



## RESEARCH ARTICLE

### THE PERTINENCY OF VARIOUS CALCULATORS IN PREDICTION OF CARDIAC RISK – AN INDIAN SCENARIO

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#### ABSTRACT

**Introduction:** Cardiovascular disease is the commonest cause of sudden death and its risk is increasing world over. There are several cardiac risk analysis scores and calculators such as the Framingham Risk score- coronary heart disease (FRS-CHD), Framingham Risk Score-Cardiovascular Disease Risk, (FRS-CVD), Joint British Society risk calculator 3 (JBS3), American College of Cardiology/American Heart Association and others but there are no studies to determine which is best for our population. Hence this study aims to compare 3 of the most established calculators and look for applicability to our settings in south India. **Materials:** A cross-sectional study was done using, The Framingham heart study calculator, QRISK®3-2018 cardiovascular disease risk calculator and the Mayo clinic heart disease risk calculator which were used to evaluate the risks in the study population and then compared. **Results:** Both QRISK and Framingham calculators taken together give a reliability coefficient of Cronbach's Alpha = 9.55 that is a 96% reliability hence either can be suggested for use in practice. However, the Framingham can give the risk using just anthropometry, or lipid profile which give different values each and can be a reason for minimal variation. But as the Framingham can give the risk using just anthropometry, or just by using lipid profile this is helpful to reduce the numbers of tests being done and also help quicker analysis. **Conclusion:** The estimation of the cardiac risk using either the QRISK3 or Framingham calculators must become standard procedure in hospital records, since they are applicable to the south Indian population, as seen in our study. Regular screening and increasing the awareness in imperative as only then can modifiable risk factors be used to try and reduce the risk of a cardiac event. The main motto of such a study was to improve community health care.

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## INTRODUCTION

As the world plunges into the period of robots and artificial intelligence, in the community health front India substantiations a swell in the metabolic diseases. Cardiovascular conditions persecute millions of Indians but they're substantially detected only at 1st donation after a major occasion of cardiac arrest, arrhythmia, hypertensive extremities and other critical conditions<sup>1</sup>. While forestalment is better than cure, how must we ascertain the same? Hence the regular health evaluation, webbing and use of cardiac threat scores is imperative. There are several cardiac threat analysis scores and calculators similar as the Framingham Risk score- coronary heart complaint (FRS- CHD), Framingham Risk Score- Cardiovascular Disease Risk,(FRS- CVD), Joint British Society threat calculator 3(JBS3), American College of Cardiology/ American Heart Association(ACC/ AHA), atherosclerotic cardiovascular complaint(ASCVD), QRISK2 and WHO risk maps.<sup>2, 3</sup> All of them have been deduced using values and data from the Caucasian races of the west hence are not directly applicable to India due to the difference of race but due to lack of substantiation and studies we're constrained into using these scales directly<sup>3,4</sup>.

Recent studies have shown the frequency of CAD in India to be about raised, It's allowed that the usual threat factors for CAD, similar as hypertension, diabetes mellitus, dyslipidemia, smoking, and rotundity, are more common in Indians<sup>2,4</sup>. Nine current threat factors, including physical inactivity, a low diet of fruits and vegetables, and psychosocial stress, were shown to regard for further than 90 of acute myocardial infarctions (AMIs) in South Asians as seen in position papers like INTERHEART study<sup>5</sup>. The Indian population is passing a fast rise in the overall cargo of conventional threat factors<sup>4,5</sup>. It must be noted then that the Asian, and particularly the Indian population have a partiality for earlier development of CAD, by virtue of their inheritable make- up, life and the psychosocial factors as seen by large studies<sup>2,5</sup>. The world must now strive to determine the connection of established cardiovascular threat scoring systems to our population. We performed our study in south India in a suburban population heading presto towards a western life and we used the QRISK ® 3, MAYO clinic score for cardiac threat assessment and the Framingham calculator of cardiac threat to assess the threat score for our cases with end of relating the most ideal score for our population in terms of race, geographic position and sociocultural practices

which are all important adjustable threat factors whilst considering the threat of development of cardiac conditions.

## AIM

To assess the applicability of cardiovascular risk calculators for analysis in the South Indian population

## MATERIALS AND METHODS

A cross sectional, observational study was conducted for period of 1 year, in urban south India and a total of 200 patients were included in the study after taking written and informed consent for participation. Inclusion criteria was all patients attending the general medicine out patient department without cardiac related complaints at the present visit. The exclusion criteria were previous history of coronary artery disease or known cases of ischemic heart disease and those below the age of 18 years. Hypertension was defined based on the JNC criteria and smoking based on the NHIS criteria and for assertion of MI we used the universal definition.

The following three calculators were used to predict the 10-year risk of cardiac arrest or CAD

- The Framingham heart study calculator
- QRISK®3-2018 cardiovascular disease risk calculator
- The mayo clinic heart disease risk calculator

Each calculator was downloaded from the official websites and the data of all 200 patients was entered into each of them for comparison between the 3 calculators.

**The Framingham Risk Score:** Is a gender-specific algorithm used to estimate the 10-year cardiovascular risk of an individual. The Framingham Risk Score was first developed based on data obtained from the Framingham Heart Study, to estimate the 10-year risk of developing coronary heart disease.

To assess the 10-year cardiovascular disease risk, cerebrovascular events, peripheral artery disease and heart failure were subsequently added as disease outcomes for the 2008 Framingham Risk Score, on top of coronary heart disease. Coronary heart disease (CHD) risk at 10 years in percent can be calculated with the help of the Framingham Risk Score. Individuals with low risk have 10% or less CHD risk at 10 years, with intermediate risk 10-20%, and with high risk 20% or more.

**Mayo clinic risk score** was also used. it determines the risk of atherosclerotic cardiovascular disease (ASCVD) and offers treatment options for patients with LDL values between 70 and 190 mg/dL who are between the ages of 40 and 75. The 10-year Multi-Ethnic Study of Atherosclerosis (MESA), ASCVD pooled cohort risk equations are used to determine risk. The calculator was used from official website “<https://www.mayoclinic.org/medical-professionals/cardiocvascular-diseases/calculators/cardiocvascular-risk-calculator/itt-20534396>”

**QRISK®3-2018 cardiovascular disease risk calculator:** Is a cardiovascular disease (CVD) prediction algorithm including body mass index, ethnicity, deprivation measures, family history, chronic renal disease, rheumatoid arthritis, atrial fibrillation, diabetes mellitus, and antihypertensive medication in addition to standard risk variables (age, systolic blood pressure, smoking status, ratio of total serum cholesterol to high-density lipoprotein cholesterol, and ratio of total serum cholesterol to total cholesterol) it also used more history pertaining to previous illnesses as compared to the previous version.

**This calculator** was used as downloaded from <https://www.qrisk.org/>. The data thus obtained was then analyzed statistically and interpreted.

## RESULTS

The data assimilated was then analyzed using SPSS (version28.0) Software and MS Excel.

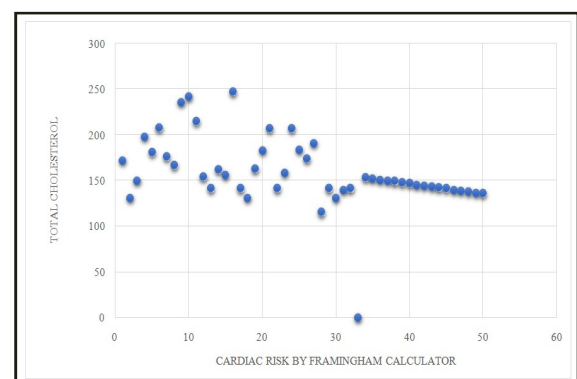
**Table 1. The components considered by each calculator**

| FRAMINGHAM CVD CALCULATOR       | MAYO CLINIC CALCULATOR  | QRISK CALCULATOR       |
|---------------------------------|---|------------------------|
| AGE, SEX, RACE                  | AGE, SEX, RACE, HT, WHT.  | Age, sex, race HT, WHT |
| SMOKING AND TOBACCO CONSUMPTION | FAMILY H/O STROKE, STENT PLACEMENT, ABDOMINAL ANEURYSM, AT, 58YR. AGE H/O TIA, STROKE | SMOKING                |
| SBP                             | SMOKING   | SBP                    |
| Rx FOR HYPERTENSION             | BP  | LIPID VALUES           |
| LIPID PROFILE / BMI             | DM Status   | DM STATUS              |
| DM STATUS                       | HDL, TOTAL CHOLESTEROL  |                        |
|                                 | PHYSICAL ACTIVITY LEVEL, FRUIT INTAKE, PROTIEIN INTAKE                                |                        |

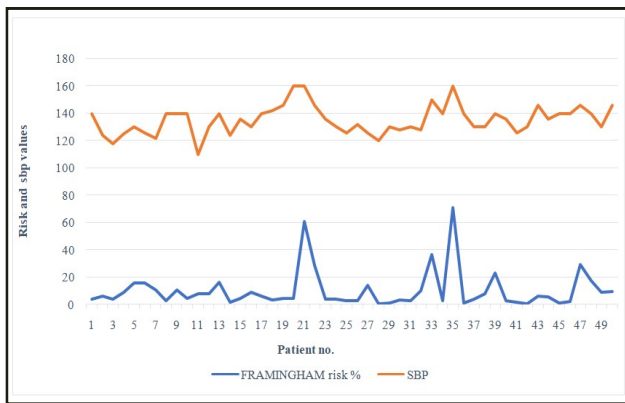
A p value of 0.05 was considered statistically significance. Corelation coefficients of Pearson and spearman were also evaluated to compare the various scores and assess them. ANOVA test is done to compare the risk calculated by the three calculators. Paired t test is done to compare the risk calculated based on the lipid profile with the calculator based on anthropometry in the place of lipid profile. The study sample consisted of 144 males and 56 females with a total of 200 all belonging to south India, coming from a suburban background with a mixed socio-economic status. The mean age of the study population was 46.92 years. Among these patients the mean systolic blood pressure was about 130mmHg which lay well within the normal range as per age and race. Less than 10% of the patients were known cases of type 2 diabetes mellitus, and most had a strong family history of the same which indicated towards a known increased propensity of developing metabolic diseases and hence CAD risk increased. Mayo clinic risk score can be used in younger patients for it provides a 30 yr. risk unlike the other 2 which give 10-year risk of developing CAD. It is thus not very suitable for quick screening due to detailed patient history and family history required.

QRISK and Framingham calculators both give 10-year risks and on statistical analysis we find that they don't show much difference between the accuracy of risk prediction or assessment with a p = 0.529 on paired t-test. Results obtained by BMI give a mean of 14.68 that over estimates the risk obtained by lipid values in Framingham calculator. The highest 10-year risk we found was using this was 56.5% and the MAYO clinic gave a highest 30-year risk if 45%.

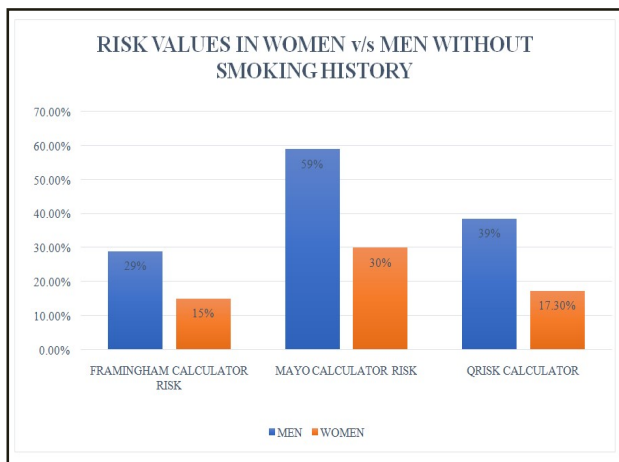
Both QRISK and Framingham calculators taken together give a reliability coefficient of Cronbach's Alpha = 9.55 that is a 96% reliability hence either can be suggested for use in practice. However, the Framingham can give the risk using just anthropometry, or lipid profile which give different values each and can be a reason for minimal variation. But as the Framingham can give the risk using just anthropometry, or just by using lipid profile this is helpful to reduce the numbers of tests being done and help quicker analysis.



**Fig. 1. Total cholesterol levels and cardiac risk scores using Framingham calculator**

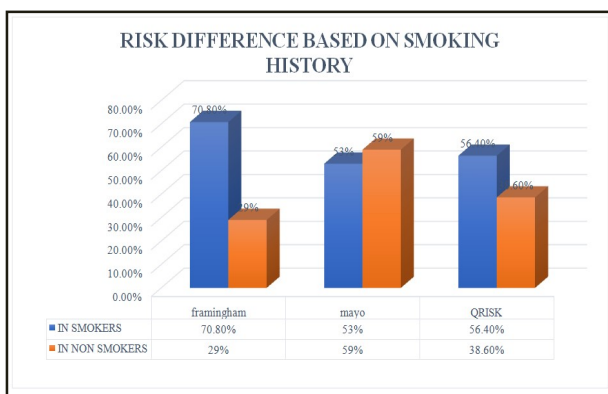


**Fig. 2. Relationship Between The Sbp And Variance Of Cardiac Risk**



Scores in these patients

**Fig. 3. Cardiovascular Disease Risk Scores and Distribution According To Gender**



**Fig. 5. Risk between smokers and non-smokers as seen using the 3**

## DISCUSSION

In development of a cardiovascular complaint there are 109 loci that are related with CAD and can explain the function of inheritable variables, according to the Genome-wide Replication and Meta-analysis<sup>9</sup> study and other genome-wide association studies.<sup>6</sup> According to a proposition, the threat is increased by the commerce of genes with environmental variables like smoking, and the concerted effect may be bigger than the sum of the goods of the individual factors. Since CAD is complex and regulated by multitudinous genes, it'll be gruelling to identify a single inheritable locus that's to condemn.<sup>7, 8</sup>

The use of scoring systems to prognosticate a possible threat is therefore more ideal as it considers multiple factors. Lipoprotein situations are elevated in about 25 of South Asians, including Indians, making it a significant threat factor. Strong threat factors for dyslipidaemia include being a woman, rotundity, sedentary lifestyle, gestational diabetes, dysglycemia, and hypertension<sup>8</sup>. Studies by Kanjilal et al<sup>15</sup> and Naveen Garg et al have shown that the Framingham threat assessment score is most applicable as it was suitable to identify pitfalls in maturity of those in the study population<sup>2,9</sup>. former studies have shown that FRS can be utilised as a individual tool for the presence of metabolic syndrome<sup>10</sup>. Takahashi et al set up a positive correlation between the number of metabolic pattern factors and the CAD threat score; the more factors there are in the metabolic pattern, the advanced the threat of developing CAD. still, the results of studies on the FRS's capability to prognosticate cardiovascular complaint threat are mixed.

The QRISK and the Framingham give 10- time pitfalls which ae more ideal as with changing anthropometry and adjustable threat factors a 30- time threat by Mayo clinic calculator seems less ideal for use in webbing.<sup>12, 13</sup> According to studies done in Asia, metabolic pattern is a stronger predictor of CVD threat, but because FRS is largely dependent on age, cardiovascular problems are undervalued in youthful people, and certain major symptoms of metabolic pattern, similar rotundity, hypertriglyceridemia and elevated high CRP situations aren't covered. Meanwhile studies done in the United States say that the FRS is more prophetic for CVD threat than metabolic syndrome<sup>14</sup>. To answer this content, further exploration across colorful age groups and regions is needed. Although the FRS is a useful tool for prognosticating CVD threat, there are several of its limitations that should be taken into account before generalising its findings to the population First of all, the FRS is an estimation algorithm and cannot be used as a medical examination. Second, the FRS may be an inaccurate tool in this population due to the underrepresentation of youthful people in the original cohort. Third, the FRS didn't take into account several other implicit CVD threat factors like family history of CVD or diabetes<sup>15,16</sup>. Numerous studies done in the history have used JBS calculators, JBS3, WHO calculators and different performances of QRISK hence their results can not be directly compared with our issues.<sup>11, 13,16</sup> Smoking history showed a positive correlation with adding the threat in all 3 calculators, adding the pitfalls in these cases. Meanwhile the manly gender showed a predilection for development of cardiac threat analogous to seen in other studies as well 17, 18. There are studies which have also estimated the stat in trust ability to reduce the threat of CVD but that has not been assessed in our study.

## Limitations

Only three calculators were used by us and separate evaluation for stat in trust ability grounded on the NICE guidelines has not been considered. It was a not a field- grounded study which might have proved to bear better results in terms of distribution of threat factors and populations of pastoral and civic background independently. Another limitation was that the threat assessments we employed were designed to descry high- threat populations without cardiovascular complaint, not people who had preliminarily endured a serious CV event.

## CONCLUSION

The estimation of the cardiac threat using either the QRISK3 or Framingham calculators must come standard procedure in sanatorium records, since they're applicable to the south Indian population, as seen in our study. The Framingham score can estimate threat using either anthropometry or lipid biographies, which give a range of values that can be viewed. This helps to cut down on the number of tests needed. It is advised to do larger studies specifically on Indian populations to further explore relatability. From a community health perspective, education about the threat factors importantly the adjustable factors should be handed to all cases.

Regular webbing during health checks ups addressing adjustable threat factors and detailed history, must be done by health care professionals, care givers and social workers who should also admit training in using similar calculators and consequently directing the cases to further operation grounded on the degree of threat. Simple threat operation can help a CVD in further than 50 of those who develop it

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