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ASSESSMENT OF CARDIOVASCULAR DISEASE RISK BY USING FRAMINGHAM RISK EQUATION AMONGST THE RESIDENTS OF AHMEDABAD CITY

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ABSTRACT

Introduction: Coronary heart disease (CHD) risk estimation tools are a simple means of identifying those at high risk in a community and hence a potentially cost-effective strategy for CHD prevention in resource-poor countries.

Aim: To estimate 10 years risk for hard CHD among the urban population by using Framingham Heart Study produced sex-specific coronary heart disease (CHD) prediction functions and to find out correlates of CHD risk in study population.

Methodology: Present community based descriptive study was carried out in 1133 residents of south zone of Ahmedabad Municipal Corporation, Gujarat state (India), age 20 years or more without any previous history of CVD. Framingham Heart Study produced simple model with office based non laboratory predictors was used to assess for estimating 10 years risk of developing hard coronary heart disease .

Results: The median 10-year probability of CHD was 2.9% (5.6% for men and 1.8% for women). One third (33.4%) population above 30 years had CVD risk 20% or more. Males had significantly higher CVD risk as compared to females (20% of males & 4.5% of female had high CVD risk). Cardiovascular disease risk was also person with inadequate sleep & in executives. **Conclusion**- Higher risk in males & unskilled worker was mainly due to tobacco addiction while in executives it was mainly due to diabetes & obesity.

Key Words: Community based, CVD risk score, Framingham

INTRODUCTION

"Cardio-vascular diseases have become the `killer No.1' in India account for one fifth of the deaths due to changing life style in the modern globalised scenario." [1,2] India has not only the high burden of cardiovascular diseases (CVDs), but also the effects of these diseases on the productive workforce aged 35–65 years and can have devastating consequences for an individual, the family, and society. Prevention of these deaths in young people is a nation's moral responsibility. [3] High risk interventions can only be started once those at high risk have been identified.[4] Coronary heart disease (CHD) risk estimation tools are a simple means of identifying those at high risk in a community and hence a potentially cost-effective strategy for CHD prevention in resource-poor countries.

Risk estimates are also useful in raising population awareness of disease and to communicate knowledge about the risk to individuals and subgroups, and motivate people

to recommended lifestyle changes or therapies,[5] with this background current study was conducted to identify high risk individuals by using a Framingham risk equation [6] .

OBJECTIVES

The study was conducted to study prevalence of risk factors of Coronary Heart Disease (CHD) in urban community; to estimate 10 years risk for hard CHD among the urban population by using Framingham Heart Study produced sex-specific coronary heart disease (CHD) prediction functions; and to find out correlates of CHD risk in study population.

METHODOLOGY

Present descriptive study was carried out in the residents of south zone of Ahmedabad Municipal Corporation (AMC), Gujarat state, India. The south zone has 9 wards covering roughly 7 lacs population.

Sample Size and sampling technique: There are very few population based studies that give the prevalence of CVD in India. Sample size was decided on the basis of prevalence of Hypertension, as Hypertension is the most useful indicator for identifying an individual at a high risk of developing CVD[4]. Considering prevalence rate of hypertension 22.9%[7], amongst in person with age group 20 years and above and taking alternative proportion 22.2%, sample size comes to 1100 for 80% power. With 10% non responsive error sample size was 1210, by using minitab software. (URL: http://www.minitab.com)

South Zone was selected purposively. South Zone is divided into 9 administrative wards.

About 125- 130 people above 20 years of age from each ward from the community with at least 150 residents aged 20 years and more of either sex in the age group 20 years and above were selected by randomly.

Framingham risk assessment score is designed for the population without CVD at baseline examination. Therefore, apart from the person who did not give consent for study and the person who had any history CVD (Myocardial infarction, Angina, Stroke, Congestive Cardiac failure) were excluded from the study. During the study 77 people were found having past history of CVD and they were excluded from the

study. Therefore the actual sample size in our study was 1133 of either sex with age group 20 years and above.

The training was given to the third year M.B.B.S. students for filling the questionnaire and for anthropometric measurement and Blood Pressure measurement by sphygmomanometer. They interviewed study population personally by using pre designed questionnaire.

Cardio Vascular Risk assessment- Almost every risk score contains some laboratory test as a risk marker. Because of the limited resources available, an attempt to simplify risk prediction, Framingham equation used to estimate individual chances (risk) of developing hard Coronary Heart Disease in forthcoming 10 years. In this equation Myocardial Infarction, Stroke, Coronary death was considered as hard coronary events. It is a sex-specific risk assessment tool developed by Framingham Heart Study is a simple model based non laboratory predictors to for estimating 10 years risk of developing hard coronary heart disease (CHD) in an individual. [6] The Concordance statistics (C statistics) of this model for usefulness for predicting event was 0.831 in women and 0.783 in men versus 0.829 in women and 0.784 in men by laboratory based model.[8] Accuracy of this model was also studied by Gaziano et al [9] who evaluated that a method that uses non-laboratory-based risk factors predicted cardiovascular events as accurately as one that relied on laboratory-based values. This approach could simplify risk assessment in situations where laboratory testing is inconvenient or unavailable. This risk estimation model is based on age, treated and untreated systolic blood pressure, diabetes, smoking, Body Mass Index (BMI). This tool is designed to determine an individual's chances of developing cardiovascular disease (coronary heart disease or stroke) in adults aged 30 years and older who do not have CVD.

As CHD manifests almost 10 years earlier on an average in Indian subcontinent compared with the rest of the world[10], we applied CVD risk estimation model to subjects 20 years and above age group in both sexes in place of 30 years.

Obesity- WHO classification based on Body mass index (BMI) was used to classify to find out prevalence of obesity[11]. Person with BMI 25 or more was considered in overweight or obese category.

Hypertension- Hypertension was diagnosed based on personal history of High Blood Pressure and those who are on drug treatment for hypertension or if the current blood pressure reading was greater than140/90 mmHg (JNC-7 criteria)[12] which was confirmed by a second reading 24 hours apart. Blood pressure was recorded in the sitting position on the right arm to the nearest 2 mmHg using sphygmomanometer. Average of two reading was taken.

Diabetes- Known case of diabetes was considered for the prevalence.

As this study was non funded community based study; we could not afford the cost for screening of diabetes and cholesterol profile by blood examination. Therefore only known cases of diabetes were taken in to consideration.

During the survey, if any person was found to be suffering from uncontrolled blood pressure and if estimation score was more than 10% or the person was a tobacco user he/she was counseled for modification or treatment of the risk factors. This risk estimation model was also utilized to sensitize individual with high risk score to adopt lifestyle modification and appropriate health care for the management of risk factors.

Statistical Analysis was carried out of SPSS version11.5 trial version and Minitab software. In the Framingham calculation there is no quantification of risk below 1% and above 30%. Therefore, mean was calculated after excluding the subjects having risk below 1% and above 30%. The association of CVD risk with other variables was studied on the basis of median CVD risk. Pearson Chi square test of significance was used to compare sub groups.

RESULTS

The total of 1133 people was studied. Data collection was done by house to house survey. In some of the houses, male family members could not be interviewed because they were at their work place at the time of interview. Therefore, 58.2% (n=659) of study population was female. While as per NHFS India 2005-06 data for Gujarat urban[13] showed 49.1% of population above 20 years of age was female. In our study average age of female population was 38.6 years (SD 12.9 years) and that of male population was 40.6 years (SD 14.9 years). The age difference between male and female population was

statistically not significant (P value >0.05) while more than 60% of population was between 20 and 45 years age and nearly 80% of population was vegetarian.

Table 1- Sex specific adjusted standardized prevalence Rate

Sex	HT*	History of DM#	BMI >25 kg/m²
Female (n=659)	35.9%	10.9%	44.1%
Male (n=474)	37.7%	9.7%	48.1%
Total (n=1133)	**36.8%**	**10.3%**	**46.1%**
P value	>0.05	>0.05	<0.05$

*Hypertension; # Diabetes Mellitus; $Statistically significant

Overall prevalence of tobacco consumption in any form was 20.8% (n=236). The addictions of tobacco chewing/snuffing and smoking were found in 17.4% and 7.1% of population respectively. Prevalence of chewing was higher than smoking in males and females both. Except one, none of the female was smoker. 42 males had habit of chewing and smoking both. There were 6 persons in our study had habit of snuffing tobacco. Prevalence of tobacco addiction was significantly high in males (28.3%) than females (5.3%). (z value 10.3, p<0.0001). Prevalence of tobacco consumption was less as compared to previous studies in Gujarat and India, but like our findings in all studies habit of tobacco in females was significantly less than males[13]. According to NFHS-III, in India, 55.8% male, 10.8% female in the age group of 12 to-60 years were consuming tobacco.[14]

Table 1 shows sex adjusted standardized prevalence of risk factors among population 20 years and above using the NHFS India 2005-06 data for Gujarat urban.[13] This was calculated by applying age & sex specific prevalence of Hypertension, H/o diabetes mellitus and overweight & obese (>BMI 25kg/m²) found in our study to age & sex specific population as per NHFS India 2005-06 data for Gujarat urban (standard population). Thereafter total prevalence was calculated.

Risk of Cardiovascular Disease

In the Framingham calculation there is no quantification of risk below 1% and above 30%, the association of CVD risk with other variables was studied on the basis of median CVD risk.

Table 2: Distribution according to CVD risk Category

Variable	CVD Risk category			Total	P Value
	Low	Intermediate	High		
Sex					
Female	570 (86.5)	59 (9.0)	30 (4.5)	659	X^2=79.5, d.f=2. P<0.0001
Male	311 (65.6)	73 (15.4)	90 (20)	474	
Diet					
Mixed	177 (80.1)	24 (10.9)	20 (9)	221	X^2=0.96, d.f.=2 P>0.05
Vegetarian	704 (77.2)	108 (11.8)	100 (11)	912	
Sleep					
<6 hours	90 (61.7)	25 (17.1)	31 (21.2)	146	X^2=27.8, d.f=2. P<0.0001
> 6 hours	791 (80.2)	107 (10.8)	89 (9)	987	
Total	**881 (77.7)**	**132 (11.7)**	**120 (10.6)**	**1133**	

Figures in parenthesis indicate percentage

Table-3: Correlates of Median CVD Risk in different occupational groups (n=1130[#])

Occupation	Executive	Clerical	Semi skilled worker	Unskilled worker	House wife	Retired	Students
n	130	106	363	123	297	40	71
Median CVD risk (%)	**9.5**	**6.7**	**1.8**	**3.9**	**3.9**	**17.1**	**2.3**
Median							
Age (years)	45	41.5	34	36	42	56.5	21
S.B.P*	126	123	120	124	122	130	122
D.B.P.*	80	80	80	80	80	85	82
Prevalence %							
Sleep < 6 hours	14.6	12.3	8.8	18.7	17.2	15	2.8
DM	13.8	9.4	2.5	7.3	8.8	10	2.8
Tobacco chewing	14.6	18.9	8.5	35	16.2	17.5	1.4
smoking	8.5	7.5	3	19.5	0.004	15	1.4
alcohol	2.3	0	0.6	0.8	0.7	2.5	0
BMI>25	40	44.3	21.5	23.6	35	50	32.4

3 unemployed persons were excluded; *SBP- Systolic Blood Pressure, DBP-Diastolic Blood Pressure

Median CVD risk in total population was 2.9%, that means in population risk of development of cardiovascular disease in 10 years was 2.9%.The absolute cardiovascular disease (CVD) risk percentage over 10 years was classified as low risk (< 10%), intermediate risk (10-20%), and high risk (> 20%).[15] In our study 11.7% and 10.6% population had intermediate and high CVD risk respectively.

10.4% (9.6% to 11.1%) for men and 5.3% (4.9% to 5.7%) for women using the Framingham equation. [16] While in a study amongst the person with positive family history of CVD (genetic proband) from Mumbai and Bangluru city (>18 years age), S Kanjilal et al reported 5.32% at high risk and 14.85% at intermediate risk for CVD in the forthcoming 10 years by the Framingham score[17].
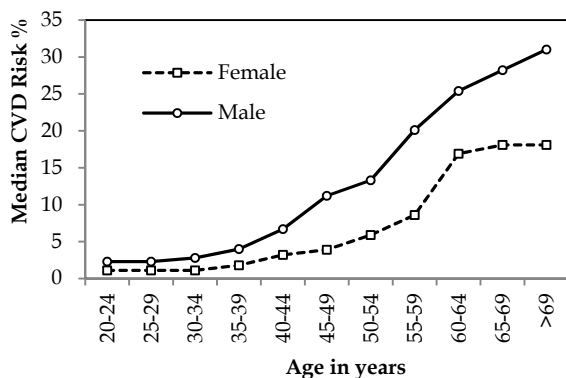

Figure 1: Median CVD Risk according to Age and Sex

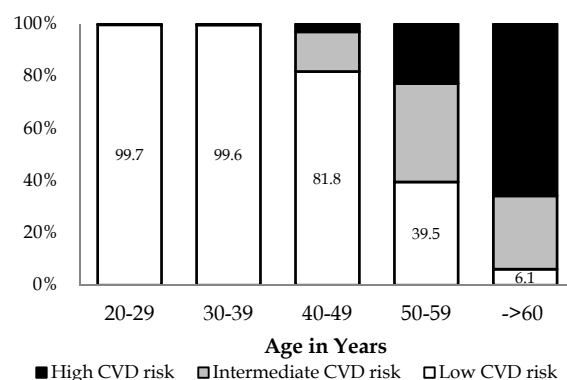In Indian rural population the mean 10-year probability of CHD for adults >30 years was

Figure 2: Age vs CVD risk categories

As shown in fig.1. , amongst female population, age wise increase was maximum between 40 and 69 years after which score remained same, but

increase was almost double between 55-59 years and 60-64 years. Age wise increase in CVD risk amongst male was similar as female upto the age group of 30-34 years but after that increase was very sharp and reached highest level (>30%) in male aged 69 years or more. The difference of median CVD risk score between 2 sexes- up to age group of 34 years was 1.2 % to 1.7%. But the observed CVD risk difference between men and women increased from 2.2% in 35-39 years age group to more than 12% in 70 years or more.

DISCUSSION

Out of the all risk factors for CVD, obesity was most prevalent accounting for 46.1% of all subjects. 10.3% of study population was the known case of Diabetes. V. Mohan et al reported age-adjusted prevalence of major risk factors for CVD was diabetes 11.9%, hypertension 25.4%, and overweight 60.2% amongst an industrial population in Chennai, using the 2001 Census of India. [15]

Age and sex wise trend of median CVD risk depicted in fig.1 indicates that age is one of the important non modifiable risk factor for CVD [4], older the age, higher is the CVD risk. The median 10-year probability of CHD for adults >20 years was 5.6% for men and 1.8% for women. This may be due to higher prevalence of smoking (15%) in males. Out of total 120 high risk subjects 75% were males and 25% were females (table 2), while in a study from Mumbai & Bangluru city[17], of the high risk subjects 61% were males and 39% were females. In the same study more women than men are found to be at low risk for CVD by all the risk scoring tools.[17]

Median CVD risk among the tobacco chewer/ snuffer was 4.0% as compared to the persons with no habit of tobacco consumption in any form, 2.9%.

CVD risk was significantly higher in the persons with inadequate sleep than person with adequate sleep, $X^2=27.8$, d.f=2 P <0.05. Inadequate sleep was considered when person had slept less than 6 hours (total day and night) for more than 15 days in last 2 months. The information regarding the sleep was totally subjective. Type of diet did not have any effect on CVD, as difference in proportion of people with high risk category is not significant, $X^2=0.96$, d.f.=2 P>0.05.

The Framingham equation applied in present study predicts the individual's probability of CVD events in forthcoming 10 years on the bases of 6 parameters namely age, sex, habit of smoking, Body Mass Index, Presence or absence of Diabetes, Systolic blood pressure with or without treatment. Table 3 was an effort to analyze/explore which risk factor/s especially parameter/s used for Framingham equation was more prevalent amongst the various occupational groups with high CVD risk. Unemployed persons were very few in numbers (n=3), analysis of CVD risk factor & CVD risk score was carried out after excluding them. As it was observed in the study that the median CVD risk was highest in retired persons (17.1%) followed by executives (9.5%) and clerical category (6.7%). Higher CVD risk in retired persons may be mainly due to age (median age 56.5 years) and age related risk factor like higher blood pressure, obesity. While among the executive and clerical person may be due to higher prevalence of Diabetes and overweight/obesity (table- 3)

Although median age and prevalence of overweight among house wives was higher than unskilled workers, their median CVD risk was lower. The higher median CVD risk in unskilled worker may be due to higher prevalence of tobacco addiction (any form). Lower CVD risk was found in semiskilled worker (1.8%) followed by students (2.3%) which may be due to their young age.

CONCLUSION

In present study 10.6% of population had CVD risk >10% and in females CVD risk score doubled after 59 years of age. Significantly high number of males (19% of male) had CVD risk >10% than females (4.6% of females) which was mainly due to tobacco addiction. The CVD risk was also high amongst the retired person because of aging & age related risk factors while high risk in executives was mainly due to diabetes & obesity.

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