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Cardiovascular disease risk assessment in a rural population (>40 years)

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***Abstract*---**Context: Cardiovascular diseases (CVDs) are the most common cause of death worldwide, although low- and middle-income countries are affected disproportionately. By 2020, it is estimated that there will be around 25 million deaths from Cardiovascular diseases globally,and out of that 19 million would be from middle- and low-income countries. Aims: The aim of this study was to estimate the 10-year risk of cardiovascular events among adults aged ≥40 years in a rural population of Meerut district using the World Health Organization (WHO)/International Society of Hypertension (ISH) risk prediction charts for SEAR-D region. Settings and Design: Community based cross-sectional study, which was conducted from january 2021 to december 2021, in the rural areas of Meerut district. Methods and Material: Study was conducted on 397 subjects who were aged ≥40 years. Two sets of the WHO/ISH risk prediction charts, with and without cholesterol, for WHO SEAR-D region were used in this study. Statistical analysis used: SPSS, version 23 was used for data analysis. Results: By using the risk assessment tools, with and without cholesterol, 78.5 and 76.8%, of the population being studied were in the 10-year cardiovascular risk category with <10% risk, whereas 11.2 and 10.4%, were in the cardiovascular risk category of ≥20% risk. The risk categories were found to be concordant in 86.3% of the

population. Conclusions: The risk prediction charts by WHO/ISH can be used at low-cost resource setting as a tool to predict Cardiovascular disease risk among asymptomatic individuals, therefore helping in early diagnosis and prevention of cardiovascular diseases in resource-scarce settings.

***Keywords*---**cardiovascular disease, noncommunicable disease, risk prediction, rural population, WHO/ISH risk prediction chart.

Introduction

Cardiovascular disease (CVD) is the most common cause of death worldwide, although, low- and middle-income countries are affected disproportionately and due to overburdening of the public health infrastructure leading to escalating direct/indirect healthcare costs throughout the world.[1,2,3,4] The increase in cardiovascular diseases in India is estimated to be one of the largest of any country worldwide[3,5] and it is expected to be the most common cause of death and disability in the country by the year 2020. There are multiple factors associated in the etiology of cardiovascular diseases, and it will be wrong to adopt a single risk factor for predicting cardiovascular risk.[1,2,3,4,5,6,7,8,9,10] The Cardiovascular disease risk prediction charts formulated by World Health Organization (WHO) and the International Society of Hypertension (ISH) for use in different sections of the world using the best available mortality and risk factor data.[10,11] The chart is a very cost-effective tool to stratify the whole population using a risk score and therefore presents a 10-year risk of major cardiovascular outcome and it would be a useful tool to counsel patients to change their lifestyles or comply with their medicines.[11]

In India , very few such studies have been undertaken, out of which most of the studies being conducted in South India. In this context, there is still a lot to be explored in North India and especially the rural areas, which have been neglected largely. An effort is being made in the present study, to assess the prevalence of cardiovascular disease risk parameters and to estimate the cardiovascular risk in adults aged >40 years, using the CVD risk prediction charts by WHO/ISH in a rural area of Meerut.

Subjects and Methods

It was a community based cross-sectional study, which was conducted from January 2021 to December 2021, under the Rural Health Training Centre in peepli khera, and it is the field practice area of Department of Community Medicine. The participants of the study were adults aged ≥40 years without any history of cardiovascular disease. To recruit individuals for the study, a multistage random sampling was used.

Sample size

To calculate the sample size, we used the formula for estimation of proportion for one sample situation. To detect prevalence of 6.8% of moderate (10–20%)

cardiovascular disease risk population, as determined by a previous study conducted in Southern India,[12] the minimum sample size required was 397 with allowable error of 3.5%, and a design effect of 2.

Sampling method

Rural part of meerut is divided into eight blocks, and out of those one block (peepli khera) was selected purposely. List of all the subcenters under Primary Health Centre of peepli khera, was collected, and out of the 9 subcenters, randomly 3 subcenters were selected . In these 3 selected subcenters, there were 14 villages. In the third stage, 3 villages were selected using random sampling and a minimum of 133 individuals with age ≥40 years were taken from every village to complete the sample size of 397 in the present study. The list of households in those 3 villages was collected, and every 2nd household was selected. 1 individual from the selected household, irrespective of gender, was included in the study on fulfilling the eligibility criteria. Eligible criteria were people with age ≥40 years, without any history of cardiovascular disease. Eligible participants who did'nt gave consent were excluded from the study.

Data collection

Those people who agreed to take part in study were informed one day in advance so that to maintain an overnight fast of minimum 8 hours till their fasting blood glucose levels was measured. The written informed consent was obtained, and the study participants were interviewed face-to-face using a semi-structured questionnaire, which was pretested on a group of 30 individuals before its utilization.

The study participants were subjected to anthropometric measurements (i.e., height and weight) : assessment of blood pressure and blood sugar (both fasting and post prandial glucose) and laboratory investigations (total serum cholesterol). Weight was calculated by using an EQUAL digital weighing scale with 180 kg capacity and with accuracy to 100 grams, and height was measured by using a stadiometer. Blood pressure was measured by using Omron HEM-7120 Automatic Blood Pressure Monitor with two different sized cuffs – one of medium size and one of large size. Accu-Chek active blood glucose meter kit was used to measure the blood glucose. A 5-ml disposable, hypodermic, sterile needle was used for collecting blood samples for total serum cholesterol investigation, which was then transferred from the syringe into a labeled sterile plain vacutainer vial. Then the vial was transferred into a sample transport box to the Department of Pathology for evaluation of the serum total cholesterol levels. A total 205 samples of blood, out of total study population of 397, were taken for estimation of total serum cholesterol.

The cardiovascular risk prediction charts by WHO/ISH for the South-East Asian region were used to assess the cardiovascular risk among the participants of the study .[11] The predictor variables for risk prediction were age, gender, blood pressure, smoking, coexistence of diabetes, and the serum cholesterol levels. The WHO has categorized 10-year cardiovascular disease risk into five levels: <10%,

10 to <20%, 20 to <30%, 30 to <40%, and ≥40% risk, which we clubbed to three levels for our study, viz. <10%, 10–20%, and ≥20%, respectively.

Definition

Hypertension = Systolic BP >140 mmHg and/or Diastolic BP >90 mmHg as recommended by Joint National Committee-VII.[13] Diabetics = Fasting Blood Sugar ≥126 mg/dl and/or Post-Prandial Blood Sugar ≥200 mg/dl.[11] High cholesterol = Total serum cholesterol levels ≥200 mg/dl.[11] Smokers = All of the current smokers and those who used any tobacco products (cigarettes, bidis, chewing tobacco, or snuff) on a regular basis for at least the previous 1 year before the assessment.[14] Alcohol users = Alcohol use is referred to intake of any form of alcohol in past 12 months and were further subcategorized depending on the amount of alcohol consumed[15] Overweight = BMI of >23 kg/m^2. BMI was calculated by using Quetlet's Index formula.[16]

Data analysis

SPSS, version 23 (SPSS-23, IBM, Chicago, USA) was used for data analysis. Chi-square test was used to test the association between categorical variables and the concordance between two prediction charts was calculated for different risk levels, using the chart with cholesterol as a reference. A "P" value of <0.05 was considered statistically significant.

Results

Among the total 397 study participants, the maximum (72.8%) were females and the majority (45.8%) of the total population were in the age group between 40–49 years. More than half (56.4%) of the total population were found to have no formal education and about half (47.1%) of the study population belonged to the OBC category. Majority (82.7%) of the female participants were housewives, whereas most (64.8%) of the males were self-employed. About two-third (66.2%) of study population had a nuclear family and about half (47.9%) of study population belonged to the lower socio-economic status.

The overall prevalence of the hypertension was found to be 34.0% in study population with a slightly higher prevalence among the females (34.90%) than in males (32.40%). Almost similar prevalence of diabetes mellitus was seen in the males (15.7%) and the females (15.6%) with an overall prevalence of 15.6%. Prevalence of high serum cholesterol was more among males (18.0%) than in females (16.7%) with an overall prevalence of 17.1%. The smokers and alcohol users consisted of 9.3 % and 7.1 %, respectively, of total study population and all of smokers and alcohol users were males.

The mean age of total study population was 51.6 (±9.3) years with an overall mean BMI of 22.8 (±4.5) kg/m^2. The mean systolic blood pressure and diastolic blood pressure of the total population was 127.2 (±20.1) and 79.7 (±11.9) mm of Hg, respectively. The overall mean fasting blood sugar and post prandial blood sugar levels of study population was 109 (±41.5) and 143.7 (±58.3) mg/dl, respectively, with almost similar values in both sexes. The mean total serum

cholesterol was found to be higher among females than in males with an overall mean total serum cholesterol level of 163.6 (±35.3) mg/d.

Cardiovascular disease risk prediction charts by WHO/ISH , with and without cholesterol, were used to predict cardiovascular disease risk in the study population. The risk of cardiovascular disease was found to be almost similar with both the risk prediction charts with maximum of the study participants being in the low-risk (<10%) category. There was no statistical difference found between the two charts which were used to predict cardiovascular disease risk on applying two sample *z*-test for comparison of proportion of two samples.

On predicting cardiovascular disease risk using charts with blood cholesterol, majority (80.3 and 77.8%, respectively) of males and females were in the low-risk (<10%) categories followed by 14.8% of males in high (≥20%) risk and 12.5% of females in the moderate (10–20%) cardiovascular disease risk categories. On age-wise distribution, the risk of cardiovascular disease increased with increasing age with more than half (66.7%) of the participants of study aged ≥70 years in high (≥20%) cardiovascular disease risk category. Almost half (48.7%) of hypertensives and about a quarter (25.9%) of diabetics had high (≥20%) cardiovascular disease risk. Gender, age groups,diabetes status, hypertension status, and BMI were found to have a statistically significant association (p-value < 0.05) with the different cardiovascular disease risk categories.

When prediction charts without the cholesterol were used, more males (14.8%) had high (≥20%) cardiovascular disease risk than the females (8.7%) and the risk of Cardiovascular diseases increased with the increasing age. Almost one-third (35.2%) of hypertensives, less than one-fourth (22.6%) of diabetics and about half (51.2%) of the participants of study with BMI of ≥23 kg/m^2 had high (≥20%) Cardiovascular disease risk. In the total, 8.1% of smokers and 14.3% of alcohol users were in the high (≥20%) Cardiovascular disease risk category. Age groups, diabetes status, hypertension status, BMI, tobacco and alcohol use were found to have a statistically significant association (p-value <0.05) with the different Cardiovascular disease risk categories.

Discussion

On estimating the Cardiovascular disease risk using risk prediction charts by WHO/ISH , with and without cholesterol, almost the similar trend was observed with the both charts with more than three-fourth of the study participants having low (<10%) risk of Cardiovascular disease. Previous studies done by Balaji *et al.* (2018),[17] Patil *et al.* (2017),[18] Ghorpade *et al.* (2015),[12] and Shrivastava *et al.* (2015)[19] has documented similar results with a majority of patients falling under low risk (<10%) category for Cardiovascular diseases.

On age wise distribution of Cardiovascular disease risk with cholesterol, it was seen that maximum (91.0%) of study participants with the low (<10%) Cardiovascular disease risk were in the age group between 40–49 years and the majority (66.7%) of study participants with high (≥20%) Cardiovascular disease risk were in the age group between 60–69 years of age and on using Cardiovascular disease risk prediction chart without cholesterol; similar trend

was observed with the majority (94.5%) of the participants of study with low (<10%) cardiovascular disease risk in the age group between 40–49 years and the majority (43.9%) of the study participants with high (≥20%) Cardiovascular disease risk in the age group between 60–69 years of age. Mutthunarayanan *et al.* (2015)[20] and Dhungana *et al.* (2015)[21] observed the similar results in their studies with the majority of study participants having <10% Cardiovascular disease risk in the age group between 40–49 years of age, while out of the study participants with ≥20% risk, maximum were in the age group of ≥60 years of age. About a quarter (25.9% when using charts with cholesterol and 22.6% using the charts without cholesterol) of diabetics had high (≥20%) cardiovascular disease risk, while majority of diabetics had low (<10%) risk of Cardiovascular disease. In contrast to this, Shrivastava *et al.* (2015)[19] documented in their study that most (36.2%) of diabetics had high (≥20%) Cardiovascular disease. This disparity might be because of differing socio-demographic profile, family history of Cardiovascular disease risk factors, and dietary habits among the study participants.

Majority (93.8 and 64.9% for with and without cholesterol charts) of smokers had low (<10%) risk of Cardiovascular disease irrespective of the type of the risk prediction charts used. None of the smokers had high (≥20%) Cardiovascular disease risk when risk was estimated using risk prediction chart with cholesterol, while 8.1% of the smokers were found to have high (≥20%) Cardiovascular disease risk on using the charts without cholesterol. Balaji *et al.* (2018)[17] had reported similar findings where 50.8% of the smokers had low Cardiovascular disease risk while only 16.1% were in the high-risk category, while Ghorpade *et al.* (2015)[12] had observed that 58.6% of the smokers had moderate risk of Cardiovascular disease and 34.6% had high risk of Cardiovascular disease.

On using the Cardiovascular disease risk prediction charts by WHO/ISH with cholesterol, the majority (48.7%) of hypertensives were in high-risk (≥20%) category, while on using same charts without cholesterol, it was observed that the majority (45.7%) were in the low-risk (<10%) category. Balaji *et al.* (2018)[17] had observed similar trend in their study with the maximum (26.0%) prevalence of hypertension being among the low-risk (<10%) group of study participants, while Ghorpade *et al.* (2015)[12] found that the prevalence of hypertension was maximum (86.2%) among the high-risk (≥20%) groups.

It was observed that the mean BMI increased with increasing risk of Cardiovascular disease with maximum mean BMI of 25.1 (±5.0) kg/m^2 in the high-risk (>20%) group category. BMI was found to be significantly associated with the risk categories on predicting the Cardiovascular disease risk using the charts with cholesterol. A similar trend was seen in previous study by Ghorpade *et al.* (2015)[12] in which they observed that the maximum mean BMI of 41.4 (±12.9) kg/m^2 was in high-risk (>20%) group category. When the WHO/ISH Cardiovascular disease risk prediction charts without cholesterol were used, the least mean BMI of 21.2 (±4.3) kg/m^2 was seen in the moderate (10–20%) risk group category and the highest mean BMI of 23.2 (±4.8) kg/m^2 was observed among the study participants with high (>20%) risk of Cardiovascular disease. In a previous study by Balaji *et al.* (2018),[17] it was seen that BMI had an increasing trend with increasing risk of Cardiovascular disease in the study participants with 22.4 (±3.1) kg/m^2 in the low-risk group and 23.1 (±2.6) kg/m^2 in

the high-risk category, while Muthunarayanan *et al.* (2015)[20] in their study observed that majority (44.4%) of the participants had a BMI of >25 kg/m^2. These disparities in BMI observations in present study and the previous studies might be because of differences in the composition of the study population and food habits of participants of the study owing to the geographical differences.

In the present study, an overall good concordance (86.3%) between WHO/ISH Cardiovascular disease risk charts, with and without cholesterol was observed. Out of the 29 individuals with nonconcordant Cardiovascular disease risk estimates, 85.7% (25/28) were overestimates; 14.3% (4/28) belonged to the low and moderate Cardiovascular disease risk categories. Similar results were observed by Nordet *et al.* (2013)[10] in which without information about cholesterol, Cardiovascular disease risk was overestimated in 136 (10.6%) and underestimated in 17 (1.3%). High concordance between the two charts implies that in resource constraint settings, where cholesterol estimation is not possible, the WHO/ISH Cardiovascular disease risk prediction chart without information about cholesterol could be used to estimate the Cardiovascular disease risk. This could prove vital in identifying high-risk people at the primary healthcare level and prevent the progress of disease.

Conclusion

Majority of the participants of our study had low (<10%) risk of any Cardiovascular disease in the next 10 years. Among the Cardiovascular disease risk factors, the prevalence of hypertension was 34.0%, prevalence of diabetes was 15.6%, and prevalence of high cholesterol was 17.1%. The Smokers and alcohol users consisted of 9.3 and 7.1%, of total study population. Good concordance between the two WHO/ISH risk prediction charts was observed in the present study.

The Cardiovascular disease risk chart by WHO/ISH could help to assess and categorize the population according to the different Cardiovascular disease risk categories, which in turn would help in giving more care and counseling for those at high risk by means of a regular follow-up, thus helping in the prevention of fatal and nonfatal Cardiovascular diseases at the primary care level in resource-scarce settings.

Orientation of primary care physicians and other healthcare workers regarding screening for risk factors from time to time and also to incorporate the use of WHO/ISH Cardiovascular disease risk prediction charts for prediction of Cardiovascular diseases could prove vital in preventing Cardiovascular diseases in low-income settings.

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