ROLE OF AGATSTON SCORES IN DETERMINING PATIENTS AT RISKS OF MAJOR CARDIOVASCULAR EVENTS UNDERGOING CARDIAC COMPUTED TOMOGRAPHY AT MUHIMBILI NATIONAL HOSPITAL.

Rachel Kokwiitika Kataraia, M. D

MMed. (Radiology) Dissertation

Muhimbili University of Health and Allied Sciences

October, 2019

Muhimbili University of Health and Allied Sciences

Department of Radiology

ROLE OF AGATSTON SCORES IN DETERMINING PATIENTS AT RISKS OF MAJOR CARDIOVASCULAR EVENTS UNDERGOING CARDIAC COMPUTED TOMOGRAPHY AT MUHIMBILI NATIONAL HOSPITAL.

By

Rachel Kokwiitika Kataraia, M. D

A Dissertation Submitted in (partial) Fulfillment of the Requirement for the Degree of Master of Medicine (Radiology) of

Muhimbili University of Health and Allied Sciences

October, 2019

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance of dissertation entitled: **Role of Agatston scores in determining patients at risks of major cardiovascular events undergoing cardiac computed tomography at Muhimbili National Hospital,** in partial fulfillment of the requirements for the degree of Master of Medicine (Radiology) of the Muhimbili University of Health and Allied Sciences,

_____

Dr. Lulu Fundikira, M.D, M.MED, Ph.D. Fellow

(SUPERVISOR)

_____

Date

_____

Dr. Peter Pallangyo, M.D, M.MED, M.P.H

(CO-SUPERVISOR)

_____

Date

DECLARATION & COPYRIGHT

I, Rachel Kokwiitika Kataraia declare that to the best of my knowledge this dissertation is my original work; it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature: _____ Date _____

This dissertation is a 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 in part, except for short extracts in fair dealing, for research or private study, critical scholarly review or discourse with an acknowledgement, without the written permission of the Directorate of Postgraduate Studies, on behalf of both the author and the Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGMENT

I am very grateful to the Almighty God Whose guidance led to writing this dissertation. He empowered me with the strength and health that kept me going, even when I felt very tired. My Heavenly Father, thank You for the perseverance, wisdom and the knowledge acquired through this thesis. I will be forever grateful for YOU have done so much for me and I cannot say it all.

Secondly, acknowledging and appreciate my supervisors Madame Chief, Dr. Lulu Fundikira, and Dr. Pedro Pallangyo for their countless efforts in directing and mentoring to achieve this best dissertation. I first heard of Agatston score from Dr. Lulu who is also my mentor and academic advisor, this word sounded a bit weird and interesting at the same time, so I went to review the kinds of literature which were very informative, novel and interesting thus built a huge interest for the study. When I first consulted Dr. Pedro for my thesis at JKCI, he listened very interestingly and said very encouraging and inspiring words. He assured me of his full support which I have experienced throughout this study. For sure you are Heaven sent supervisors; I do thank GOD for you and asking HIM to continue blessing you.

Also, I extend my heartfelt gratitude to Dr. Florah Lwakatare, the Head of the Radiology Department at MNH for allowing me and making it possible to do this study. Thank so much Dr. Fredrick Lyimo of MHN, the cardiac dedicated Radiologist who first introduced me to Dr. Pedro then taught me how to read and report on CT coronary calcium scores which were done based on my study and final confirmed on the findings, I cannot thank you enough Doc, my prayers will always be with you.

Million thanks to all staff members of MUHAS and MNH Radiology Departments.

I would not be etiquette enough, without giving special thanks to Mr. M. Msemo and Mr. M. Marika the cardiac dedicated radiographers and all other members at the MNH CT Unit for their efforts in helping for data collection. Thanks a million and be blessed guys.

I would also like to acknowledge and extend my heartfelt gratitude to all patients who participated in my study, your cooperation and willingness have made this thesis a success.

Last but not least, many heartfelt regards go to my lovely and beautiful family, first to husband Emmanuel P. Mavunde thanks for the unconditional support; handsome sons Adriel Petrus

and Adric Jed for staying away from mom whenever needed time to work on this study you stayed with you dada Florah and Vaileth, “Asante Sana wanangu", to my parents and in-laws thank you for prayers and encouragement. Special thanks to Hon. Anthony P. Mavunde for all the support.

DEDICATION

To my loving husband, Emmanuel for the endless unconditional love, sacrifices, encouragement, patience, and support made all of this possible.

To my sons Adriel Petrus and Adric Jed.

To my parents Edda and Joseph for nurturing to the person I am today.

To my siblings Robert, Rhoda, Rovina, Ronald, Robin, and Romeo.

ABSTRACT

Background: Agatston score is a semi-automated tool to calculate a calcium score based on the extent of coronary artery calcification (CAC) detected by an unenhanced low-dose CT scan. The amount of calcification calculated has been applied in the clinical field as an indicator of major cardiovascular event risk.

CT can predict coronary heart disease (CHD) events, even beyond the Framingham Risk Score (FRS). A score of over 300 signifies a high chance of developing major cardiovascular events.

Broad Objective: To assess the role of Agatston scores in determining patients at risk of major cardiovascular events undergoing cardiac computed tomography at Muhimbili National Hospital.

Methodology: This Hospital-based, cross-sectional study was done at Muhimbili National Hospital (MNH) - Dar Es Salaam, Tanzania, assessed the CACS in all cardiac patients referred for cardiac CT and asymptomatic Chest CT patients regardless of the order indicated, from November 2018 to April 2019. The study involved a total of 238 patients who underwent cardiac or chest computed tomography to determine their Agatston scores and online calculated Framingham risk scores for possible risks of major cardiovascular events.

Standardized structured questionnaires were used for recording patients' demographics, clinical information, calculated FRS and the Agatston scores. The PI did the cardiac CT images evaluation and then was confirmed by a specialized cardiac radiologist, in case of disagreement a third radiologist was consulted. The imaging data were recorded only when consensus on the findings was reached. **SPSS** for Windows ***version 22.0*** was used for the data analysis. Categorical variables the independent (age, sex) with the dependent (Agatston scores, FRS) and the comparison of the two scores were all analyzed by Chi-square test with a confidence interval of 95%, p-value < 0.05 was considered statistically significant.

Results: This study involved 238 patients, (134 males, 104 females). The age ranged from 34 to 98 years with a mean age of 61years. The CACS ranged 0 to 1399 (mean score 94) showed that Agatston scores strongly associated ($p<0.001$) with aging, with the highest risk of developing major cardiovascular events observed at age group >80 years (75.9%) compared to other age groups, 70-79years (48.7%), 60-69 years (21.5%), 50-59 years (19.0%), 40-49 years

and 30-39 years (0%). Also, an association ($p<0.05$) was observed between Agatston scores and male gender (29.9%) compared to females (15.4%). Strong associations ($p<0.001$) between FRS with aging were more seen with age group >80 years (82.8%) compared to other groups such as 70-79 (38.5%), 60-69 (7.7%) while 50-59, 40-49 and 30-39 had (0%) and male gender were more at risk with 26.1% compared to females (8.7%).

The Agatston scores > 300 reclassified 5.6% low and 36.5% intermediate FRS to high-risk individuals to develop major CVE. The difference between Agatston score and FRS was strongly statistically significant ($p<0.001$).

Conclusions: Agatston score and FRS increase with aging and males are more prone to high scores hence are at higher risk of developing major cardiovascular events.

It is then recommended to use Agatston score routinely in CAD risk assessment. This will modify the patients' management prior to developing major cardiovascular events.

The guidelines by SCCT and STR can be implemented as primary management to detect asymptomatic cases.

TABLE OF CONTENTS

CERTIFICATION i
DECLARATION & COPYRIGHT ii
ACKNOWLEDGMENT iii
DEDICATION v
ABSTRACT vi
LIST OF TABLES x
LIST OF ABBREVIATIONS/ ACRONYMS xi
DEFINITION OF KEY TERMS: xii
CHAPTER ONE 1
1.0. INTRODUCTION AND LITERATURE REVIEW 1
1.1 BACKGROUND: 1
1.2 STATEMENT OF THE PROBLEM: 4
1.3 RATIONALE OF THE STUDY: 4
1.4 OBJECTIVES: 5
1.4.1. BROAD OBJECTIVE: 5
1.4.2. SPECIFIC OBJECTIVES: 5
1.5. RESEARCH QUESTIONS: 5
1.6 CONCEPTUAL FRAMEWORK: 6
CHAPTER TWO 7
2.0 METHODOLOGY 7
2.1 STUDY TYPE: 7
2.2 STUDY AREA: 7
2.3 STUDY DURATION: 7
2.4 STUDY POPULATION: 7
2.5 INCLUSION CRITERIA: 7
2.6 EXCLUSION CRITERIA: 8
2.7 SAMPLING METHOD: 8
2.8 SAMPLE SIZE CALCULATIONS: 8

2.9 IMAGING TECHNIQUES 9
2.10 DATA COLLECTION: 9
2.11 DATA ANALYSIS. 10
2.12 ETHICAL CONSIDERATION AND ETHICAL CLEARANCE: 10
2.13 STUDY LIMITATIONS AND MITIGATION: 11
CHAPTER THREE 12
3.0 RESULTS 12
CHAPTER FOUR 15
4.0 DISCUSSION. 15
CHAPTER FIVE 17
5.0 CONCLUSIONS AND RECOMMENDATIONS 17
6.0 REFERENCES 18
Appendix 1: Consent Form English version: 22
Kiambatanisho 2: Fomu ya Ridhaa 25
Appendix 3: QUESTIONNAIRE AND OBSERVATIONAL CHECKLIST. 28

LIST OF TABLES

Table 1: Showing Agatson Score by Age in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, November 2018 to April 2019.....12

Table 2: Showing Agatston Score by Sex in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, November 2018 to April 2019.....13

Table 3: Showing FRS by Age in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, November 2018 to April 2019. 13

Table 4: Showing FRS by sex in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, November 2018 to April 2019. 14

Table 5: Showing the Agatston scores and FRS in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, November 2018 to April 2019.....14

LIST OF ABBREVIATIONS/ ACRONYMS

AHA	American Heart Association
CAC	Coronary artery calcification
CACS	Coronary artery calcium score
CCTA	Coronary Computed Tomography Angiography
CHD	Coronary heart disease
CT	Computed Tomography
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
EBCT	Electron beam Computed tomography
FRS	Framingham Risk Score
HDL-C	High-density lipoprotein cholesterol
HTN	Hypertension
HU	Hounsfield unit
JKCI	Jakaya Kikwete Cardiac Institute
LDL-C	Low-density lipoprotein cholesterol
MACE	Major adverse cardiac events
MDCT	Multidetector Computed Tomography
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
NCCT	Non-contrast Computed Tomography
PACS	Picture archiving and communication system
SCCT	Society of Cardiovascular Computed Tomography
SPSS	Statistical Package for Social Sciences
STR	Society of Thoracic Radiology
3D	Three Dimensional

DEFINITION OF KEY TERMS:

Agatston score: is a semi-automated tool to calculate a score based on the extent of coronary artery calcification detected by an unenhanced low-dose CT scan, which is routinely performed in patients undergoing cardiac CT.

Computed tomography (CT): Also called computerized axial tomography, or CAT scan, is an x-ray technique that uses an x-ray sensing unit that rotates around the body, along with a computer to create cross-sectional images. The images generated by a computer synthesis of x-ray transmission data obtained for many different directions in a given standard anatomic plane or view which can be axial (horizontal), coronal reformatted (cutting the body into slices that are from anterior to posterior or vice versa) or sagittal reformatted (longitudinal slices that are from the sides and volumetric (3D) representation of structures.

Coronary artery disease: A disease characterized by narrowing or blockage of the blood vessels that supply blood to the heart.

Framingham Risk Scoring System (FRS): The most commonly used, multi-variable scoring system and the most extensively validated quantitative assessment tool for determining an individual's potential risk of developing CHD and of experiencing a significant coronary event. It includes the following major risk factors: gender, total cholesterol, high-density lipoprotein (HDL) cholesterol, systolic blood pressure (or on treatment for hypertension), cigarette smoking, and age.

Helical CT (also known as spiral CT scanning): A type of CT that creates images at a higher speed than conventional CT through moving a patient in a continuously rotating x-ray source.

Multislice spiral CT (MSCT) (also known as multi-row detector CT or MDCT): A technical evolution of helical CT, it uses CT machines equipped with an array of multiple x-ray detectors that can simultaneously image many sections during rapid volumetric image acquisition.

Tomograph: An apparatus for moving an x-ray source in one direction as the film is moved in the opposite direction, thus showing in detail a predetermined plane of tissue while blurring or eliminating detail in other planes.

CHAPTER ONE

1.0. INTRODUCTION AND LITERATURE REVIEW

1.1 BACKGROUND:

The CAC score method was initially introduced in 1990 by Agatston for EBCT scanners and then later adopted MDCT exams, which based on the maximum x-ray attenuation coefficient, or CT number, measured in Hounsfield units (HU)(1).

Agatston score is a semi-automated tool to calculate a score based on the extent of coronary artery calcification detected by an unenhanced low-dose CT scan, which is routinely performed in patients undergoing cardiac CT, the amount of calcification, which is present in the anatomic location of the heart can also define the prognosis of the patient(1–3). Quantification of coronary artery calcium (CAC) is reliable, reproducible, and predictive of cardiovascular risk. At the other end of the spectrum, high Agatston scores (>300) are associated with a high probability of developing major cardiovascular events(4).

Coronary heart disease (CHD) events can be predicted by CT (5–7) even beyond the Framingham Risk Score (FRS). It was found in one study, where participants were grouped according to an Agatston score > or < 300, those with an Agatston score ≥300 had significantly more cardiovascular events than those with lower scores at every level of risk (low, intermediate, and high), based on the Framingham risk score(5). The FRS has been validly used as the 10-year risk of coronary heart disease (CHD) (8).

Calcification is fundamental to the atherosclerotic process, with small calcified foci developing as early as the teens or twenties, immediately after the formation of fatty streaks. Coronary artery calcification (CAC) is highly prevalent in patients with coronary heart disease (CHD) and is associated with significant adverse cardiovascular events(9). Studies show that the extent of coronary artery calcification (CAC) strongly correlates with the degree of atherosclerosis and the rate of future cardiac events (5).

The American Heart Association Prevention Conference V recommended grouping individuals according to their future risk of CAD, typically determined using the Framingham risk score or index. An individual is considered to be at high risk if the likelihood of developing the cardiovascular disease over the next ten years, based on traditional risk factors,

is >20% (10,11) An individual with a 10% to 20% likelihood of disease is at intermediate risk and an individual with a <10% likelihood of disease is at low risk(11).

Coronary calcium scoring is best targeted to the screening of people who fall into the intermediate-risk category or to individuals at low risk but with other factors, such as a family history of heart disease, which may elevate their risk beyond that measured by traditional risk factors(12).

In 2006, AHA issued a scientific statement on the use of cardiac CT (13). Most of the documents reviewed the utility of calcium scoring to determine prognosis and diagnosis.

The South Bay Heart Watch Study demonstrated that coronary calcium screening could further improve the identification of individuals who are at high risk for MI or cardiovascular death over the next 5 to 10 years. This study found that the measurement of calcified coronary plaque prospectively provided significantly more information about the likelihood of myocardial infarction or cardiovascular death than traditional risk factors alone (5).

A study by Fernandez F.L et al. demonstrated that a CAC score of >300 was associated with a significant increase in coronary heart disease event risk when compared with that determined by the Framingham risk score alone (14). In the asymptomatic population, one study has observed that CAC is present in 50% of persons 40 to 49 years old and 80% of those 60 to 69 years old (15). It has long been known that coronary calcified plaque predicts increased risk for myocardial infarction and cardiovascular death (16).

The Multi-Ethnic Study of Atherosclerosis (MESA) suggests that the CAC score is a predictor of subsequent clinically significant coronary heart disease (CHD) and may provide predictive information beyond that provided by standard risk factors, also reported that after adjustment for conventional risk factors, a doubling of the CAC scores resulted in a 20% increase in the risk of a major coronary event (myocardial infarction/death from CHD) and a 25% increase in the risk of any coronary event (17).

An analysis was done by Polonsky and peers in the 2010 study of risk for coronary events by comparing the use of the conventional FRS System alone with the inclusion of CAC scores, as part of the risk stratification model. With the addition of CAC to the model, an additional 23% of those who experienced events were reclassified as high risk, and another 13% who did not

experience events were reclassified as low risk(18). Budoff and colleagues reported that the CAC score provided incremental information, in addition to traditional risk factors in the prediction of all-cause mortality(6,19,20).

The prevalence of CAC is age- and gender-dependent, occurring in over 90% of men and 67% older than 70 years of age. The extent of coronary artery calcification (CAC) strongly correlated with the degree of Atherosclerosis and the rate of future cardiac events (9,15,21)

In 2006, Anand and colleagues published a study which reported that CAC scores were superior to established cardiovascular risk factors in predicting silent myocardial ischemia and short-term outcome(22).

The Framingham Risk Score predicts CHD events only moderately well where family history is not included as a risk factor. There have been several studies supporting the role of the CAC score for the prediction of myocardial infarction and cardiovascular mortality. It was shown to have a great scope in risk stratification(23).

Parma and colleagues in their 2016 study of the probability of CAD and the incidence of major adverse coronary events, which included cardiac death, nonfatal MI, and coronary revascularization, resulted in 40.65% with no coronary calcifications and 59.53% were found to have CAC(24).CAC is not only independently associated with CHD of asymptomatic subjects but also carries prognostic importance in patients with known CHD(25).

Very little is known in Africa regarding CAC scores, one published a preliminary study on CAC scores within a black African population was done in Ghana. The majority of cases (78.8%) had a zero calcium score, with patients within the age group of 55–64 years dominating the non-zero calcium score population. Males were found to have higher calcium levels compared to females, and CAC and prevalence steadily rose with the increasing age(4,26).

It was demonstrated by the SCCT and STR in 2016 that CACS can be calculated from routine chest CT thus could pick asymptomatic CAD very early(27).

Agatston Scores in Tanzania has not been studied yet. Thus there is a very wide knowledge gap in the utilization of Agatston scores.

1.2 STATEMENT OF THE PROBLEM:

Coronary artery calcification (CAC) was previously thought to be a benign process, and the calcified lesion increases following aging. Heart disease is one of the leading causes of death for men and women. A crucial public health issue is to determine people at risk by scanning their CAC scores.

In most developed countries after 2006 when the AHA issued a scientific statement on the use of cardiac CT, they have been ever since practicing this routinely(28).

In African countries cardiologists base on the traditional way, the FRS to classify their patients thus many patients have been missing the opportunity of the earliest preventive management of cardiovascular events which could have been predicted very early if CACS were measured during chest or cardiac CT scans. The relevant publication found in Africa was a preliminary study on CAC scores within a black African population which was done in Ghana (4). However in studies of Bud off MJ et al. and Goff DC et al., found that CACS plays a vital role in reclassifying individuals with risks of CHD(29,30).

Tanzania like many other African countries has not started utilizing the Agatston Scores in determining the development of major cardiovascular events.

The situation is hampered by very low availability advanced diagnostic facilities with MDCT over the years. And as a matter of fact, only a few hospitals have this diagnostic facility, most medical personnel are not familiar with usage of CT to determine future major cardiovascular events by measuring CACS.

With this in view, the purpose of this study was to assess the role of Agatston Scores in cardiac patients at risk of developing cardiovascular events who underwent cardiac CT at MNH Radiology departments Dar Es Salaam, Tanzania.

1.3 RATIONALE OF THE STUDY:

Heart disease is one of the leading causes of death for men and women. A crucial public health issue is to determine people at risk by scanning their CAC scores. A strong prognostic significance of CAC has now been established for >15 years from studies involving tens of thousands of subjects collectively. CAC scanning would provide an excellent outcome if applied as a central role in CVD risk assessment, hence the early prediction and management of cardiovascular events.

1.4 OBJECTIVES:

1.4.1. BROAD OBJECTIVE:

To assess the role of Agatston scores in determining patients at risk of major cardiovascular events undergoing cardiac computed tomography at Muhimbili National Hospital, from November 2018 to April 2019.

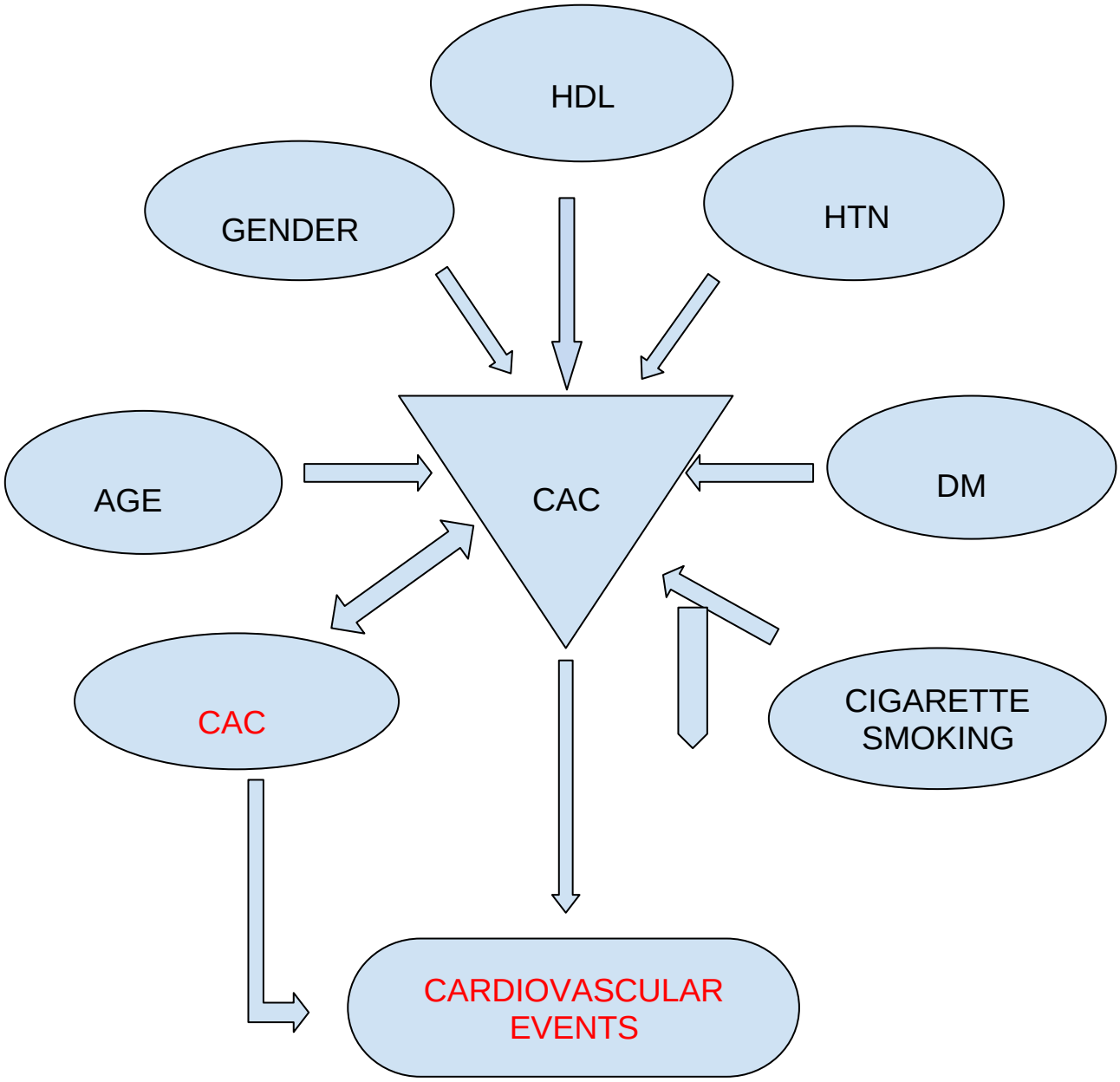
1.4.2. SPECIFIC OBJECTIVES:

1. To determine the Agatston scores by age and sex in patients at risk of major cardiovascular events undergoing cardiac computed tomography at MNH, from November 2018 to April 2019.
2. To determine the FRS by age and sex in patients at risk of major cardiovascular events undergoing cardiac computed tomography at MNH, from November 2018 to April 2019.
3. To compare between Agatston score and FRS in patients at risk of major cardiovascular events undergoing cardiac computed tomography at MHN, from November 2018 to April 2019.

1.5. RESEARCH QUESTIONS:

1. What are the Agatston Scores by age and sex in cardiac patients at risk of major cardiovascular events undergoing cardiac computed?
2. What are the Framingham Risk scores by age and sex in cardiac patients at risk of major cardiovascular events undergoing cardiac computed?
3. What is the difference between Agatston score and FRS in determining patients at risk of major cardiovascular events undergoing cardiac computed tomography?

1.6 CONCEPTUAL FRAMEWORK:



The above is schematic diagram illustrating the conceptual framework that was used to conduct this study which intended to show how the CACS alone can predict Cardiovascular Events even beyond traditional CHD risk; FRS factors (Age, Gender, HTN, DM, HDL, Cigarette smoking) modified from (5)***.***

CHAPTER TWO

2.0 METHODOLOGY

2.1 STUDY TYPE:

This was a hospital-based cross-sectional study.

2.2 STUDY AREA:

Study location: CT scan unit at MNH Radiology Department in Dar Es Salaam Tanzania. MNH is the largest national level referral hospital, a teaching hospital and research center. MNH receives 3000 patients per day and has the bed capacity of 2000. The MNH cardiology department has 200 beds.

JKCI is a national specialized and university teaching hospital offering cardiovascular care training and research. It is located within the MNH premises. JKCI receives 250 to 300 outpatients per day; it has 106-bed capacities and is equipped with modern technology for cardiac care including a cath lab. It provides services to all age groups from ambulatory procedures to open-heart surgeries.

2.3 STUDY DURATION:

The study was conducted from November 2018 to April 2019.

2.4 STUDY POPULATION:

The study involved and covered all cardiac patients referred by physicians for Cardiac CT at MNH CT scan unit. The patients came from MNH and JKCI and all other patients who came for Chest CT regardless of the indication.

2.5 INCLUSION CRITERIA:

- All cardiac patients referred by physicians for Cardiac CT and gave consent to be involved in the study.
- All patients who came for chest CT and agreed to be involved in the study.

2.6 EXCLUSION CRITERIA:

- All cardiac patients who attended MNH CT unit for cardiac CT but did not give consent to be involved, in the study.

2.7 SAMPLING METHOD:

Based on the most available samples, a convenient non- probability sampling technique was used to get the desired sample size which involved all cardiac patients for cardiac CT and patients who came for CT chest then consented to participate in the study.

2.8 SAMPLE SIZE CALCULATIONS:

The sample size for this study was calculated using Fisher's formula. The prevalence of 21.2% (4) from the Ghana study was considered statistically significant in this study.

The sample size calculation was:

$n=Z^2P\ (1-P)/E^2$

Where: n= sample size,

Z = (1.96) standard normal variance.

P = 0.2

E = margin error 5 %

So from the formula $n = \frac{Z^2 P(1-P)}{e^2}$

e = 0.05,

Z=1.96 and

P=0.1

$n = \frac{(1.96)^2 \times 0.212(1-0.212)}{(0.05)^2} = 257$

n = 257.

n + 5% n = 270

This study involved **238 patients** out of the expected sample of **270 Patients.**

2.9 IMAGING TECHNIQUES

The patient was kept in a supine position covered the carina through the apex of the heart. The preferred heart rate was up to 70b/min to eliminate the motion artifacts of the beating heart.

Multidetector cardiac CT: The **MDCT-** Siemens Somatom Definition Flash (128 – Slice Dual Source Scanner, Frankfurt, Germany MFD October 2015) at MNH was used, followed by a dedicated protocol for coronary calcium scoring at kV 120, mAs 70, Field of view 26–35 cm. Scan mode Axial–cardiac Reconstruction. Partial scan, an ECG gated Prospective each 75% of R-R interval with helical acquisition using slice thickness of 3mm, slice spacing of 3mm, 0.6mm Collimations and 410/10 window levels.

Method of Calculation Agatston Score: The CACS were calculated by a specialized cardiac CT workstation software Singo Via which identified calcifications that met the scoring criteria throughout the image. Then calcified plaques in the coronary arteries were measured in volume and then converted to Agatston scores units.

2.10 DATA COLLECTION:

Data were collected through the very well-structured standardized questionnaires with the observational checklist of FRS charts which were filled by the PI. Also, the FRS calculation by the online FRS calculator which is the most widely and currently used was also applied in this study where, Hypertension was defined as the presence of a persistent elevated SBP ≥140 mmHg and/or diastolic DBP ≥90 mmHg, the use of antihypertensive drugs and/or past medical history of hypertension. Diabetes mellitus was defined as a random blood glucose level of ≥11.1 mmol/L and/or fasting blood glucose level of ≥7.0 mmol/L or greater and/or use of insulin or an oral hypoglycemic agent. Total cholesterol values between 200 and 239 mg/dL were considered to carry borderline high risk whilst all values above 240 mg/dL carried high risk. Dyslipidemia was defined as low levels of high-density lipoprotein cholesterol (<60mg/dL), A family history of heart disease in the sample population was defined as heart disease in a first-degree relative at age ≤65 years and ≤55 years for women and men, respectively(18,31). This clinical information was fed on the online calculator which gave the calculated outcome FRS(31).

Images were displayed and viewed on the workstation with an inbuilt computer software program, the SingoVia. The PI did the cardiac CT images evaluation and then was confirmed by specialized cardiac Radiologists, in case of disagreement a third radiologist was consulted. The imaging data were recorded only when consensus on the findings was reached. Data were recorded and all the records were kept on PACS.

2.11 DATA ANALYSIS.

Data were analyzed using the Statistical Package for Social Sciences (SPSS) for Windows version 22.0. Categorical variables the independent (age, sex) with the dependent (FRS, Agatston scores) and the comparison of the two scores were all analyzed by Chi-square test with a confidence interval of 95%, p-value < 0.05 was considered statistically significant.

2.12 ETHICAL CONSIDERATION AND ETHICAL CLEARANCE:

Ethical clearance issues were cleared from the MUHAS Research and Publication Committee. Before conducting this research, the proposal was presented to the Radiology department, which was responsible for requesting the clearance, permission, and introduction letter that described the purpose of the study.

Then the investigator was introduced through the letters from the MUHAS authority to the MNH Executive Director and copies to the head of the Radiology department for permission to conduct the study in November 2018.

Confidentiality during data collection and final report handling were observed. The patient's name was not included in the data collection form. Where necessary the codes were used.

The investigator introduced herself to an individual patient and explained the purpose of the study, then requested the consent to participate in the study. The interviews were conducted in a private room. The patients who met the sampling criteria were requested to fill and sign the consent forms. The patients who signed the consent were the ones enrolled for the study. The ones who refused to give consent did not affect their right to receive standard treatment.

2.13 STUDY LIMITATIONS AND MITIGATION:

There is still no published study on the Agatston scores done in Tanzania or East Africa to date, thus the local prevalence rate is unknown. Hence the prevalence rate used would not be genuinely representative of the actual local problem in Tanzania. The prevalence used as a result of a preliminary study on CAC scores which was done in Ghana, Western Africa.

This study was limited by the fact that all participants were referred for CAC testing and were not considered to be a random sample of the population thus convenient sampling was used.

The CACS CT investigation was not done routinely at MNH; therefore the proper protocols of unenhanced low dosed studies for CACS were done before coronary CT angiographies which are routinely and frequently done.

Some patients had racing heart rates, with the availability of a suitable CT machine that has inbuilt software for CAC scoring at the MNH CT unit, all patients who experienced palpitations were given intravenous medications to control the racing heart as the standard techniques directed.

The sample size was not reached to the expected size due refusal to participate in the study and some due to social-economic reasons. Some participants were not healthily ensured and could not afford to pay for the required investigation. Some of these patients who had social-economic constraints, the special exemption to pay partially or full exemptions were granted by the Head of MNH Radiology department.

CHAPTER THREE

3.0 RESULTS

There were a total of 238 patients (134males, 104 females).

The age ranged from 34 to 98 years, mean age 61years.

Agatston scores ranged from 0 to 1399, mean score 94.

Table 1: Showing Agatson Score by Age in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, from November 2018 to April 2019.

Agatston scores increase with age, high risk for >80 Age group (75.9%) compared to other groups. These differences were statistically significant (p<0.001).

AGE	Pearson's Chi-squared test AGATSTON SCORE				TOTAL (%)
	0 (%)	1-99 (%)	100-299 (%)	>300 (%)	
30-39	22 (95.7)	1 (4.3)	0 (0.0)	0 (0.0)	23 (97)
40-49	23 (79.3)	6 (20.7)	0 (0.0)	0 (0.0)	29 (12.2)
50-59	29 (54.7)	16 (30.2)	7 (13.2)	1 (19.0)	53 (22.3)
60-69	14 (21.5)	26 (40.0)	11 (16.9)	14 (21.5)	65 (27.3)
70-79	2 (5.1)	9 (23.1)	9 (23.1)	19 (48.7)	39 (16.4)
>80	1 (3.4)	2 (6.9)	4 (13.8)	22 (75.9)	29 (12.2)
TOTAL	91	60	31	56	238 (100.0)

Table 2: Showing Agatston Score by Sex in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, from November 2018 to April 2019.

Males at high risk were 29.9% compared to females (15.4%). These differences were statistically significant ($p<0.05$).

SEX	Pearson's Chi-squared test AGATSTON SCORE				TOTAL (%)
	0 (%)	1-99 (%)	100-299 (%)	>300 (%)	
MALES	46 (34.3)	27 (20.1)	21 (15.7)	40 (29.9)	134 (56.3)
FEMALES	45 (43.3)	33 (31.7)	10 (9.6)	16 (15.4)	104 (43.7)
TOTAL (%)	91	60	31	56	238 (100)

Table 3: Showing FRS by Age in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, from November 2018 to April 2019.

FRS increases with age, >80 Age group (82.8%) compared to other groups, differences were statistically significant ($p<0.001$).

AGE	Pearson's Chi-squared test FRS			TOTAL (%)
	<10% Low Risk (%)	10%-20% Intermediate Risk (%)	>20% High Risk (%)	
30-39	23 (1)	0 (0.0)	0 (0.0)	23 (9.7)
40-49	29 (1)	0 (0.0)	0 (0.0)	29 (12.2)
50-59	45 (84.9)	8 (15.1)	0 (0.0)	53 (22.3)
60-69	35 (53.8)	25 (38.5)	5 (7.7)	65 (27.3)
70-79	9 (23.1)	15 (38.5)	15 (38.5)	39 (16.4)
>80	1 (3.4)	4 (13.8)	24 (82.8)	29 (12.2)
TOTAL (%)	142	52	44	238 (100)

Table 4: Showing FRS by sex in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, from November 2018 to April 2019.

Males are at high risk with 26.1% compared to females (8.7%). These differences were statistically significant (p<0.001).

SEX	Pearson's Chi-squared test FRS			TOTAL (%)
	<10% Low Risk (%)	10%-20% Intermediate Risk (%)	>20% High Risk (%)	
MALES	62 (46.3)	37 (27.6)	35 (26.1)	134 (56,3)
FEMALES	80 (76.9)	15 (14.4)	9 (8.7)	104 (43.7)
TOTAL (%)	142	52	44	238 (100)

Table 5: Showing the Agatston scores and FRS in patients at risk of cardiovascular events undergoing cardiac computed tomography at MNH, from November 2018 to April 2019.

The Agatston score > 300 reclassified (5.6%) low risk and (36.5%) intermediate FRS to high-risk for CVE. (p<0.001).

FRS	Pearson's Chi-squared test AGATSTON SCORE				TOTAL (%)
	0 (%)	1-99 (%)	100-299 (%)	>300 (%)	
<10% Low Risk	84 (59.2)	38 (26.8)	12 (8.5)	8 (5.6)	142 (59.7)
10%-20% Intermediate Risk	6 (11.5)	18 (34.6)	9 (17.3)	19 (36.5)	52 (21.8)
>20% High Risk	1 (2.3)	4 (9.1)	10 (22.7)	29 (65.9)	44 (18.5)
TOTAL	91	60	31	56	238 (100.0)

CHAPTER FOUR

4.0 DISCUSSION.

A total of 238 patients were included in this study. Male preponderance was observed in 134(56.3%). The mean age was 61 years (youngest 34years, oldest 91years) and CACS ranged from 0 to 1399 (mean score 91).

The results have shown that Agatston scores strongly associated ($p<0.001$) with aging, with the highest risk observed at age group >80 years (75.9%). Aging is the risk factor for calcified coronary atherosclerotic changes and their extent strongly correlates with the rate of future major CVE. These findings correspond to other studies that showed aging has a potential CAC increase(10,11,31). Other studies suggested that coronary artery atherosclerosis and calcification are almost universal in those with advanced old age(32).

Therefore old age and male gender are the most risk factors to have high Agatston scores as also seen in other studies that resulted in the prevalence of CAC to be age- and gender-dependent, occurring in over 90% of men and 67% older than 70 years of age. Where the extent of coronary artery calcification (CAC) strongly correlated with the degree of atherosclerosis and the rate of future cardiac events (13,19,21). The Ghana study in West Africa which also resulted in CAC and prevalence steadily rose with the increasing age and males had higher calcium levels compared to females(4). Another study found males tended to have higher average calcium scores in each coronary artery than females due to a greater tendency to have multiple vessel involvement(33).

The strong associations between FRS with aging were observed, as was seen in the age group >80 years, (82.8%) and male gender 26.1% ($p<0.001$). The FRS increased with aging and males had higher scores, this was also found in previous studies(3,6). The CAC score is a strong predictor of CHD incidence, and provides predictive information beyond the traditional risk factors in different ethnic groups(5), The average CHD risk over a period of 10 years tends to plateau slightly in the oldest men and women(8) Other studies showed, an individual is considered to be at high risk if the likelihood of developing the cardiovascular disease over the next ten years, based on traditional risk factors, is >20% (10,11). .

The Agatston scores > 300 reclassified 5.6% low and 36.5% intermediate FRS to high-risk individuals to develop major CVE. The difference between Agatston score and FRS was strongly statistically significant ($p<0.001$). These findings could be compared with other studies that found out that Agatston alone could predict the development of cardiovascular events, as the measurement of calcified coronary plaque prospectively provided significantly more information about the likelihood of myocardial infarction or cardiovascular death than traditional risk factors alone(3). CAC score alone was able to predict CHD risk independently of FRS. Moreover, the CAC score significantly modified the risk prediction in all categories of the FRS category with risk >10%(23). Another study resulted in more than one-half (52%) of the intermediate-risk group were reclassified according to CAC scores, of which 22% were correctly categorized as high risk, the p-value was <0.001 (29). The other two studies found that a significant positive correlation between the CACS and the FRS ($p<0.05$) (33) and CAC has proved to be a potential method to improve risk discrimination(32).

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

Agatston score and FRS increase with aging and males are more prone to high scores hence are at high risk of developing major cardiovascular events.

5.2 RECOMMENDATIONS

It is prime time to focus on promoting appropriate CAC-guided CVD risk assessment in our population which has proven to show a benefit. Therefore Agatston score should be routinely used in CAD risk assessment over FRS because excellent evidence has provided in this study. This will modify the patients' management before developing major cardiovascular events.

The guidelines by SCCT and STR can be implemented as primary management to detect asymptomatic cases, by calculating CAC scores in every chest scan regardless of indication, this will help us to predict CAD events very early, and take necessary measures for the best management of our patients.

A larger study should be done using this study as the baseline.

6.0 REFERENCES

1. Agatston AS, Janowitz WR, Hildner FJ, Zusmer NR, Viamonte M, Detrano R. Quantification of coronary artery calcium using ultrafast computed tomography. J Am Coll Cardiol. 1990;15(4):827–32.

2. Lichtenstein G, Perlman A, Shpitzen S, Durst R, Shaham D, Leitersdorf E, et al. Correlation between coronary artery calcification by non-cardiac CT and Framingham score in young patients. PLoS One 2018 Mar 28;13(3):e0195061.

3. Tae-Hwan Lim, Practical Textbook of Cardiac CT and MRI.

   Springer(2015)ISBN:9783642363976 2015

4. Adjaye GA, Anyitey- IC, Aboagye E, Coleman NE, Amankwah P, Abaidoo NK. Coronary Artery Calcium Scoring Is It Time for a Change in Methodology. 2018;75–80.

5. Greenland P, Labree L, Azen SP, Doherty TM, Deltrano RC. With Framingham Score for Risk Prediction in Asymptomatic Individuals. Jama. 2004;291(2):210–5.

6. Budoff MJ, Shaw LJ, Liu ST, Weinstein SR, Mosler TP, Tseng PH, et al. Long-Term Prognosis Associated With Coronary Calcification. Observations From a Registry of 25,253 Patients. J Am Coll Cardiol. 2007;49(18):1860–70.

7. Arad Y, Spadaro LA, Goodman K, Newstein D, Guerci AD. Prediction of coronary events with electron beam computed tomography. J Am Coll Cardiol. 2000;36(4):1253–60.

8. Wilson PWF, D'Agostino RB, Levy D, Belanger AM, Silbershatz H, Kannel WB. Prediction of coronary heart disease using risk factor categories. Circulation 1998. Circulation. 1998;97:1837–47.

9. Demer LL, Tintut Y. Vascular calcification: Pathobiology of a multifaceted disease. Circulation. 2008;117(22):2938–48.

10. Grundy SM, Bazzarre T, Cleeman J, D'Agostino RB, Hill M, Houston-Miller N, et al. Prevention Conference V: Beyond secondary prevention: identifying the high-risk patient for primary prevention: medical office assessment: Writing Group I. Circulation. 2000;101(1):E3–11.

11. NCEP ADULT TREATMENT PANEL III REPORT. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Jama. 2001;285(19):2486–97.

12. Daviglus ML, Pirzada A, Liu K, Yan LL, Garside DB, Dyer AR, et al. Comparison of low risk and higher risk profiles in middle age to frequency and quantity of coronary artery calcium years later. Am J Cardiol. 2004;94(3):367–9.

13. Budoff MJ, Achenbach S, Blumenthal RS, Carr JJ, Goldin JG, Greenland P, et al. Assessment of coronary artery disease by cardiac computed tomography: A scientific statement from the American Heart Association Committee on Cardiovascular Imaging and Intervention, Council on Cardiovascular Radiology and Intervention, and Committee on C. Vol. 114, Circulation. 2006. 1761–1791 p.

14. Raggi P, Berman DS. Computed tomography coronary calcium screening and myocardial perfusion imaging. J Nucl Cardiol. 2005;12(1):96–103.

15. Wong ND, Kouwabunpat D, Vo AN, Detrano RC, Eisenberg H, Goel M, et al. Coronary calcium and atherosclerosis by ultrafast computed tomography in asymptomatic men and women: Relation to age and risk factors. Am Heart J. 1994 Feb;127(2):422–30.

16. Gene Bond M, Clark LT, Criqui MH, Iii JRC, Friedman L, Fuster V, et al. Beyond Secondary Prevention : Identifying the High-Risk Patient for. 2015;111–6.

17. Bild DE, Detrano R, Peterson D, Guerci A, Liu K, Shahar E, et al. Ethnic differences in coronary calcification: The Multi-Ethnic Study of Atherosclerosis (MESA). Circulation.

2005;111(10):1313–20.

18. Neal W Jorgensen, Gregory Burke, Diane Bild et al, Coronary Artery Calcium Score and Risk Classification for Coronary Heart Disease Prediction, JAMA 303(16):1610-6 • April 2010.

19. Green MJ, Peterson SK, Baker MW, Friedman C, Harper GR, Rubinstein WS, et al. NIH Public Access. 2005;7(4):221–9.

20. Kaphingst KA, Persky S, Lachance C. Impact of a primary care based intervention on breast cancer knowledge, risk perception and concern: A randomized, controlled trial NIH Public Access. 2010;14(4):384–99.21. Kalra SS, Shanahan CM. Vascular calcification and hypertension: Cause and effect. Ann Med. 2012;44(SUPPL. 1).

22. Anand DV, Lim E, Hopkins D, Corder R, Shaw LJ, Sharp P, et al. Risk stratification in uncomplicated type 2 diabetes: Prospective evaluation of the combined use of coronary artery calcium imaging and selective myocardial perfusion scintigraphy. Eur Heart J. 2006;27(6):713–21.

23. Reddy HK. Cardiac risk stratification : Role of the coronary calcium score. 2010;603–11.

24. Parma Z, Parma R, Brzoska J, Sosnowski M. Prognostic value of coronary artery calcium score in patients with symptoms suggestive of coronary artery disease. Pol Arch Med Wewn. 2016;126(6):395–401.

25. Roy D, Steyer GJ, Gargesha M, Stone ME, Wilson L. NIH Public Access. 2009;292(3):342–51.

26. Adjaye GA, Anyitey- IC, Aboagye E, Coleman NE, Amankwah P, Abaidoo NK. Age – gender distribution of coronary artery calcium score in a black African population in Ghana. 2018;75–80.

27. Hecht HS, Cronin P, Blaha MJ, Budoff MJ, Kazerooni EA, Narula J, et al. 2016 SCCT/STR guidelines for coronary artery calcium scoring of noncontrast noncardiac chest CT scans: A report of the Society of Cardiovascular Computed Tomography and Society of Thoracic Radiology. J Thorac Imaging 2017;32(5):W54–66.

28. Budoff MJ, Achenbach S, Blumenthal RS, Carr JJ, Goldin JG, Greenland P, et al. Assessment of coronary artery disease by cardiac computed tomography: A scientific statement from the American Heart Association Committee on Cardiovascular Imaging and Intervention, Council on Cardiovascular Radiology and Intervention, and Committee on C. Vol. 114, Circulation. 2006. 1761–1791 p.

29. Budoff MJ, Malpeso JM. Is coronary artery calcium the key to the assessment of cardiovascular risk in asymptomatic adults? J Cardiovasc Comput Tomogr 2011;5(1):12–5.

30. Goff DC, Lloyd-jones DM, Bennett G, Coady S, Agostino RBD, Gibbons R, et al. Reply: 2013 ACC/AHA guideline on the assessment of cardiovascular risk. J Am Coll Cardiol. 2014;63(25):2886.

31. Nedea D. No Title [Internet]. May 4, 2017 • 02:10 PM; 1998. Available from: https://www.mdapp.co/framingham-risk-score-calculator-123/

32. Newman AB, Naydeck BL, Sutton-tyrrell K, Feldman A, Edmundowicz D, Kuller LH. Prevalence and Risk Factors. 2001;

33. Makaryus AN, Sison C, Kohansieh M, Makaryus JN. Implications of Gender Difference in Coronary Calcification as Assessed by CT Coronary Angiography. 2014;8:51–5.

7.0 APPENDICES:

Appendix 1: Consent Form English version:

CONSENT TO PARTICIPATE IN A STUDY TITLED AGATSTON SCORES AND CARDIOVASCULAR EVENTS RISKS IN PATIENTS UNDERGOING CARDIAC COMPUTED TOMOGRAPHY AT MUHIMBILI.

Greetings!

I am Dr. Rachel K. Kataraia from Muhimbili University of Health and Allied Sciences. Conducting a study on the assessment of Agatston Score and cardiovascular events risks in patients undergoing cardiac Computed Tomography (CT) at Muhimbili hospitals.

Purpose of the Study.

This study aims to show to what extent the Agatston score or coronary artery calcification detected by an unenhanced low-dose CT scan can predict coronary heart disease (CHD) events, even beyond the traditional Framingham Risk Score (FRS). Moreover, more important is to find out how the information from these measures can improve the management and reduce the incidence of cardiovascular events.

Participation

If you agree to participate in the study, you will be required to answer all the questions that will be asked by the investigator in the form of an interview.

Confidentiality

All information that will be collected from you will be treated confidentially and will not be used for any other purpose other than this study.

Risks

We do not expect any harm to happen for joining in this study.

You have all the Rights to take part or not to take part in this study.

If you choose not to participate in the study or decide to stop participating will continue to be customarily treated.

You can stop participating in this study at any time, even if you have already given consent and if for any reason would wish to come back into the study after withdrawal, we will be ready to accept to continue with the study.

Refusal to participate or withdraw from the study will not involve penalty or loss of any benefits to which had been entitled in your management.

Benefits

Taking part in this research study will contribute towards getting information that will be used to improve the management and reduce the incidence of cardiovascular events.

Policymakers will collectively use your information and others participating in the study in addressing discrepancies and give a way of improvement.

Whom to Contact

If you ever have any questions about this study, can always contact the following:

Dr. Rachel Kataraia (Principal Investigator)

School of Medicine, Muhimbili University of Health and Allied Sciences,

P.O. Box 65001, Dar es Salaam.

Mobile phone numbers: 0713 545 648 / 0763 234 230

Dr. Lulu Fundikira,

Head, Radiology and Imaging Department.

Ag. Director, Clinical Support Services.

Muhimbili University of Health and Allied Sciences.

Phone +255 715 994849.,

P.O. Box 65013, Dar es Salaam.

Also, if you will have questions about rights as a participant, may contact

Dr. Bruno Sunguya, Director of Research and Publications.

P. O. Box 65001, Dar es Salaam.

Signature_____

Do you agree to participate? Write the word ‘Yes' if you agree_____

I, _____ have read the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of participant _____

Signature of investigator _____

Date of signed consent _____

Kiambatanisho 2: Fomu ya Ridhaa

RIDHAA YA KUSHIRIKI KATIKA UTAFITI KUHUSU "AGATSTON SCORE" KIPIMO CHA CT YA MOYO ILI KUWEZA KUBASHIRI MATUKIO HATARI YA KIAFYA YA MOYO.

Habari!

Jina langu ni Rachel Kataraia, mimi ni daktari kutoka chuo kikuu cha afya na sayansi shirikishi cha Muhimbili. Ninafanya utafiti kuhusu kuchunguza mishipa ya moyo na kuweza kupata matukio hatari ya kiafya ya moyo yanayoweza kupelekea moyo kushindwa kufanya kazi kabisa au kifo cha ghafla.

Malengo ya utafiti

Lengo la utafiti huu ni kuangalia ni kwa kiasi gani matumizi ya kipimo cha "CT" ya moyo ambacho ni salama na cha haraka zaidi ukilinganisha na njia iliyozoeleka ya "Framingham risk score"cha mishipa ya ateri za moyo iliyoathirika inaweza kubashiri matukio hatari ya kiafya ya moyo yanayoweza kupelekea moyo kushindwa kufanya kazi kabisa au kifo cha ghafla, ili kuweza kufanya maamuzi ya njia bora ya matibabu mapema na kupunguza vifo vya ghafla.

Ushiriki

Kama utakubali kujiunga katika utafiti, utahitajika kujibu maswali yote utakayo ulizwa na mtafiti katika usaili.

Usiri

Taarifa zote zitakazo kusanywa kutoka kwako zitahifadhiwa katika hali ya usiri mkubwa, na hazitatumika kwa malengo tofauti na ya utafiti huu pekee

Madhara

Ni matumaini yetu kuwa hakuna madhara yoyote yatakayokupata wewe kutokana na kushiriki katika utafiti huu. Halikadhalika, una uhuru wa kujitoa kushiriki pale utakapoamua hivyo. Na kama utaamua kutoshiriki au ukiamua kusitisha ushiriki wako katika utafiti huu utaendelea kuhudumiwa kama kawaida. Unaweza kusitisha ushiriki wako katika utafiti huu wakati wowote hata kama umekwishatoa ridhaa ya kushiriki, na endapo kwa sababu yoyote utaamua kurejea kushiriki basi uamuzi wako huo utapokelewa kwa moyo mkunjufu. Endapo utakataa kushiriki au utaamua kujitoa kushiriki katika utafiti huu, haitapelekea wewe kuadhibiwa au kunyimwa stahiki zako za kimatitabu.

Manufaa

Utakapo shiriki katika utafiti huu, utakuwa umechangia kupatikana kwa taarifa zitakazo saidia kuongeza ubora wa huduma wanazopewa wagonjwa wa moyo na pia kuboresha zaidi matitabu yako kwa kupunguza uwezekano wa kupata mshtuko wa moyo na vifo vya ghafla.

Maelezo yako, pamoja na ya washiriki wengine kwa pamoja yatatumiwa na watunga sera za afya katika kuboresha maeneo yenye mapungufu na kuwezesha utoaji wa huduma zilizo bora zaidi.

Kwa mawasiliano zaidi kuhusu utafiti huu wasiliana na:

Dkt. Rachel Kataraia (Mtafiti mkuu)

Shule ya tiba, Chuo Kikuu cha Afya na Sayansi shirikishi cha Muhimbili,

Sanduku la posta 65001, Dar es Salaam.

Nambari za simu ya mkononi: 0713 545 648/ 0763 234230

AU

Dr. Lulu Fundikira (Msimamizi wa utafiti)

Idara ya Radiologia,

Shule ya tiba, Chuo Kikuu cha Afya na Sayansi shirikishi cha Muhimbili,

Kaimu Mkurugenzi Huduma za kliniki.

Sanduku la posta 65001, Dar es Salaam.

Nambari ya simu ya mkononi: 0715 004 849

Aidha kwa maswali zaidi kuhusu haki zako kama mshiriki wa utafiti huu, unaweza kuwasiliana na Dkt. Bruno Sunguya, Mkurugenzi wa Utafiti na Uchapishaji.

Sandiku la Posta 65001, Dar Es Salaam.

Sahihi……..

Je, unakubali kushiriki? Andika neno "Ndiyo" kama unakubali ……..

Mimi, _____ nimesoma na kuelewa yaliyomo katika fomu 8hii. Maswali yangu yamejibiwa. Ninakubali kushiriki katika utafiti huu.

Sahihi ya mshiriki _____

Sahihi ya mtafiti _____

Tarehe iliyosainiwa fomu ya ridhaa _____

Appendix 3: QUESTIONNAIRE AND OBSERVATIONAL CHECKLIST.

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES (MUHAS)

SCHOOL OF MEDICINE

DEPARTMENT OF RADIOLOGY

P .O. Box 65001, Dar Es Salaam, Tanzania.

QUESTIONNAIRE AND OBSERVATIONAL CHECKLIST FORM FOR ASSESSMENT OF AGATSTON SCORES AND FRS CARDIOVASCULAR RISK FACTORS.

Identity no_____

Part 1: FRS Cardiovascular risks factors

Patient Demographics:
Age: _____

Gender:

Male	**Female**

Personal History:

On Hypertension Treatment?

Yes	**No**

History of Diabetes?

Yes	**No**

Smoking History?

Yes	**No**

<u>Current Examination and Laboratory results</u>:

Systolic Blood Pressure (mm of Hg)

HDL Cholesterol (mg/dL)

Total Cholesterol (mg/dL)

Part 2: Coronary calcium scoring findings

Calcium score	**Check**
0	**Yes_____ No_____**
1–99	**Yes_____ No_____**
100–299	**Yes_____ No_____**
≥ 300	**Yes_____ No_____**
Actual score on cardiac CT imaging	