Characteristics, prevalence, pattern and risk factors of coronary artery disease among patients undergoing coronary angiogram at Jakaya Kikwete Cardiac Institute January 2015 – June 2017

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CHARACTERISTICS, PLEVALENCE, PATTERN AND RISK FACTORS OF CORONARY ARTERY DISEASE AMONG PATIENTS UNDERGOING CORONARY ANGIOGRAM AT JAKAYA KIKWETE CARDIAC INSTITUTE JANUARY 2015 – JUNE 2017

By

Alice Karungi Kaijage

A Dissertation Submitted in (Partial) Fulfillment of the Requirement for the Degree of Master of Medicine (Internal Medicine) of

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CERTIFICATION

The undersigned certify that they have read and hereby recommends for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: **"Characteristics, prevalence, pattern and risk factors of coronary artery disease among patients undergoing coronary angiogram at Jakaya Kikwete Cardiac Institute - January 2015– June 2017",** in (partial) fulfillment of the of the requirements for the degree of Master of Medicine (Internal Medicine) of the Muhimbili University of Health and Allied Sciences.

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DECLARATION AND COPYRIGHT

I, **Dr. Alice Karungi Kaijage**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any university for similar or any other degree award.

Signature: ……..…… **Date:** ……

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DEDICATION

This work is dedicated to my loving parents Wilfred B Mutafungwa and Marietha K. Kaijage, my siblings Eunice, Gerald and Abella and my nieces Restituta, Angela, Happifania, Sophia and Remidius. Their love, patience, encouragement, understanding and sacrifices made all this possible, may God continue to bless and keep them.

ABSTRACT

Background: Coronary artery disease (CAD) remains a significant cause of morbidity and mortality worldwide. Little is known about CAD in Tanzania and many other countries of sub Saharan Africa. This study aimed to shed light on the burden, pattern, and associated risk factors among patients undergoing CAG in a Tanzanian population.

Objective: To describe the characteristics, pattern, and determine the associated risk factors for CAD among patients undergoing coronary angiogram at Jakaya Kikwete cardiac institute (JKCI) between January 2015 and June 2017.

Methods: A cross-sectional analysis of the JKCI catheterization–laboratory (cath-lab) database between January 2015 and June 2017 was conducted. All patients with complete key data were included. Linear logistic regression analyses were performed to determine associated factors for CAD. All analyses were 2-sided and p value < 0.05 was used to denote significance. Variables of interest included, age, sex, co morbidities, renal functions, information regarding smoking status, electrolytes, full blood count, serology for HIV, Hepatitis B & C and syphilis, diabetes, weight and height (for BMI calculation), hypertension and cholesterol.

Results: The mean age was 60.6 years and over 83% of participants were aged 50 years and above. Males comprised 60% of all participants and over two-thirds of participants were overweight or obese. Hypertensive heart disease (43%) was the commonest underlying aetiology followed by Ischemic heart disease (35%). The prevalence of coronary artery disease (CAD) was 45.5%. Among patients with CAD, single vessel involvement was more common (43.6%) and LAD was the most involved vessel (78%). During multivariate analyses, Male sex (OR 2.6, 95% CI 1.6-4.1, $p<0.001$), BMI ≥ 25 (OR 2.2, 95% CI 1.3-3.8, $p<0.01$), and Diabetes Mellitus (OR 3.2, 95% CI 2.0-5.2, $p<0.001$) were found to be independent predictors of CAD.

Conclusion: Coronary artery disease is considerably prevalent among patients undergoing coronary angiogram at Jakaya Kikwete Cardiac Institute, LAD being the most affected vessels and BMI >25, DM and male sex featured as independent predictors of CAD. Deliberate measures to prevent, timely diagnose and prompt management of CAD are warranted.

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LIST OF ABBREVIATION

AMI		Acute myocardial infarction
BMI	:	Basal Metabolic Rate
CAD	:	Coronary artery disease
CAG	:	Coronary angiogram
CHF	:	Congestive heart failure
CSA	:	Chronic stable angina
CSAP	:	Chronic Stable Angina Pectoris
CVD	:	Cardiovascular disease
DM	:	Diabetes Mellitus
ECG	:	Electrocardiogram
GFR	:	Glomerular Filtration Rate
HF	:	Heart Failure
JKCI	;	Jakaya Kikwete Cardiac Institute
LAD	:	Left anterior descending
LCX	:	Left circumflex
MI	:	Myocardial infarction
MNH	:	Muhimbili National Hospital
MUHAS	:	Muhimbili University of Health and Allied Sciences
NCDs	:	Non Communicable Diseases
NSTEACS	:	Non ST elevation Acute coronary syndrome
NSTEMI	:	Non ST elevation myocardial infarction
PCI	:	Percutaneous Coronary Intervention
RCA	:	Right coronary artery
STEMI	:	ST Elevation Myocardial Infarction
UA	:	Unstable Angina
VD	:	Vessel Diseases
WHO	:	World Health Organization

OPERATIONAL DEFINITIONS

Coronary Artery disease (CAD):

Fifty percent or more stenosis of epicardial coronary arteries.

Acute Coronary Syndrome (ACS):

A spectrum of clinical conditions from unstable angina to ST-elevation MI consequent to myocardial ischemia. Clinically, acute chest pain, typical in character, is lasting more than 15 minutes. 'Typical' defined as retrosternal discomfort (heaviness), brought about or increased with exertion and reduced with rest or nitrates. ECG and quantitative/qualitative measurement of cardiac biomarkers – Troponins T/I or CKMB helps to decide about the type of ACS.

Unstable Angina (UA):

A clinical syndrome subset of ACS defined by ECG ST-segment depression or prominent T wave inversion and no elevation of cardiac biomarkers of necrosis (Troponins T/I or CKMB)

NSTEMI:

A clinical syndrome subset of ACS defined by ECG ST-segment depression or prominent T wave inversion and/or positive biomarkers of necrosis in the absence of ST-segment elevation.

STEMI:

A clinical syndrome subset of ACS characterized by ST-segment elevation or new onset LBBB due to myocardial necrosis

Chronic Stable Angina:

Chronic manifestation of CAD described as retrosternal discomfort (heaviness), brought about or increased with exertion and reduced with rest or nitrates lasting less than 10 minutes.

Anaemia:

A state in which the number (quantity) of red blood cells and/or their oxygen-carrying capacity (quality) is inadequate to meet physiologic requirements, which vary by age, sex, altitude, smoking, and pregnancy status.

Ramus:

Refers to a variant branch of Left main coronary artery as a result of its trifurcation

Non Communicable Diseases:

Medical conditions or diseases, which by definition are non-infectious and non-transmissible among people

Prevalence:

Is the proportion of cases of a specified condition/disease in a given population at a specific time.

CHAPTER ONE

1.0 BACKGROUND AND LITERATURE REVIEW

Global burden of Non Communicable Diseases

Globally, non-communicable diseases are responsible for over 38 million of deaths each year. About three-quarters of all NCDs transpire in resource limited settings which also continue to battle with infectious diseases, malnutrition, and diarrheal diseases. Amongst the NCDs, cardiovascular related illnesses prevalent in over 80% are the leading cause of morbidity and mortality worldwide. The up rise of NCDs is attributable to the increased rates of risk behaviours including smoking, alcohol abuse, physical inactivity, obesity and poor feeding habits (1–3).

Coronary Artery Disease: Burden & Risk Factors

Coronary artery disease (CAD) remains the number one killer globally. Like other NCDs the prevalence and incidence of CAD is also rising rapidly and this is attributed to the rise of classical risk factors for CAD in societies. Notably the rising prevalence of obesity and diabetes mellitus is fueling this (4–9). Cigarette smoking is among strongest predictors of CAD (10,11). For instance, people who consume more than 20 cigarettes daily have up to a 3-fold increase in total heart disease and continued smoking is a strong factor for recurrent heart attacks. Age is another strong predictor of CAD (9, 12, 13). The ages more than 45 and 55 years in males and females respectively are established cut off point for this risk. Co morbid diabetes mellitus accentuates the risk of cardiovascular disease up to 8-fold. Apart from its association with elevated vascular risk, obesity is associated with glucose intolerance, insulin resistance, hypertension, physical inactivity, lifestyle and dyslipidemia all of which are associated with CAD (5,12,13). Moreover, coexisting depression is an established associated risk factor for both CAD occurrence and poor outcomes (14–16). Additionally, elevated CRP has also been shown to increase the risk of CAD (17–19).

The prevalence and pattern of coronary artery disease among patients undergoing coronary angiogram

Several studies have produced variable prevalence and pattern of CAD among patients undergoing CAG. A study by Ezhumalai et al involving women patients who underwent coronary angiography revealed that LAD was the most involved vessel (35.2%) followed by RCA (26%) and LCX (25.6%)(20). In this study the LMCA was the least affected vessel (3.4%) and chronic total occlusion was present in 5.4% of women. In an observational report by Salam et al involving 7 Middle Eastern countries, the prevalence of CAD among patients with acute heart failure varied from 49.1% in Yemen to 68% in Kuwait (21). An Ethiopian study by Shashu et al revealed that 75.7% of patients who underwent catheterization had evidence of CAD and 40.5% of them had multivessel disease. (22). Another study conducted in Iraq revealed that the prevalence of angiographically detected CAD was 31% (23) Furthermore, in a meta-analysis of 54 studies involving nearly 1.4 million participants the prevalence of non-obstructive CAD among patients with stable angina was 67% (24).

Tanzania like many other developing nations is facing a rapid rise of NCDs with cardiovascular disorders topping up the list. Availability of coronary angiography facilities, improves diagnostic ability for CAD. With the presence of two running catheterization laboratories in the country it is high time to determine the prevalence of CAD in our population and explore the associated factors.

1.1 Problem statement

Cardiovascular diseases are currently the number one cause of morbidity and mortality globally. In the western world, coronary artery disease is the number one killer however in the developing nations like Tanzania the burden of CAD is poorly understood. Currently in Tanzania cardiac catheterization facilities are only available at two centres; namely Aga Khan Hospital and JKCI. Despite this, the real prevalence, pattern and associated factors of CAG in a Tanzanian population remain unknown.

1.2 Rationale of study

It is now possible to detect angiographically which patients have got CAD and at what levels. This study aims to shed light on the burden, characteristics and associated risk factors among patients undergoing CAG in a Tanzanian population. Moreover, knowledge of the prevalence and associated risk factors will serve as a stepping stone to future studies.

1.3 Hypothesis

CAD is common among patients undergoing CAG at JKCI.

1.4 Research question

What are the socio demographic characteristics, prevalence, patterns and associated risk factors of CAD among patients undergoing Coronary angiogram at JKCI?

1.5 Objectives

1.5.1 Broad objective

To describe the characteristics, patterns, and to determine the prevalence of CAD and the associated risk factors for CAD among patients undergoing coronary angiography at JKCI between January 2015 and June 2017.

1.5.2 Specific objectives

1. To describe socio-demographic characteristics of patients undergoing coronary angiogram at JKCI.
2. To determine the prevalence of coronary artery disease among patients undergoing coronary angiogram at JKCI.
3. To determine the pattern (affected vessel) of coronary artery disease among patients undergoing coronary angiogram at JKCI.
4. To determine associated risk factors for coronary artery diseases among patients undergoing coronary angiogram at JKCI.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study design

A cross sectional analysis of JKCI catheterization laboratory database from Jan 2015 to June 2017.

2.2 Sample size

Approximately 800 patients have undergone CAG at JKCI so far. We have analysed data from all patients who underwent coronary angiogram between January 2015 and March 2017 whose information suffice the inclusion criteria.

2.3 Study area

Jakaya Kikwete Cardiac Institute (JKCI) is currently the only tertiary hospital offering specialized cardiovascular management in the country. It has just an over 100 bed capacity and attends nearly 200 outpatients daily. JKCI amongst other things runs a modern catheterization laboratory performing about four procedures daily.

2.4 Study population

Patients who underwent coronary Angiogram at JKCI from Jan 2015 to June 2017.

2.5 Data source

This study utilized the existing JKCI catheterization laboratory database. This database is a comprehensive multivariable source of information for all performed procedures since its existence. Several socio-demographic and clinical information about patients including age, sex, co morbidities, renal functions, as well as procedural findings and subsequent management are filled in the database, however, information regarding smoking status electrolytes, full blood count, serology for HIV, Hepatitis B & C and syphilis were inconsistently filled. Risk factors such as diabetes, weight and height (for BMI calculation), hypertension and cholesterol were all extracted and recorded.

2.5.1 Inclusion Criteria

Patients who underwent CAG with clinical suspicion of CAD i.e. chest pain, ischaemic changes on ECG, positive stress Test.

2.5.2 Exclusion Criteria

Patients who underwent CAG for other reasons e.g. preoperative preparations (evaluation of coronary artery before cardiac surgery), Incomplete CAGs and Subsequent CAGs i.e. patient with multiple CAG were counted as one.

2.6 Data collection and analysis

A structured data collection tool capturing variables to answer the specific objectives of this study was utilized. After ensuring accuracy of data, a pre-designed Ms Excel template capturing variables in the questionnaire was used for data entry. STATA v.11.0 analysis software was used for all statistical analyses. Chi-square test was used in the analysis of categorical variables while student's t-test was used in analysis of continuous variables. A logistic regression analysis was performed to assess for factors associated with CAD. Several characteristics known to be associated with CADwere included in the regression model in a stepwise backward manner. Characteristics significant during a bivariate analysis were included in a multivariate model. All analyses were two-sided and P-value <0.05 was taken as a cut-off point for significance.

2.7 Ethical clearance

Ethical clearance was sought from MUHAS and permission to conduct the study was sought from the Unit of Research of JKCI.

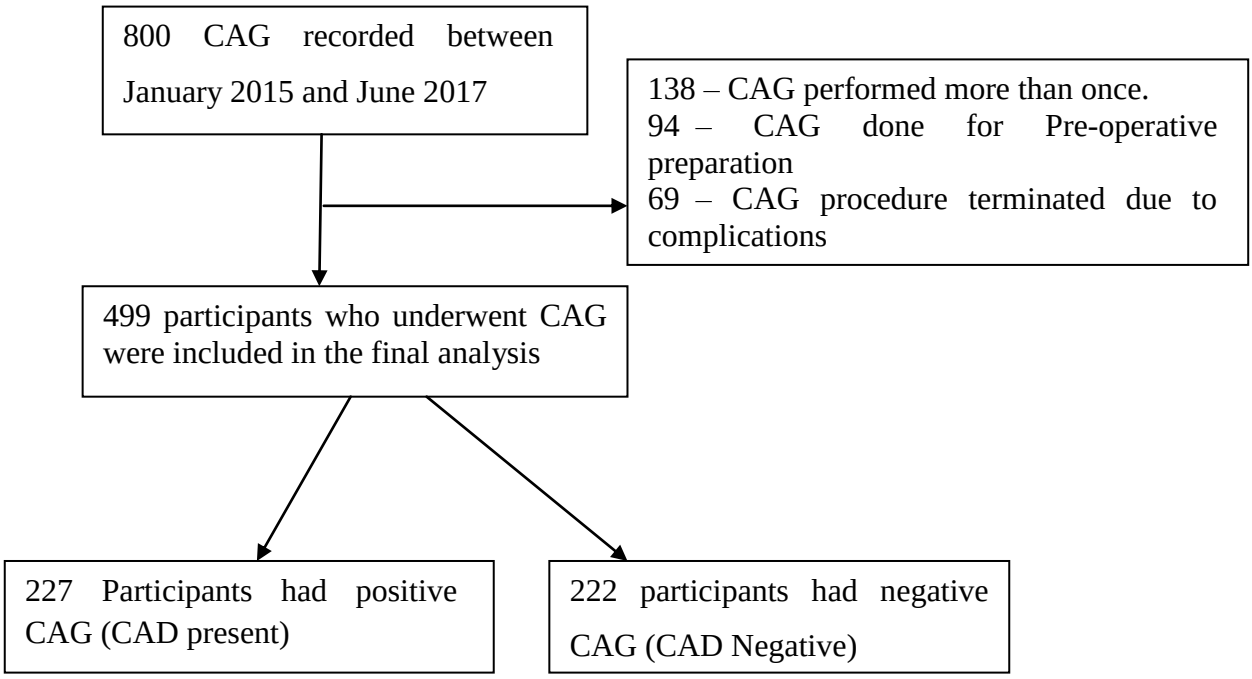
2.8 Results dissemination

Findings of this study were presented to the department of internal medicine MUHAS as well as to staff of JKCI. Furthermore, upon its completion we aspire to publish this work in a reputable journal.Study timeline.

CHAPTER THREE

3.0 RESULTS

Study Flow Diagram



Records for all patients (N= 800) who underwent coronary angiogram at JKCI from Jan 2015 to June 2017 were reviewed and a total of 499 records met the inclusions criteria and were included in the final data set for analysis. Mean age of the participants was 60.6 ± 11 years, and about 83.2% were aged 50 years and above. There was a male sex predominance of about 60.1%.

More than three quarters of the study population were either overweight or obese (BMI >25) with a mean BMI of 30 ± 6.2. Hypertensive heart disease was the most prevalent ECHO finding among the study population (42.7%) followed by Ischemic heart disease (35.1%) as summarised in table 1.About 18.6% of all participants had renal dysfunction and about 34% had anaemia. The mean systolic and diastolic blood pressure was 141.3 and 81.6 respectively. Smoking status was documented in 125 cases (25%) a quarter of the CAG population. Only 9 (7.2%) were ever smokers in the documented group. About

48.3% of participants had hypercholesterolemia and 28.9% of all participants had a history of diabetes mellitus.

Table 1: Socio-demographic and clinical characteristics of patients undergoing coronary angiogram at JKCI (N=499).

Characteristic	Proportion
Age	
Mean	60.6 (11.0)
<50	84 (16.8%)
>= 50	415 (83.2%)
Sex	
Male	300 (60.1%)
Female	199 (39.9%)
BMI	
Mean	30.0 (6.2)
Underweight	6 (1.2%)
Normal	100 (20.0%)
Overweight	174 (34.9%)
Obese	219 (43.9%)
Smoking status	
Undocumented	374 (75.0%)
Documented	125 (25.0%)
Smokers	9 (07.2%)
Non-smokers	116 (92.8%)
Renal dysfunction (eGFR<60)	93 (18.6%)
Haemoglobin (mean, SD)	13.1 (1.7)
Anaemia	169 (33.9%)
Normal	330 (66.1%)
Hypercholesterolemia	
Yes	244(48.3%)
No	258(51.7%)
Diabetes Mellitus	
Yes	144(28.9%)
No	355(71.1%)
Blood Pressure among those with HTN	
SBP	141.3 (26.2)
DBP	81.6 (14.9)
Echo Diagnosis	
Normal	35 (7.0%)
HHD	213 (42.7%)
Ischemic HD	175 (35.1%)
Dilated Cardiomyopathy	50 (10.0%)
Others	26 (5.2%)

Prevalence and Pattern of Coronary artery disease

The prevalence of CAD was found to be 45.5%. Of the 227 patients with CAD, 99 (19.8%) had single vessel involvement, 43 (8.7%) double vessel and 85 (17.0%) had triple vessel disease, Table 2. Left anterior descending (LAD) was the most involved vessel (78%), followed by RCA (56.8%), LCx (51.1%) and Ramus (4.8%).

Table 2: Pattern (number of vessels) of coronary artery disease among patients undergoing coronary angiogram at JKCI (N=499).

# of Vessels affected	Proportion (%)
None	272 (54.5%)
1 – single vessel	99 (19.8%)
2 – double vessel	43 (8.7%)
3 – triple vessel	85 (17.0%)

Table 3: Pattern (affected vessel) of coronary artery disease among patients undergoing coronary angiogram at JKCI (N=499).

Type of Vessel affected	Proportion (%)
LAD	177 (78%)
RCA	129 (56.8%)
LCx	116 (51.1%)
Ramus	11 (4.8%)

- Proportions in this table exceed 100% because several patients had involvement of more than a single vessel

Associated risk factors for coronary artery diseases

Multiple factors were analysed on a bivariate and subsequent multivariate regression models to identify their association with the presence of CAD among the study population. Male sex (OR 2.6, 95% CI 1.6-4.1, p<0.001), BMI ≥ 25 (OR 2.2, 95% CI 1.3-3.8, p<0.01), and Diabetes Mellitus (OR 3.2, 95% CI 2.0-5.2, p<0.001) were found to be independent predictors of CAD during multivariate analyses as shown on tables 4 and 5 below.

Table 4: Factors associated with CAD - Logistic regression (Bivariate analysis).

Characteristic	**comparative**	**OR**	**95% CI**	**P value**
Age >45/55 for M/F	Age <45/55 for M/F	3.0	1.7-5.6	<0.001
Male	Female	2.5	1.7-3.8	<0.001
BMI>=25	BMI<25	2.7	1.6-4.3	<0.001
Elevated cholesterol	Normal cholesterol	1.3	0.9-1.9	0.2
Diabetic	Diabetes-free	3.5	2.2-5.4	<0.004
Hypertensive	Hypertensive-free	2.2	1.3-3.5	<0.01

Table 5: Factors associated with CAD - Logistic regression (Multivariate analysis).

Characteristic	**Comparative**	**OR**	**95% CI**	**P value**
Age >45/55 for M/F	Age <45/55 for M/F	1.8	0.9-3.5	0.098
Male	Female	2.6	1.6-4.1	<0.001
BMI>=25	BMI<25	2.2	1.3-3.8	<0.01
Diabetic	Diabetes-free	3.2	2.0-5.2	<0.001
Hypertensive	Hypertensive-free	1.5	0.9-2.5	0.159

CHAPTER FOUR

4.0 DISCUSSION

The prevalence of angiographically detected CAD varies widely in the literature (25). A study by Alaia M et al found a prevalence of CAD to be 45 %(24). Furthermore, another study by Mohan V et al found a prevalence of 11.0 %(26). Moreover, ameta-analysisdone by Wang et al revealed a prevalence range between 13% and 67% among studies (20). In this present study, the prevalence of CAD was 45.5% which is comparable to what was noted in previous other studies.The CAG group was highly selected, as those who went for angiography were initially suspected to have CAD.Thus this high prevalence does not reflect the prevalence of CAD in the general Tanzanian population.

Single vessel disease and LAD (Left Anteriol Descending Artery) involvement were found to be the commonest pattern. There is pattern variability within the literature. For instance in a Polish study by Maroszvriska, single vessel disease was the most reported vessel (61.9%) and LAD was the most involved vessel (61.6%)(27). Similarly, in another Indian study 53.3% of participants had single vessel disease (24). In contrary, another Indian study by Sriharibabu double vessel disease was the most common form of CAD (47.6%)(21). No known specific determinants as to what would be the affected vessel in CAD.

Several factors have been associated with increased risk for Coronary Artery Disease .In this present study, multivariate logistic regression analyses revealed male sex, BMI, and Diabetes to be the independent predictors of CAD. Similar to our findings, a Jordanian study revealed Diabetes to be associated risk factors of CAD (28). Studies by Labounty and Dores et al, revealed BMI>25 to be associated with increased risk of CAD)(29). Furthermore 2 studies by Mohammad et al and Tsujimoto revealed Male sex has increased risk for CAD(28,30).Smoking which is a known traditional risk factor for CAD did not feature in this study probably because this information was missing in majority of our patient’s data (more than three quarter of the population).

4.1 Strength and Limitations

This study is the first one in this setting to provide the prevalence and associated factors of angiographically detected CAD among Tanzanians. Our methodology allowed us to navigate through the entire database of CAGs performed in this setting.

Despite all the strength, this study is not short of limitations. First, due to its retrospective nature, we were faced by a considerable amount of missing data. Secondly, due to the inherent flaws of the study design our study was subjected to a number of biases including reporting bias, observer bias, selection bias and measurement bias.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In conclusion, Coronary artery disease is considerably prevalent among patients undergoing coronary angiogram at Jakaya Kikwete Cardiac Institute. Associated risk factors of CAD among the studied population were male sex, overweight and DM.

Our findings imply that CAD is common and warrants deliberate measures to prevent, timely diagnose and prompt manage it.

5.2 Recommendations

With growing burden of CAD's, in resource poor setting including this one, there is huge need to educate the community on the Risk factors and presentation of CAD's so that preventive and interventional strategies are stepped up in the community.

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APPENDICES

Appendix A: Questionnaire

Serial No……..

File No……..

Coronary Artery Disease study.
Data collection Tool

Age ……. Gender: ☐ F ☐ M Weight ……..kg

Height ……..…..m BMI…….kg/m^2

LDL…….HOL……Total cholesterol……

Smoker ☐ Yes ☐ No

Hypertensive ☐ Yes ☐ No

Diabetes ☐ Yes ☐ No

ECHO DX……EF ……

Finding of CAG

Vessel _____ %

LAD _____ %

RLX _____ %

RCA _____ %

Ramus _____ %

Conclusion: ☐ Normal ☐ Single Vessel disease ☐ double vessel disease

Triple vessel disease ☐

Appendix B: Time frame

	2016			**2017**							**2018**			
ACTIVITIES	OCT	NOV	DEC	JAN	MAR	MAY	JULY	SEPT	NOV	DEC	JAN	FEB	MAR	APR
Proposal development														
Ethical clearance														
Data collection														
Data entry & Analysis														
Report writing &Submission														

Appendix C: Budget

ITEAM DETAIL	**RATE IN TSH**	**TOTAL**
STATIONAERIES PRINTING AND PHOTOCOPYING	700000	700000
BINDING OF 3 DISSERTATION REPORTS	150000	150000
TOTAL		850,000