

Original Research Article

Predicting 10-year cardiovascular risk using WHO/ISH risk prediction chart among urban population in Salem

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ABSTRACT

Background: Coronary vascular disease (CVD) risk estimation tools are a simple means of identifying those at high risk in a community and hence a potentially cost-effective strategy for CVD prevention in resource-poor countries. The WHO /ISH risk prediction charts provide approximate estimates of cardiovascular disease risk in people who do not have established coronary heart disease, stroke or other atherosclerotic disease.

Methods: A total of 280 subjects between 40 to 70 years of age were included in this cross sectional study. Eligible households was selected randomly (every 5th household) for the interview using systematic random sampling. Age, gender, smoking status, systolic blood pressure, presence or absence of diabetes and total serum cholesterol were used to compute the total CVD risk using WHO/ISH CVD risk prediction chart. The chart stratify an individual into low (<10%), moderate (10% to <20%), high (20% to <30%), and very high (>30%) risk groups.

Results: Moderate and high CVD risk were 12.14% and 7.5% respectively. Of total study participants, 2.5% had very high risk (>40%). High risk (binge drinking) alcohol drinkers ($p=0.04$) and abdominal obesity ($p=0.0001$) were significantly associated with higher CVD risk. Higher prevalence of behavioral risk factors was also reported in our study population.

Conclusions: A large proportion of the population is at moderate and high cardiovascular risk. Risk stratification and identification of individuals with a high risk for CHD who could potentially benefit from intensive primary prevention efforts are critically important in reducing the burden of CVD in India.

Keywords: Cardiovascular diseases, WHO/ISH chart, Risk prediction

INTRODUCTION

Cardiovascular diseases are the largest cause of mortality, accounting for around half of all deaths resulting from NCDs. Overall, CVDs accounted for around one-fourth of all deaths in India. CVDs are expected to be the fastest growing chronic illnesses, growing at 9.2% annually, and accounting for the second largest number of NCD patients after mental illnesses. A more worrying fact is that the incidences of CVDs have gone up significantly for people between the ages 25 and 69 to 24.8%, which means we are losing more productive people to these diseases.¹

Practical and feasible approaches are needed to prevent people from getting heart attacks and strokes. Currently individuals are often given drug treatment based on the presence or absence of single cardiovascular risk factors, such as high blood pressure or high blood lipids. Although this approach appears simple, it can result in committing a patient with only a small cardiovascular risk to many years of drug therapy or, conversely, neglecting to treat those with an overall higher cardiovascular risk. Risk stratification and identification of individuals with a high risk for CHD who could potentially benefit from intensive primary prevention

efforts are critically important in reducing the burden of CVD in India.

Coronary vascular disease (CVD) risk estimation tools are a simple means of identifying those at high risk in a community and hence a potentially cost-effective strategy for CVD prevention in resource-poor countries. The WHO /ISH risk prediction charts provide approximate estimates of cardiovascular disease risk in people who do not have established coronary heart disease, stroke or other atherosclerotic disease.² The interval of 10 years for risk estimation was chosen as 10-year risk identifies those patients most likely to benefit from drug therapy in the near term, thus improving cost effectiveness and safety of therapy.² Very few studies have been conducted in India to estimate the cardiovascular risk using WHO/ISH risk prediction charts. This study was undertaken to estimate 10 year cardiovascular risk among urban population using WHO/ISH risk prediction charts.

Aim

The objective of the study was to estimate 10 year risk of a cardiovascular event among urban population in Salem district by using WHO/ISH risk prediction charts.

METHODS

The cross sectional study was conducted in the urban field practicing area of our medical college hospital for a period of three months from March 2018 to June 2018. The study was approved by the institutional ethics committee. Using a prevalence of 20 percent high cardiovascular risk and absolute precision of 5 percent with 95 percent confidence, the required sample size was estimated to be 280.³ Informed consent was obtained from the study participants. Eligible households was selected randomly (every 5th household) for the interview using systematic random sampling. This was followed by selection of one eligible respondent from each of the selected households. In case a household had more than one eligible respondent, one respondent was selected randomly. The reference population for the study was adults aged more than 40 years. All patients with established coronary heart disease and stroke were excluded from the study. The study participants were interviewed with the help of a structured pretested questionnaire. The three sections of the questionnaire included demographic variables, behavioral risk factors, physical measurements and bio- chemical examination. The behavioral risk factors explored were tobacco use, alcohol consumption, fruits and vegetable intake and physical activity. Physical measurements included waist circumference and blood pressure measurement using the standardized techniques. Fasting blood specimen was collected to measure total blood cholesterol and fasting blood glucose level.

Definition of variables

Smokers: All current smokers and those who quit smoking less than 1 year before the assessment are considered smokers for assessing cardiovascular risk.

Current drinker: Those who consumed alcohol in the year preceding the Survey but ≤ 5 (for women ≤ 4) standard drinks on any occasion.

High risk drinker (binge drinker): Those who drink more than 5 (for women 4) standard drinks on any single day.

Standard servings of fruits and vegetables: 1 servings is equivalent to 1 orange or apple or mango or banana or 3 tablespoons of cooked vegetables

Insufficient physical activity: Insufficient physical activity can be defined as less than 5times 30 minutes of moderate activity per week, or less than 3 times 20 minutes of vigorous activity per week.

Examples of moderate intensity physical activity includes walking briskly, gardening, dancing, swimming, bicycling, volleyball, scrubbing floors, carrying water from river or well, manual grinding or pounding of cereals, manual washing of clothes.

Vigorous intensity activity includes jogging, running, high impact aerobic exercise, rowing, carrying or lifting heavy loads, digging or construction work, football and cycling uphill.

Abdominal obesity: Waist circumference more than 90 cm in males and more than 80 cm in females.

WHO/ISH risk prediction chart

WHO/ISH chart for SEAR (D) of WHO epidemiological sub-region was used to estimate the total 10-year risk of CVD of all participants.² Age, gender, smoking status, systolic blood pressure, presence or absence of diabetes and total serum cholesterol in mill mole/liter (mmol/l) were used to compute the total CVD risk. The chart stratify an individual into low (<10%), moderate (10% to <20%), high (20% to <30%), and very high (>30%) risk groups.

The data were entered and analyzed using the SPSS software package version 18.0. Chi-square test was performed to find the association between the risk factors (alcohol use, physical inactivity, insufficient fruits & vegetable intake and abdominal obesity) and cardiovascular risk. Odds ratio was calculated with 95% confidence interval. A 'p' value of less than 0.05 was considered statistically significant. Confidentiality was maintained in the process of data collection and analysis.

RESULTS

A total of 280 subjects between 40 to 70 years of age were included in the study. Majority of the study subjects were females (55.71%). The percentage of respondents

with no formal education was 15.71%. The majority of the respondents (37.14%) had completed middle school. This was followed by those who had completed primary school (24.28%).

Table 1: Characteristics of the study population.

Variables	Males (n=124) N (%)	Females (n=156) N (%)	Total (n=280) N (%)	P value
1. Age in years				
40-49	41 (33.06)	55 (35.26)	96 (34.28)	0.03
50-59	53 (42.74)	76 (48.72)	129 (46.07)	
60-69	30 (24.20)	80 (51.22)	110 (39.28)	
2. Level of education				
No formal schooling	16 (12.90)	18 (11.54)	44 (15.71)	0.04
Primary school completed	33 (26.61)	35 (22.43)	68 (24.28)	
Middle school completed	39 (31.45)	75 (48.07)	104 (37.14)	
High school completed	28 (22.59)	24 (15.38)	52 (18.57)	
Degree/diploma	8 (6.45)	4 (2.56)	12 (4.28)	
3. Occupation				
Sedentary	52 (41.93)	96 (61.54)	148 (52.9)	0.0005
Moderate	32 (25.80)	44 (28.20)	76 (27.3)	
Heavy	9 (7.25)	2 (1.28)	11 (3.6)	
Unemployed/Retired	31 (25.00)	14 (8.97)	45 (16.3)	
4. Socio economic status				
Upper class	8 (6.45)	6 (3.85)	14 (5.00)	0.433
Upper middle	32 (25.80)	55 (35.26)	87 (31.07)	
Lower middle	57 (45.97)	61 (39.10)	118 (42.14)	
Upper lower	17 (13.70)	20 (12.82)	37 (13.21)	
Lower	10 (8.06)	14 (8.97)	24 (8.57)	
5. Smoker				
Yes	19 (15.32)	2 (1.28)	21 (7.50)	0.00001
No	105 (84.68)	154 (98.72)	259 (92.50)	
6. Alcohol use				
Life time abstainer	83 (66.93)	156 (100.00)	239 (85.36)	-
Current drinker	28 (22.58)	0 (0.00)	28 (10.00)	
High risk drinker	13 (4.64)	0 (0.00)	13 (4.64)	
7. Physical activity				
Yes	59 (47.58)	93 (59.66)	122 (43.57)	0.04
No	65 (52.42)	63 (40.34)	158 (56.43)	
8. Abdominal obesity				
Yes	26 (20.97)	44 (28.20)	70 (25.00)	0.16
No	98 (79.03)	112 (71.80)	210 (75.00)	
9. Insufficient fruits & vegetable intake				
Yes	117 (94.35)	149 (95.51)	266 (95.00)	0.87
No	6 (5.65)	8 (4.49)	14 (5.00)	
10. Hypertension				
Yes	26 (20.96)	23 (14.74)	49 (17.50)	0.17
No	98 (79.04)	133 (85.26)	231 (82.50)	
11. Diabetes				
Yes	14 (11.29)	28 (17.99)	42 (15.00)	0.12
No	110 (88.71)	128 (82.01)	238 (85.00)	
12. Serum cholesterol				
>200 mg/dl	18 (14.51)	20 (12.82)	38 (13.50)	0.68
<200 mg/dl	106 (85.49)	136 (87.18)	242 (86.42)	

*Figure in parentheses indicates percentage; P value derived by applying Chi-square test

Table 2: Distribution of the study population into low, moderate and high CVD risk as per socio demographic variables.

Variable	Low risk n=225 N (%)	Moderate risk n=34 N (%)	High risk n=21 N (%)	Total N (%)
1. Age in years				
40-49	76 (33.77)	9 (26.47)	1 (4.76)	96 (34.28)
50-59	92 (40.88)	14 (41.17)	8 (38.09)	129 (46.07)
60-69	57 (25.33)	11 (32.35)	12 (57.14)	110 (39.28)
2. Gender				
Male	93 (41.33)	20 (58.82)	11 (52.38)	124 (44.28)
Female	132 (58.67)	14 (41.18)	10 (47.62)	156 (55.71)
3. Level of education				
No formal schooling	34 (15.11)	7 (20.59)	3 (14.29)	44 (15.71)
Primary school completed	57 (25.33)	6 (17.65)	5 (23.81)	68 (24.28)
Middle school completed	86 (38.22)	9 (26.47)	9 (42.86)	104 (37.14)
High school completed	38 (16.88)	10 (29.41)	4 (19.05)	52 (18.57)
Degree/diploma	10 (4.44)	2 (5.88)	0 (0.00)	12 (4.28)
4. Occupation				
Sedentary	124 (55.11)	15 (44.12)	9 (42.86)	148 (52.9)
Moderate	60 (26.66)	12 (35.29)	4 (19.05)	76 (27.3)
Heavy	10 (4.44)	1 (2.94)	0 (0.00)	11 (3.6)
Unemployed/Retired	31 (13.77)	6 (17.65)	8 (38.09)	45 (16.3)
5. Socio economic status				
Upper class	8 (3.55)	4 (11.77)	2 (9.52)	14 (5.00)
Upper middle	76 (33.77)	5 (14.70)	6 (28.57)	87 (31.07)
Lower middle	95 (42.22)	14 (41.18)	9 (42.86)	118 (42.14)
Upper lower	27 (12.00)	7 (20.59)	3 (14.26)	37 (13.21)
Lower	19 (8.44)	4 (11.76)	1 (4.76)	24 (8.57)

*Figure in parentheses indicates percentage.

Table 3: Risk variables (except variables used in WHO/ISH prediction chart) associated with cardio vascular disease.

Variables	CVD risk <10% n=225 N (%)	CVD risk >10% n=55 N (%)	Total	P value	OR (95% CI)
1. Alcohol use					
Life time abstainer	195 (86.66)	44 (80.0)	239 (85.36)	0.04	Ref.
Current drinker	22 (9.77)	6 (10.90)	28 (10.00)		1.20(0.46-3.15)
High risk drinker	8 (3.55)	5 (9.09)	13 (4.64)		7.76(5.62-10.21)
2. Physical activity					
Sufficient	95 (42.22)	27 (49.09)	122 (43.57)	0.35	Ref
Insufficient	130 (57.77)	28 (50.90)	158 (56.43)		0.75 (0.41-1.3)
3. Abdominal obesity					
No	176 (78.22)	44 (80.00)	210 (75.00)	0.0001	Ref
Yes	49 (21.78)	21 (20.00)	70 (25.00)		1.71(1.08-2.48)
4. Fruits & vegetable intake					
Sufficient	11 (4.88)	3 (5.45)	14 (5.00)	0.86	Ref
Insufficient	214 (95.12)	52 (94.55)	266 (95.00)		0.89(0.23-3.30)

*Figures in parentheses indicates percentage; P value derived by applying Chi-square test.

Participants were classified into sedentary, moderate and heavy based on their occupational activities. Majority of the study population i.e. 52.9% (148) were involved in

sedentary occupation activity, in which the female constituted the maximum number. Among women, home-makers comprised the highest percentage of those

engaged in unpaid work. Majority of the study population belonged to the lower middle (42.14%) followed by upper middle class (31.07%). Upper class constituted 5% and lower socioeconomic class constituted 9% of the total study population.

The survey questionnaire asked questions about certain life style of respondents which could be considered as the behavioral risk factors for cardiovascular diseases. The prevalence of smoking was more among men than among women. 7.50% of the respondents were current smokers. Most of the female respondents (98.7%) did not smoke. The mean age at which smokers started smoking was 19.3 (CI 16.2-22.4) and the mean duration of smoking years among daily smokers was 8.5 (CI 4.1-14.6). Nearly 66.93% of the male respondents were lifetime abstainers for alcohol drinking. On the other hand all the female respondents were lifetime abstainers. The respondents, who were current drinker, were also asked about their behaviour in terms of the number of days and number of drinks per occasion. Nearly 32% of male drinkers drank alcohol daily, while about 26% drank less than once a month. Nearly 4.64% of the males were high risk (binge) drinkers.

The total physical activity of the respondents is classified under two categories sufficient and insufficient on the basis of duration for which they perform physical activities of varying intensity.

The level of physical activity was insufficient among 48.36% of males and 76.22% of females. Females were more inactive than males. During survey questions asked about the average number of servings of fruits and vegetables consumed per day. On an average, nearly 95% of all respondents consumed less than five servings of fruit and/or vegetables.

Overall 25% of the respondents were classified as having abdominal obesity. There is no significant difference between males and females in the prevalence of abdominal obesity. Percentage of respondents with raised blood pressure (SBP \geq 140 and/or DBP \geq 90 mmHg) and currently on medication for raised blood pressure was 17.50% . The percentage of men with high blood pressure or on medication was higher than that of females. Percentage of respondents with diabetes was 15%.

Total 10-year CVD risk using WHO/ISH chart

The majority of people had low (<10%) 10-year CVD risk 80.35%. Moderate and high risks were 12.14% and 7.5% respectively. More male (16.12%) than female (8.97%) had moderate risk. Likewise, more men (4.5%) than women (4.2%) were at high CVD risk. Of total study participants, 7 (2.5%) had very high risk.

DISCUSSION

This study found that large proportion of study participants had moderate to high risk (19.6%) which was

consistent with the findings reported in studies conducted in similar settings.^{4,6}

Ghorpade reported Seventeen percent of the study participants having moderate to high risk for the occurrence of cardiovascular events by using WHO/ISH risk prediction charts in a study done in rural population of South India.⁵ In contrast a study conducted in rural Punjab to estimate cardiovascular risk by Vikramaditya et al reported 19.1% of the study population having moderate risk(10-20%) and 16% of the population having high risk (>20%) using WHO/ISH risk prediction chart.⁷ Out of total medium and high CVD risk individuals, 56.36% were males. This may be due to higher prevalence of smoking (15.3%) in males. Similar trend was reported in a study conducted in Mumbai and Bengaluru.⁸ In the same study more women than men are found to be at low risk for CVD by all the risk scoring tools.

Risk variables like alcohol use, abdominal obesity, physical inactivity and insufficient fruits and vegetable intake were analyzed for their association with Cardiovascular disease. These variables were not used in the WHO/ISH risk prediction chart for predicting cardiovascular risk.

Study result showed binge drinkers (OR 7.76 95% C.I.5.62-10.21) had a higher cardiovascular risk compared with life time abstainers, and it was statistically significant (p=0.04).

People who drink heavily have a high mortality from all causes and cardiovascular disease, including sudden death and haemorrhagic stroke. In addition, they may suffer from psychological, social and other medical problems related to high alcohol consumption.⁹ However, uncertainty remains regarding any benefits or risks attributable to light-to-moderate alcohol intake on the risk of cardiovascular disease. Conflicting studies have noted beneficial unassociated and deleterious effect of light-to-moderate alcohol intake on the risk of cardiovascular disease.¹⁰⁻¹² It is also important to note that alcohol consumption is associated with a wide range of medical and social problems, including road traffic injuries. Some individuals are also at risk of progression to problem drinking. Other risks associated with moderate drinking include haemorrhagic stroke, large bowel cancer, and female breast cancer. Consequently, from both the public health and clinical viewpoints, there is no merit in promoting alcohol consumption as a preventive strategy.

In our study, the level of physical activity was insufficient among 56.43% of respondents. However, in our study physical inactivity was not significantly associated with cardiovascular disease (p=0.35). Evidence gathered from an urban area of Faridabad, a district in India, provided an indicative profile of the current patterns of physical activity in the country. A very high level of physical inactivity was recorded: males

were more active than females but overall 83.3% of respondents were inactive.¹³ Overall, the evidence points to the benefit of continued regular moderate physical activity, which does not need to be strenuous or prolonged, and can include daily leisure activities, such as walking or gardening.

On an average, nearly 95% of the study respondents consumed less than the recommended five servings of fruit and/or vegetables per day. Fruits & vegetable intake not significantly associated ($p=0.35$) with cardiovascular disease in our study. A few surveys reported data on fruit and vegetable consumption among Indians. The percentage of respondents consumed less than five servings of fruits and vegetables per day ranged from a low 76% in Maharashtra to high 99% in Tamil Nadu. The mean number of serving of fruits and vegetables ranged between 1.4 in Tamil Nadu to 2.6 in Mizoram, which was much lesser than the recommended number of 5 servings per day.¹⁴

Study result showed abdominal obesity (OR1.71 95% C.I.1.08-2.48) had a higher cardiovascular risk compared with normal individuals, and was statistically significant ($p=0.0001$).Waist circumference (WC) was the main variable used as a measure of central obesity as it is much simpler and more practical to use and because it associates more strongly with cardio-vascular diseases and is a better predictor of future risk of metabolic diseases.¹⁵

The risk estimates provide approximate estimates of cardiovascular disease (CVD) risk in people who do not have established coronary heart disease, stroke or other atherosclerotic disease. They are useful to help identify those at high cardiovascular risk, and to motivate patients, particularly to change behaviour and, when appropriate, to take antihypertensive, lipid-lowering drugs and aspirin. Recent research suggests that compared with the vertical treatment approach, adopting pharmaceutical treatment strategies based on the total CVD risk assessment approach offers considerable savings.^{16,17} The 2007 WHO guidelines for primary prevention of CVD recommend the second approach by targeting limited healthcare resources most cost-effectively at high-risk groups to prevent CVD.¹⁸

CVD risk may be higher than indicated by the charts if the individual was already on antihypertensive therapy, premature menopause, obesity, sedentary lifestyle or family history of premature coronary heart disease, sedentary lifestyle, low HDL, socio economic deprivation.

CONCLUSION

A large proportion of the population is at moderate and high cardiovascular risk. Risk stratification and identification of individuals with a high risk for CHD who could potentially benefit from intensive primary

prevention efforts are critically important in reducing the burden of CVD in India. Thus, the risk prediction charts will improve the effectiveness of cardiovascular risk management, even in settings which do not have sophisticated technology.

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REFERENCES

1. Cardiovascular diseases in India; Challenges and way ahead, International Heart Protection Summit September 2011, www.deloitte.com/in. Accessed on 25 September 2017.
2. WHO/ISH RISK prediction chart for 14 epidemiological regions. Available at: www.who.int. Accessed on 25 September 2017.
3. Parikh S, Patel M, Tiwari H, Bala DV, Joshi B. Assessment of Cardiovascular Disease Risk by using Framingham Risk Equation amongst the Residents of Ahmedabad City. *Natl J Community Med*. 2013;4(3):392-7.
4. Khanal MK, Ahmed MS, Moniruzzaman M, Banik PC, Dhungana RR, Bhandari P, et al. Total cardiovascular risk for next 10 years among rural population of Nepal using WHO/ISH risk prediction chart. *BMC Res Notes*. 2017;10(1):120.
5. Ghorpade AG, Shrivastava SR, Kar SS, Sarkar S, Majgi SM, Roy G. Estimation of the cardiovascular risk using World Health Organization/International Society of Hypertension (WHO/ISH) risk prediction charts in a rural population of South India. *Int J Health Policy Manag*. 2015;4(8):531-6.
6. Parikh S, Patel M, Tiwari H, Bala DV, Joshi B. Assessment of Cardiovascular Disease Risk by using Framingham Risk Equation amongst the Residents of Ahmedabad City. *Natl J Community Med*. 2013;4(3):392-7.
7. Vikramaditya B, Satija M, Chaudhary A, Sharma S, Girdhar S, Bansal P. A community based cross sectional study to estimate total cardiovascular risk in rural Punjab *Int J Community Med Public Health*. 2017;4(4):1295-302.
8. Kanjilal S, Rao VS, Mukherjee M, Natesha BK, Renuka KS, Sibi K, et al. Application of cardiovascular disease risk prediction models and the relevance of novel biomarkers to risk stratification in Asian Indians. *Vasc Health Risk Manag*. 2008;4(1):199-211.
9. Marmot MG. Alcohol and coronary heart disease. *Internal J Epidemiol*. 2001;30(4):724-9.
10. Thadhani R, Camargo CA Jr, Stampfer MJ, Curhan GC, Willett WC, Rimm EB. Prospective study of moderate alcohol consumption and risk of hypertension in young women. *Arch Internal Med*. 2002;162:569-74.

11. Stranges S, Wu T, Dorn JM, Freudenheim JL, Muti P, Farinero E, et al. Relationship of alcohol drinking pattern to risk of hypertension: a population-based study. *Hypertension*. 2004;44:813–9.
12. Moore RD, Levine DM, Southard J, Entwisle G, Shapiro S. Alcohol consumption and blood pressure in the 1982 Maryland Hypertension Survey. *Am J Hypertens*. 1990;3:1–7.
13. WHO global strategy on diet, physical activity and health: South-East Asia regional consultation meeting report; World Health Organization Geneva; 2003: 76-78.
14. National Institute of Medical Statistics, Indian Council of Medical Research (ICMR), 2009, IDSP Non-Communicable Disease Risk Factors Survey, Phase-I States of India, 2007-08. National Institute of Medical Statistics and Division of Non-Communicable Diseases, Indian Council of Medical Research, New Delhi, India.
15. Ford ES, Mokdad AH, Giles WH. Trends in waist circumference among US adults. *Obesity Res*. 2003;11:1223-31.
16. Mendis S, Lindholm LH, Anderson SG, Alwan A, Koju R, Onwubere BJC, et al. Total cardiovascular risk approach to improve efficiency of cardiovascular prevention in resource constrain settings. *J Clin Epidemiol*. 2011;64(12):1451-62.
17. Ndindjock R, Gedeon J, Mendis S, Paccaud F, Bovet P. Potential impact of single-risk-factor versus total risk management for the prevention of cardiovascular events in Seychelles. *Bull World Health Organ*. 2011;89:286-95.
18. World Health Organization: Prevention of cardiovascular disease: Guidelines for assessment and management of cardiovascular risk. Geneva: World Health Organization; 2007, www.who.int. Accessed on 25 September 2017.

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