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## **Identification of High Risk Individuals for Cardiovascular Diseases through Framingham Risk Score (FRS) and Score Risk (SCORE)**

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### **ABSTRACT**

According to WHO cardiovascular disease (CVD) is the major cause of death in the worldwide. In India too, it has gone through a drastic lifestyle modification from traditional to western one and adapting sedentary lifestyle, consequently prone the people for CVDs. The present study was undertaken to identify the high risk individuals for CVDs in the next 10 years by using the cardiovascular risk assessment tools such as FRS and SCORE and recommendation of lifestyle modification and initiation of pharmacotherapy. A prospective observational study was conducted in patients with all possible risk factors (age, sex, high blood pressure, high HDL, TC, Smoking, and Obesity) for CVD over a period of six month in a tertiary care hospital. A total numbers of patients selected for the study was 90 among, 49 were males and 41 were females. The patients were categorized in to different risk groups. According to FRS tool, 35.5% individuals were at high risk and with SCORE tool, it was 41.1%. Whereas 33.3% individual who were under the high risk for CVDs by both the tools. The individuals' lies between mild to moderate risk for CVDs were recommended for lifestyle modification to attenuate the triggering risk factors. Whereas high risk individual by both the FRS and SCORE tools were recommended for lifestyle modification along with pharmacotherapy in order to keep the risk factors under control.

**Keywords:** Cardiovascular diseases; Risk factors; Assessment tools; Primary prevention.

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## INTRODUCTION

Cardiovascular disease (CVD) is increasing rapidly worldwide and it accounts for 17 per cent of the overall mortality. It is assumed that not only developed countries will be affected by CVD, but the developing countries will also equally affected, even more and rates are awaited to rise further over the following some decades<sup>1,2</sup>.

The modification in lifestyle and dietary habits toward more western styles, subsequent increases in the CVD risk factors such as obesity, smoking, hypertension and diabetes mellitus may lie in this trend<sup>3</sup>. The apparent increases of CVD emphasize the crucial need to redouble treatment and prevention efforts. The concepts of risk assessment and reduction are the cornerstones of preventive cardiology practice<sup>4</sup>. There are various risk assessment scales are available, including the FRS, SCORE, PROCAM and Reynolds<sup>5</sup>.

The guidelines for risk factor management presented by the first joint task force of the European societies on coronary prevention utilized a simple risk chart based on a risk function published by the Framingham investigators. The FRS chart displayed risk of any coronary heart disease event, fatal or non fatal based on categories of age, sex, smoking status, TC, and SBP<sup>6</sup>. It can be useful for both the patients and clinicians to make a decision regarding lifestyle modification and preventive medical treatment<sup>7</sup>. SCORE is to identify high risks individuals for cardiovascular diseases and recently, the SCORE formulated a risk functions to estimation the total CHD derived from the predictors including, age (40-65), sex, smoking, SBP, TC<sup>8</sup>.

The World Health Organization (WHO) figured that over 75% of premature CVD is preventable and risk factor management can help to reduce the growing CVD burden on both individuals and healthcare providers<sup>9</sup>. Consensus exists that lifestyle changes such as smoking cessation; higher levels of physical activity and certain dietary patterns can lead to lower rates of CVD. Elimination of modifiable risk factors including unhealthy life style allows for prevention of 80% of CVD cases and individuals with desirable life style factors are expected to have a 67-72% lower risk of developing heart failure<sup>10, 11</sup>. Hence the present study was undertaken to identify the high risk individuals for CVDs through FRS and SCORE scales and address them for life style modifications and pharmacotherapy.

## MATERIALS AND METHOD

A Prospective observational study was carried out in a patient who visited to Shri B. M. Patil Medical College Hospital and Research Centre. This study is was approved by the institutional ethics committee under the no- IEC/BLDE COP/2019/03. The patient who lies in between the age group of 20 to 79 years were selected for the study. We excluded the patients with a history of

Diabetes Mellitus, Myocardial infarction or Stroke. The FRS and SCORE were calculated according to the risk factors including age, sex, TC, systolic blood pressure, HDL, smoking status.

The data collection was categorized as collection of demographic and behavioral data such as smoking, dietary habits, physical activity; personal and family history of HTN and Diabetes, then fitness assessment includes measurements of height, weight, blood pressure, pulse and calculation of BMI according to the measurements. Finally, the laboratory values such as total cholesterol, HDL and LDL. The cardiovascular mortality and morbidity rates were calculated for the total subjects in the age groups 20-30,30-40,40-50,50-60,60-70 and >70.

According to FRS risk chart, the number of points for each risk factor was detected and ten year risk in percentage was calculated by total points. As per SCORE, the risks were assessed through the algorithm for high risk countries. The classification of cardiovascular risk by Framingham risk score was categorized into high risk (>20%), intermediate risk (10-20%) and low risk (<10%) and by SCORE, individual were at high risk when it is >5. The patients who are at low to intermediate risk are intervened with life style modification in order to prevent the cardiovascular events in near future and high risk individuals are intervened with life style modification along with a pharmacotherapy.

In statistical analysis, computer software package was used to generate the tables and the results. Chi square test were used to compare quantitative data. A  $p < 0.05$  was considered statistically significant and  $p > 0.05$  is non-significant.

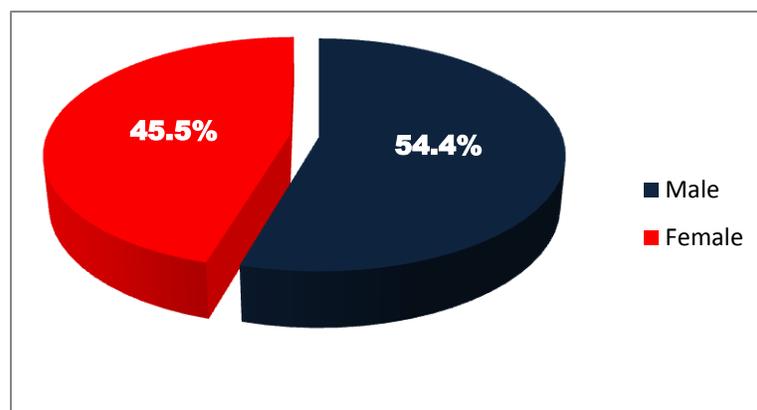
## RESULTS AND DISCUSSION

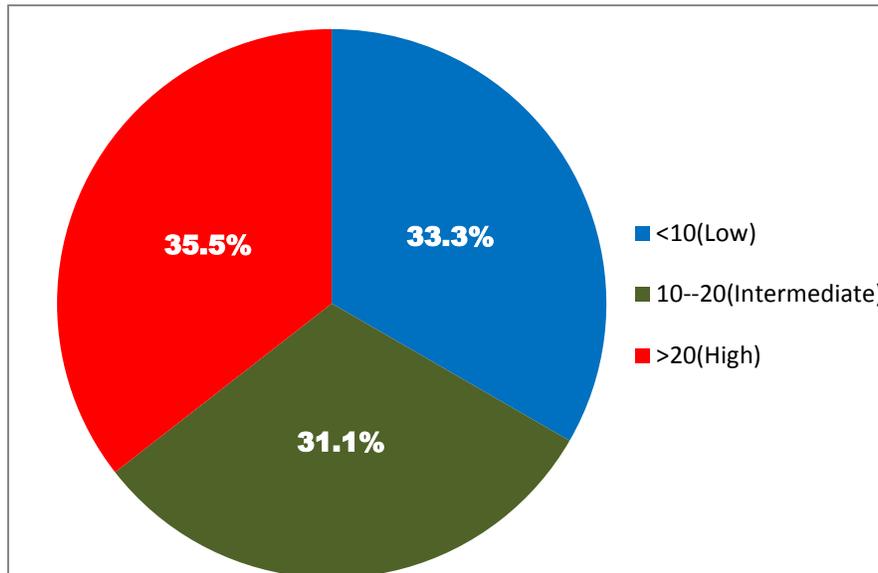
Out of 90 patients, males (54.5%) were more when compared to females (45.5%) (Figure 1). As per FRS, 32(35.5%) individuals had high risk (>20) and the intermediate risk group was 31.1 % ( 28) while low risk group was 33.3 % ( 30) (Figure 2). According to SCORE assessment tool, 68 patients had undergone SCORE risk calculation out of which 37(41.1) patients had high (>5) risk and 31(34.4) patients had low (<5) risk (Figure 3).In the risk prediction analysis, the risk factors were statistically significant to FRS as well as SCORE risk values. The distribution of cardiovascular risk is presented in Table1. When both risk scores were evaluated, 30(33.3%) of individuals showed high risk in both of these tools (Figure 3).

**Table 1: The distribution of cardiovascular risk factors**

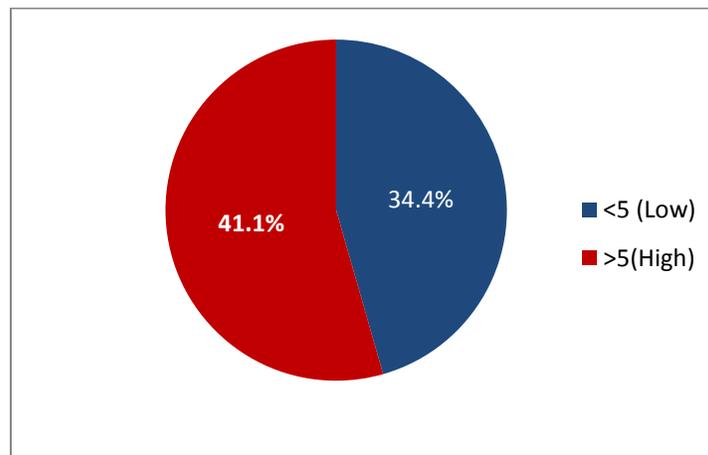
Risk factors	N	FRS X <sup>2</sup>	p value	SCORE X <sup>2</sup>	p value
Age					
20-30	04	2.518	0.0003	102.0	<0.001
30-40	16				
40-50	17				
50-60	29				
60-70	23				
>70	1				
BMI					
N wt(18.5-24 )	24	27.892	<0.001	9.658	0.0466
O wt (25-30 )	32				
Obese >30	34				
BP					
120-130	11	31.073	<0.0001	23.616	0.0027
130-140	12				
140-150	20				
150-160	21				
>160	26				
Smoking	44	6.455	0.0397	7.314	0.0258
TC					
<200	37	19.137	0.007		
200-239	39			13.610	0.0086
>240	14				
HDL					
<40	35	13.647	<0.0093	12.207	0.0159
40-59	51				
>60	4				

BMI- body mass index; BP-blood pressure; TC-total cholesterol;  
HDL-high density lipoprotein

**Figure 1: Distribution of cases according to gender.**



**Figure 2: Percentage of patients according to FRS category**



**Figure 3: Percentage of patients according to SCORE category**

## DISCUSSION

The Framingham score is a most widely used and suggested by the American Heart Association (AHA) and SBC, while the SCORE risk is recommended by Esc. Both use the risk factors such as age and blood pressure; and laboratory variables such as total cholesterol level to predict cardiovascular risk. FRS, which predicts the 10 year risk of incident of CHD including fatal and nonfatal MI, unstable anginas based on the level of individual risk factors, while SCORE model predicts the 10year risk of incident of fatal atherosclerotic cardiovascular events, including myocardial and cerebral infarction<sup>12</sup>.

The study included a total of 90 patients admitted in the medicine ward on the basis of CVD risk factors. There were 49(54.4%) male and 41 (45.5%) female patients. According to FRS tool, approximately 32(35.5%) individuals were in the high risk category, 28(31.1%) were categorized as intermediate risk and 30 (33.3%) individuals as low risk. According to SCORE tool, there

were only 68 patients had undergone SCORE risk calculation due to the age limitation of SCORE risk from 40-65 yrs. Approximately 37 (41.1%) individuals was in high (>5) risk while 31 (34.4%) individuals had low (<5) risk. A study conducted by Priscila Valente Fernandes, *et al.*, where 18.1% patients were at high risk where as 37.5 % patients were at intermediate risk and remaining 44.4% were erroneously stratified as low risk. According to SCORE scale, 36.1% patients were considered at high risk and remaining 63.9% were at low risk which was comparable to this study<sup>5</sup>.

In the present study chi-square test was used to observe the association between each parameter to FRS and SCORE risk. Out of 90 patients, maximum 19 (21.1%) number of male population and 13(14.4%) number of female population were at high (>20) risk. According to SCORE maximum 25 (27.7%) number of male population and 12 number of female Population were at high (>5) risk. Here female patients were at low risk than males. It may be due to smoking habit in males, which is comparable to the study conducted by Dr Ogunmola O J *et al.*, that study includes 183 patients, majority of the women (75%) are in low risk category<sup>1</sup>. There is a statistical significant variation in 10-year risk score category among male and female. This is similar to previous evidence derived from the Framingham Heart study population showing higher risk in males compared to females<sup>13,14</sup>. According to FRS scale, Out of 90 patients , maximum 15 (16.6%) patients and minimum 2(2.2%) patients had high risk and low risk respectively in the age group between 60 -70 and in the age group between 40-50 we found that only 3(3.3%)patients were at high risk and 8(8.8%)patients were at low risk. According SCORE scale , Out of 68 patients ,maximum 20(22.2%) patients were at high risk and 11 (12.2%) were at low risk in the age group between 60-70 and in the age group between 40-50 we found that only 1 (1.1%) patient was at high risk and 15 (16.6%) patients were at low risk. Age wise trend of CVD risk indicates that age is one of the important non modifiable risk factor for CVD, Older age, as assessed by these risk scores, is associated with greater risk of CVD<sup>15</sup>. It is comparable to the study conducted by Christian Yosaputra *et al.*, where out of 220 patients only 8 (3.6%) patients were accounting >20 FRS score where as in present study ,out of 69 patients 30 (3.3%)patients were accounting >20 FRS score in the age group between 40-70<sup>3</sup>. In this study, among 90 patients, maximum 19 (21.1%) number of male population and 13(14.4%) number of female population were at high (>20) FRS risk. According to SCORE maximum 25 (27.7%) number of male population and 12 number of female Population were at high (>5) risk.

In the present it is considered normal weight, overweight and obese patients. According to FRS, of 90 patients 21.1% of patients were obese and had high (>20) risk while 18.8% of patients had normal weight and at low (<10) risk. According to SCORE risk, 19 patients were at high risk

among obese. The risk of CVD has been rising in obese and overweight patients so it has showed associated and statistically significant with FRS risk as in the study conducted by Samia mora et. al,<sup>16</sup>. Obesity, particularly to be found at the abdominal or visceral level, is considered one of the utmost risk factors for coronary artery disease, as well as being associated with increased incidence of hypertension, dyslipidemia and diabetes, which in turn also contribute to the worsening of ischemic heart disease<sup>17</sup>. Cigarette smoking predisposes the person to several different clinical atherosclerotic syndromes, including stable angina, acute coronary syndromes, sudden death, and stroke. Aortic and peripheral atherosclerosis are also amplified, leading to intermittent claudication and abdominal aortic aneurysms<sup>18</sup>. In this study 44(48%) individuals were smokers and categorized under high risk in both FRS as well as SCORE risk with p values 0.0397 and 0.0258 respectively. It was similar to a study conducted by keto jaana et.al, which stated that smoking is a major risk factor for CVD<sup>19</sup>. Smokers had high risk and it was associated with a higher risk of a fatal cardiovascular event defined by the SCORE and FRS .Most of the population studies confirm that hypertension increases the risk of cardiovascular consequences approximately two to three times in an individual, in the present study too it is found higher prevalence of 10 year risk of CVD in patients with BP(FRS  $p < 0.0001$ , SCORE  $p > 0.0027$ ) Cholesterol, triglycerides (TG), and HDL are important constituents of the lipid fraction of the human body<sup>20</sup>. In this study , association between TC and FRS was statistically significant but we did not find any statistical similarities between TC and SCORE .On the other hand , reduced HDL level showed high prevalence and impact on 10 year CVD risk scores(FRS & SCORE).

As per the CVD risk scores, the high risk category needed life style modification as well as pharmacotherapy to prevent the future cardiovascular disease risk. While low to intermediate risk category have to change their life styles in order to reduce the cardiovascular disease risk in future. Pharmacotherapy including antihypertensive drugs, lipid lowering drugs, smoking cessation drugs in order to prevent the future cardiovascular disease risk. The patients who were at low to intermediate risk, life style modification like exercise, yoga, and suitable diet had been suggested to reduce the total risk .The main efficacy of calculating cardiovascular risk is to aid in clinical decision-making by identifying high-risk patients in primary health care who could benefit it from lipid-lowering or anti-hypertensive therapy<sup>8</sup>.

If it is compared FRS and SCORE risk assessment tools, most of the parameters are same except the HDL level, because only FRS is considering the HDL concentration for calculating the CVD risk among patients. Even though most of the risk factors by FRS and SCORE are common, the percentage of population under high risk varies from each category (FRS-35.5%, SCORE-41.1%). Hence it is calculated that the 33.3 % of people are at high risk in accordance with both

FRS and SCORE risk tools. All these 33.3% of people were instructed to adopt the life style modification and should adhere to their pharmacotherapy in order to reduce the risk for developing the CVDs.

Life style modifications (exercise, yoga, Diet therapy, smoking cessation) decreases the CVD risk by reducing body weight, blood pressure, cholesterol levels (LDL,V-LDL,TC) and increasing HDL level makes an individual more healthy. For high risk individuals, only life style modification may not be so effective, hence pharmacotherapy is recommended in order to manage the risk factors effectively because pharmacotherapy attenuates the physiological and physico-chemical imbalances.

## CONCLUSION

The present study was conducted to predict the 10 yr cardiovascular disease risk among 90 patients in future and to prevent mortality and morbidity rate due to CVDs. The FRS and SCORE risk scales were used to identify the high risk individuals. According to FRS tool, approximately 35.5% individuals were in the high risk category, 31.1% were categorized as intermediate risk and 33.3% individuals as low risk. Whereas by SCORE tool, approximately 41.1% individuals were in high (>5) risk while 34.4% individuals had low (<5) risk. There were around 33.3% common individual who are at high risk by both FRS and SCORE. The individuals who are high risk were suggested with life style modification and pharmacotherapy. Whereas the patients with low to intermediate risk were suggested with life style modification. The individual who are at high risk by both FRS & SCORE were warned for possible risks of CVDs and were given extra care as concern with life style modification, medication adherence, patient counseling for disease and medications. Hence the present study justifies its objective to reduce the cardiovascular disease risks of patients in order to decrease morbidity and mortality rate.

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