

ASSESSMENT OF 10-YEAR RISK OF DEVELOPING A MAJOR CARDIOVASCULAR EVENT IN PATIENTS ATTENDING A HOSPITAL FOR THE TREATMENT OF OTHER DISORDERS

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ABSTRACT

Objective: To assess the individual's predicted risk of developing a CVD event in 10 y using risk scores among persons with other disorders/diseases.

Methods: This is a cross-sectional observational study conducted for a period of 6 mo among 283 subjects. Total risk was estimated individually by using Framingham Risk Scoring Algorithm and ASCVD risk estimator.

Results: According to Framingham Risk score the prevalence of low risk (<10%) identified as 67.84% (192), followed by intermediate risk (10%-19%), 19.08% (54), and high risk ($\geq 20\%$) 13.07% (37). By using ASCVD Risk estimator, risk has reported in our study population was low risk (<5%) is 48.76% (138), borderline risk (5-7.4%) is 13.07% (37), intermediate risk (7.5-19.9%) is about 25.09% (71), high risk (>20%) is about 13.07% (37).

Conclusion: In this study burden of CVD risk was relatively low, which was estimated by both the Framingham scale and ASCVD Risk estimator. Risk scoring of individuals helps us to identify the patients at high risk of CV diseases and also helps in providing management strategies.

Keywords: Cardiovascular diseases, Risk factors, Risk estimation, Framingham Risk Scoring Algorithm, ASCVD risk estimator

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INTRODUCTION

Cardiovascular diseases (CVD) brings up a group of diseases involving the heart and blood vessels and are the number one cause of death, accounting 30% of all deaths in the world. According to a joint report by the Harvard School of Public Health and World Economic Forum, CVD majorly contributes an economic burden leading to a staggering loss of \$47 trillion globally over the period 2010-2030 [1].

A Century of research has shown that the occurrence of CVD relates to genetic, physiological, social and environmental factors. Hence, Prevention of CVD can be established by a coordinated set of actions, at public and individual level which aimed at eradicating, eliminating, or minimizing the impact of risk factors on CVDs and their related disability [2].

CVD risk factors are broadly classified into 2 groups: modifiable and non-modifiable. The non-modifiable risk factors are those which one has no control over and include age and sex the modifiable risk factors are contrary and include; diabetes, hypertension, dyslipidemia, obesity, smoking, alcohol, diet, psychosocial factors and physical exercise. While significant advances in genetics and the ability to reduce social inequalities, has become evident that modification of these factors that cause atherosclerosis can also reduce mortality [3, 4].

Risk estimation systems are developed to help the clinicians to assess the effects of risk factors that cause CVD and in planning of therapeutic strategies. Risk scoring makes patients aware of their risk status and can, therefore, serve as enough motivation for engaging in activities to lower overall risk. Many risk estimations systems are in existence where most of them include age, gender, smoking, serum lipids and hypertension as their core variables.

CVD prevention remains as a challenge for the general population, politicians, and healthcare workers [2]. Assessment of an individual's

predicted Risk of developing a CVD event in 5 or 10 y has been identified as one of the ways to determine the burden of CVD risk and to guide treatment decisions [5]. Although there are many studies on CV risk prediction, the value of CV risk estimation is always justified because the prevalence of CV risk factors has continuously been changing in a region with different magnitude and direction over the past 30 y. While other factors like obesity, diabetes mellitus and cigarette smoking have become more prevalent. Furthermore, changes have not been similar between both the gender and among different ages [6].

Hence this study aimed to assess total cardiovascular disease risk- the probability of an individual experiencing a cardiovascular event over 10 y using the most recent Framingham Risk Scoring Algorithm and ASCVD risk estimator.

MATERIALS AND METHODS

This is a cross-sectional observational study which was conducted for a period of 6 mo in patients who are admitted as inpatients from November 2018 and April 2019 in Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation Andhra Pradesh (India). A total of 283 consecutive samples whose age is above 18 y old, agreed to participate voluntarily were recruited into the study and patients of above 65 y, Unresponsive and, or non-communicative, Patients whose records showed established or a history of any cardiovascular diseases are excluded. All the patients agreed to participate with a written consent form. Ethical clearance obtained from the Institutional Ethics Committee with a Protocol Approval No. UG/359/18.

Data including the patient demographic details, medical and medication histories, diagnosis, treatment chart and data on laboratory investigations are collected from the patient medical records and risk was estimated individually by using Framingham Risk Scoring Algorithm and ASCVD risk estimator.

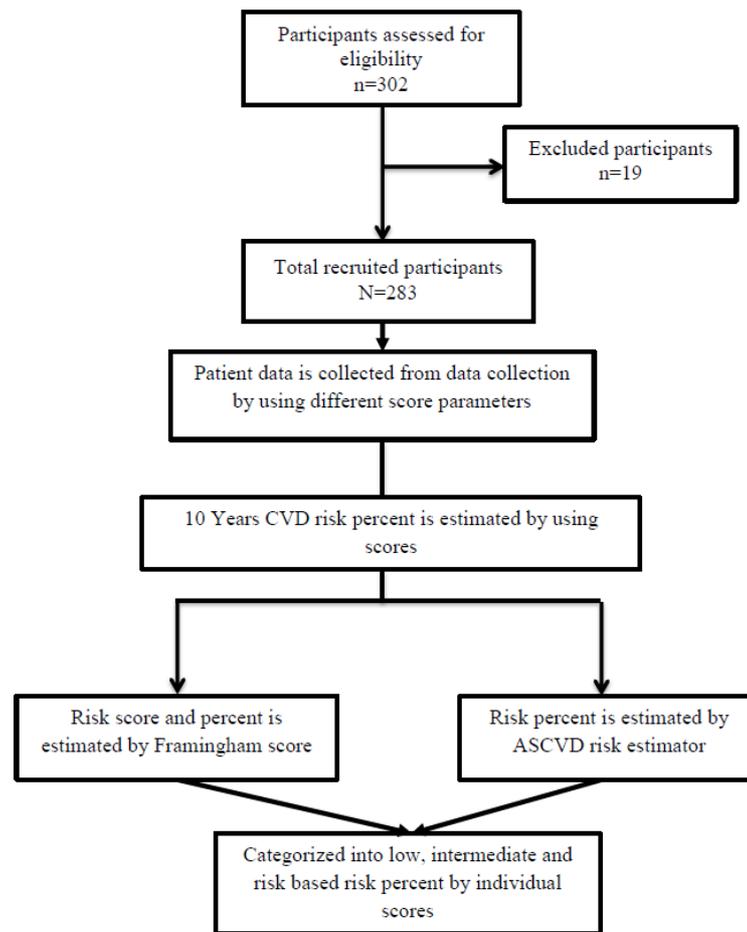


Fig. 1: Flowchart of study design

Study tools

a) Framingham risk score

The globally best known and the most widely used tool for assessing the 10 y cardiovascular risk is the Framingham risk score. The Framingham group has pioneered many methods commonly used for estimation of risk. Several modified versions of the Framingham have also been developed and included in national, international guidelines, which are presented as either charts or tables [4]. Framingham risk is calculated by combining the variables gender, age, LDL cholesterol value, HDL cholesterol value, blood pressure, diabetes and smoking. The Framingham risk score was divided into three categories in this study to quantify the risk of developing CVD over the next 10 y. According to the criteria proposed by the Ministry of Health, the risk was categorized into low risk <10%, intermediate risk 10-19% and high risk \geq 20% according to calculator.

b) ASCVD risk estimator

The ASCVD Risk scale (created by the American College of Cardiology) uses the variables: gender, age, race, whether a smoker or not, diabetic or not, treatment for high blood pressure or not, total cholesterol value and HDL, and systolic blood pressure, to calculate the risk of developing heart disease.

The calculation of this score was made through the "ASCVD Risk Estimator" site. For risk classification, every patient's data are entered in the ASCVD Risk Estimator. Patients with estimated 10-year risk \geq 20%, were considered at high risk, at intermediate risk if they had an estimated 10-year risk 7.5-19.9%, at borderline risk if they had an estimated 10-year risk 5-7.4%, and at low risk if they had an estimated 10-year risk <5%, following the AHA/ACC criteria.

Patients are considered as hypertensive and diabetic if using any medications and dyslipidemic if they showed LDL levels >160 mg/dl and/or HDL <40 mg/dl

Statistical analyses

The data was expressed by percentages. Data were analyzed using statistical tools like Epi-info 7.0 and Graph pad prism version 8.1.

RESULTS

Of all the patients admitted into the hospital during the study period, 283 patients had met the inclusion criteria. Out of them 151 (53.36%) were men and 132 (46.64%) were women, the Baseline characteristics of the study population are presented in table 1. The average age of the whole population was 47.4+10.9. Males were predominant. The age from 18 y above to 65 y was included in this study, which was divided into groups.

The prevalence of Systolic BP according to standard guidelines in total sample Pre-Hypertension is about 37.10% (105), Stage-I is about 30.04% (85) and Stage-II is about 19.79% (56). The prevalence of Diastolic BP, Prehypertension, is about 32.51% (92), followed by stage-I 31.45% (89), Stage-II is 16.25% (46). The smoking history was ex-smoker 11.66% (33) followed by current smokers is 22.26% (63). In men (N1=151) is about ex-smoker 21.19% (32), followed by Non-Smokers 38.41% (58), smokers 40 % (61). The prevalence of Smoking history in Women is about ex-smoker 0.76%, followed by smokers 1.5%, Non-smokers is 97.73% (129) and alcohol consumption history in women is about 0.76%. In Men, the history of alcohol consumption is about ex-alcoholic 11.26%, followed by Non-alcoholic 29.14%, Alcoholic 59.60%.

Table 1: Demographic details of the study population

Age group	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
18-20	3	1.06%	2	1.32%	1	0.76%
21-30	21	7.42%	14	9.27%	7	5.30%
31-40	53	18.73%	33	21.85%	20	15.15%
41-50	93	32.86%	42	27.81%	51	38.64%
51-60	96	33.92%	49	32.45%	47	35.61%
61-65	17	6.01%	11	7.28%	6	4.55%
TOTAL	N=283	100.00%	N1=151	100.00%	N2=132	100.00%
Systolic BP MmHg	Frequency	Percent	Frequency	Percent	Frequency	Percent
Normal (<120)	37	13.07%	17	11.26%	20	15.15%
Pre-Hypertension (120-139)	105	37.10%	66	43.71%	39	29.55%
Stage-1 (140-159)	85	30.04%	38	25.17%	47	35.61%
Stage-2 (≥160)	56	19.79%	30	19.87%	26	19.70%
Diastolic BP MmHg	Frequency	Percent	Frequency	Percent	Frequency	Percent
Normal (<80)	56	19.79%	29	19.21%	27	20.45%
Pre hypertension (80-89)	92	32.51%	48	31.79%	44	33.33%
Stage-1 (90-99)	89	31.45%	47	31.13%	42	31.82%
Stage-2 (≥100)	46	16.25%	27	17.88%	19	14.39%
Smoker	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Ex-smoker	33	11.66%	32	21.19%	1	0.76%
No	187	66.08%	58	38.41%	129	97.73%
Yes	63	22.26%	61	40.40%	2	1.52%
Alcoholic	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Ex-Alcoholic	17	6.01%	17	11.26%	0	0%
No	175	61.84%	44	29.14%	131	99.24%
Yes	91	32.16%	90	59.60%	1	0.76%
Total cholesterol (mg/dl)	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Desirable (<200 mg/dl)	227	80.21%	126	83.44%	101	76.52%
Borderline high (200-239 mg/dl)	29	10.25%	15	9.93%	14	10.61%
High (≥240 mg/dl)	27	9.54%	10	6.62%	17	12.88%
HDL cholesterol (mg/dl)	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Low (<40 mg/dl)	217	76.68%	121	80.13%	96	72.73%
Normal (40-60 mg/dl)	66	23.32%	30	19.87%	36	27.27%
LDL cholesterol (mg/dl)	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Optimal (<100 mg/dl)	177	62.54%	101	66.89%	76	57.58%
Near or Above Optimal (100-129 mg/dl)	58	20.49%	30	19.87%	28	21.21%
Borderline high (130-159 mg/dl)	28	9.89%	12	7.95%	16	12.12%
High (160- 189 mg/dl)	10	3.53%	5	3.31%	5	3.79%
Very high (≥190 mg/dl)	10	3.53%	3	1.99%	7	5.30%
Diabetic?	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Yes	128	45.23%	63	41.72%	65	49.24%
No	155	54.77%	88	58.28%	67	50.76%
Blood pressure being treated with medicines	Frequency	Percent	Frequency	Percent	Frequency	Percent
Yes	138	48.76%	64	42.38%	73	55.30%
No	145	51.24%	87	57.62%	59	44.70%

The Lipid profile (total cholesterol, HDL, LDL) of the sample was mentioned in table 2. The total cholesterol levels were classified by ATP III classification. The prevalence of cholesterol levels in the whole sample is about desirable is 80.21% (227), followed by borderline high is 10.25% (29). HDL Cholesterol levels were classified into 3 categories; the prevalence of HDL in total sample is low is about 76.68% (217) and the standard value is approximately 23.32% (66). LDL Cholesterol levels are classified

into 5; the prevalence of LDL cholesterol in total sample is optimal; about 62.54% (177), near or above optimal, is 20.49% (58).

The prevalence of Diabetic mellitus in our study population is 128 (45.23%); out of that 63 were males and 65 were females. Patients who are on anti-hypertensive therapy are about 48.76% (138) was male 64 out of 151 and females are about 73 out of 132.

Table 2: Lipid profile of the study population

Total cholesterol (mg/dl)	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Desirable (<200 mg/dl)	227	80.21%	126	83.44%	101	76.52%
Borderline high (200-239 mg/dl)	29	10.25%	15	9.93%	14	10.61%
High (≥240 mg/dl)	27	9.54%	10	6.62%	17	12.88%
Total	N=283	100.00%	N1= 151	100.00%	N2=132	100.00%
HDL cholesterol (mg/dl)	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Low (<40 mg/dl)	217	76.68%	121	80.13%	96	72.73%
Normal (40-60 mg/dl)	66	23.32%	30	19.87%	36	27.27%
TOTAL	N=283	100.00%	N1=151	100.00%	N2=132	100.00%
LDL cholesterol (mg/dl)	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Optimal (<100 mg/dl)	177	62.54%	101	66.89%	76	57.58%
Near or Above Optimal (100-129 mg/dl)	58	20.49%	30	19.87%	28	21.21%
Borderline High (130-159 mg/dl)	28	9.89%	12	7.95%	16	12.12%
High (160-189 mg/dl)	10	3.53%	5	3.31%	5	3.79%
Very high (≥190 mg/dl)	10	3.53%	3	1.99%	7	5.30%
Total	N=283	100.00%	N1=151	100.00%	N2=132	100.00%

Framingham risk

According to Framingham scale the risk scores were categorized into low risk Intermediate risk, High risk. The prevalence of low risk identified is about 67.84% (192), followed by intermediate risk is about 19.08% (54), and high risk is about 13.07% (37) table 3.

The prevalence of low risk identified in men is about 45.03%, followed by intermediate risk is about 31.13%, and high risk is about 23.84%. The prevalence of low risk identified in women is about 93.94%, followed by intermediate risk is about 5.30%, and high risk is about 0.76%.

Statin and aspirin therapy

According ASCVD Risk estimator, aspirin and statin therapy should also considered. In our study, Patients who are on Statin therapy are about 25.80% (73) in which 44 were male (25.80%) and 29 are

female (29.14%). Aspirin therapy is about 70 (24.73%) in which 45 were male is (29.80%) and 25 were females (18.94%).

ASCVD risk

The prevalence of Prior, current 10 y risk percent has identified by using ASCVD risk estimator and ASCVD score was classified into low risk(<5%), Borderline risk (5-7.4%), Intermediate risk (7.5-19.9%), High Risk(>20%). The prevalence of risk reported in our study population was low risk 48.76% (138), borderline risk 13.07% (37), intermediate-risk 25.09% (71), high Risk is about 13.07% (37) table 4

According to ASCVD Risk estimation in our study, the majority of males have reported with low risk 36.42% (55), followed by Borderline risk in 10.60% (16), Intermediate risk 31.79% (48) and High Risk in 21.19%(32). In Female it was identified as low risk 62.88% (83), Borderline risk 15.91% (21), and Intermediate risk 17.42% (23) High Risk 3.79% (5).

Table 3: Risk estimation using Framingham risk estimator

Framingham risk category	Frequency	Percent	Men frequency	Percent	Women frequency	Percent
Low Risk (<10%)	192	67.84%	68	45.03%	124	93.94%
Intermediate risk (10%-19%)	54	19.08%	47	31.13%	7	5.30%
High Risk (≥20%)	37	13.07%	36	23.84%	1	0.76%
Total	N=283	100.00%	N1=151	100.00%	N2=132	100.00%

Table 4: Risk estimation using ASCVD risk estimator

Ascvd categorized risk	Frequency	Percent	Men frequency	Percent	Men frequency	Percent
Low Risk (<5%)	138	48.76%	55	36.42%	83	62.88%
Borderline Risk (5%-7.4%)	37	13.07%	16	10.60%	21	15.91%
Intermediate Risk (7.5-19.9%)	71	25.09%	48	31.79%	23	17.42%
High Risk (≥20%)	37	13.07%	32	21.19%	5	3.79%
Total	283	100.00%	151	100.00%	132	100.00%

DISCUSSION

Deaths from cardiovascular diseases (CVDs) in the world correspond to about 17.5 million people per year [7]. By 2030, cardiovascular disease (CVD) will account for 32.5% of all deaths; with coronary heart disease estimated to be the primary cause of death in 14.9% of males and 13.1% in females [8].

In our study the variables included estimating risk score and percentage are age, sex, smoking status, alcohol, diabetes status, lipid profile, and blood pressure values consistent with the study conducted by Radha Valaulikar *et al.*, which stated that age more than 60 y, smoking status and hypertension, were significantly associated with a 10-year cardiovascular risk of ≥20%. These variables are routinely available in patients receiving medical care, particularly in primary care unit as screening for hypertension, dyslipidemia, smoking status, and fasting hyperglycemia as a part of normal preventive health measures.

It was observed that in the studied male population, the frequency of hypertension was 39.56%, which is higher than the national average and that of other studies assessing cardiovascular risk [9, 10]. Our research shows that low risk of CVD-related outcome was higher 45.03% by FRS and 48.76%, by ASCVD risk estimator similar to the study conducted by A G Ghorpade *et al.* As, both these studies were conducted in rural areas furthermore studies are needed to confirm this result.

In this study, the prevalence of low risk identified in men and women is 45.03%, 36.42% and 93.94%, 62.88 respectively by this we can anticipate that women will suffer less than men from CVD over the next 10 y contrast to the study conducted by Nakhaie Mahmood Reza *et al.* where 10-year CVD risk was significantly higher among female than male. The other reasons of the low risk may be due to the lower prevalence of other significant risk factors like alcohol, smoking, diabetes and hypertension in female when compared to male. Also, the majority of the subjects, both male and female, showed desirable and optimal levels of lipid profile explains

that most of them follow an active lifestyle and are at low risk as a sedentary lifestyle is one of the significant risk factors of CVD [11].

In our study, both the risk estimator scores have shown almost the same results that the majority are at low risk. When comparing the two scales, we found that the two cover the most significant risk factors; however, ASCVD Risk has more restrictions due to the cutoff values for its variables (age and cholesterol value). Thus it excludes a considerable portion of the sample, which does not occur on the Framingham scale, in which it was possible to calculate the Risk of CVD development, especially for those with high blood pressure at the time of data collection. So the Framingham scale has better results to assess cardiac risk over 18 y old, and is most suitable in population studies.

Regardless of the scale chosen for the analysis of risk factors, an individual patient's awareness is essential for changing the habits that may bring harm to their health. Thus, monitoring of the patient by health professionals is of great importance, since as well as reducing the risk of CVDs, it can collaborate in the reception and integration of population into the health services.

CONCLUSION

In this study burden of CVD risk was relatively low, which was estimated by both Framingham scale and ASCVD Risk estimator. In spite the scale used, the frequent risk scoring of an individual helps us to identify the patients at high risk of Cardiovascular disorders and also helps in providing a rational means for taking decisions on intervening in a targeted way, thereby making best use of resources available to reduce cardiovascular risk.

LIMITATIONS

The primary limitation of our study is that the risk scores used are primarily intended for identifying high-risk population free of cardiovascular disease, not for patients who already have developed a hard CV event. As this is a cross-sectional study, we cannot

perform any causal correlations, thus conducting further studies with more populations for identification of cardiovascular events is necessary.

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Nil

AUTHORS CONTRIBUTIONS

Mahima Swaroopo has proposed the idea, developed the methodology and performed the analysis, interpretation of the obtained data. Reddy Praveen, Sk. LalSaheb, Sk. SaiRinnisha contributed the work in literature and data collection P. Saranya wrote the manuscript. Dr. Aakash Teja and Dr. Vijaykumar supervised and assisted the whole study.

CONFLICT OF INTERESTS

Declared none

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