dis*. 2007; 17(2):228-233.
- 94: Reuter H, Burgess LJ, Doubell AF. Role of chest radiography in diagnosing patients with tuberculous pericarditis. *Cardiovasc J S Afr*. 2005;16(2):108-111.
95. Ladipo GO, Froude JR, Parry EH. Pattern of heart disease in adults of the Nigerian Savanna: a prospective clinical study. *Afr J MMed Sci*. 1977; 6(4):185-192.