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Research Article

Prediction of 10-Year Cardiovascular Disease Risk Using WHO HEARTS Risk-Based CVD Management Tools (Non-Laboratory-Based) Among Rural Population of South Andaman Islands in India

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Abstract

Introduction

CVDs are the leading cause of death in the world, and in India. Data related to risk factors of CVDs is showing increase in trends of CVD risk factors in recent years, and same is the trend in Andaman and Nicobar Islands, which is still on a higher side, especially in rural areas.

Objectives

To predict 10-year CVD risk among adults aged ≥40 years in rural areas of South Andaman Islands.

To study the factors associated with CVD risk levels among adults aged ≥40 years in rural population of South Andaman Islands.

Methodology

A Community based cross sectional study. A total of 275 Adults aged ≥ 40 years of age who do not have any established coronary heart disease and stroke were included in the study. Data was collected using WHO HEARTS Risk -based CVD Management tools (Non-Laboratory-based) for the South Asian region.

Results

32.4% and 5.8% of rural population in South Andaman Islands are at moderate and high CVD risk respectively in next 10-years. Male gender, being an elderly person, Illiterate / having lower level of educational status, belonging to a backward caste, being an alcoholic, having diabetes, and insufficient intake of fruits are the factors associated with higher levels CVD risk.

Conclusion

A large proportion of rural population are at moderate and high CVD risk in next 10 years in these Islands. Interventions for community risk reduction need to be undertaken in these Islands.

Keywords: Prediction; CVD Risk; HEARTS; Andaman

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Introduction

Illnesses related to Heart and blood vessels are known as cardiovascular diseases (CVDs), which accounts for large numbers of morbidities and fatalities worldwide. CVDs are the leading cause of death in the world [1]. Low and middle-income Nations account for more than 75 per cent of deaths caused by heart disease and stroke [1, 2].

According to recent estimates, 17.9 million deaths or 32% of all fatalities worldwide in 2019 were attributed to CVDs; among which heart attack and stroke related deaths accounted for 85% of these fatalities. The majority of CVD fatalities occur in lowand middle-income nations. While CVD-related mortality has decreased in certain wealthy Nations, they have significantly increased in low and middle-income countries; these Nations carry almost 80% of the Global load [3].

Non-Communicable Diseases contribute to around 5.87 million deaths annually in India which account for around 60 % of all deaths in the Country, CVDs are the most common causes of these NCD deaths in the Country [4]. It is important to note that India shares more than two-third of the total deaths due to NCDs in the South-East Asia Region (SEAR) of WHO [1, 2]. Asian Indians have a 20-50% greater rate of CVD-related mortality than any other population [4]. In Indian sub-continent, as measured through Government led surveys of NFHS-4 (2015-16) and NFHS-5 (2019-20), data related to risk factors of CVDs is showing increase in trends of CVD risk factors in recent years, and same is the trend in Andaman and Nicobar Islands, which is still on a higher side [5, 6], especially in rural areas [7-10].

According to recent reports, evidences suggests that rural population in Andaman and Nicobar Islands are having higher proportion of CVD risk factors [9, 10]. Few studies have been undertaken in India on estimation of common CVD risk factors using this WHO / ISH risk prediction charts, but most of the studies were being conducted in main land of India [11-13], availability of such evidences from Andaman and Nicobar Islands need to be constructed, especially in the rural areas, which are remote, difficult to access Islands, consisting of tribal population and where healthcare facilities are sparse.

WHO has released HEARTS risk based CVD management tools [14] in 2019 for conducting the community based CVD risk assessment. The new charts produce estimates for 21 regions of Institute for Health Metrics and Evaluation (IHME) Global Burden of Disease (GBD) regions. It is a useful and cost-effective tool to study the entire population using a risk score and it provides a 10-year risk of cardiovascular diseases and would be a useful tool to take appropriate actions by respective Health authorities, and will be helpful to counsel patients to modify their lifestyles, modify risk factors and comply with the medical advices [10].

A study by Arun Gangadhar Ghorpade et al from a rural population in South India has concluded that 17% of the participants had moderate to high risk for the occurrence of cardiovascular events, and study has shown that Categorizing people as low (<10%)/moderate (10%-20%)/high (>20%) risk is one of the crucial steps to reduce the magnitude of fatal/non-fatal outcomes [11].

A study by Trideep and group among rural population in Lucknow, has concluded that WHO/ISH risk prediction charts can be used as a tool to predict CVD risk among asymptomatic individuals, and, such studies help in early detection and prevention of CVDs in resource-poor settings [1].

Therefore, this current study with objectives to estimate the risk of cardiovascular disease among rural population South Andaman Islands over the next 10 years using WHO HEARTS risk-based CVD management tools is proposed. Study of CVD risk factors and mitigation of such risk factors helps us to reduce morbidity and mortality from such preventable causes in these Islands.

Objectives

1. To predict 10-year CVD risk among adults aged ≥40 years in rural areas of South Andaman Islands.
2. To study the factors associated with CVD risk levels among adults aged ≥40 years in rural population of South Andaman Islands.

Methodology

A Community based cross sectional study was conducted in the rural areas of South Andaman Islands. Adults aged ≥ 40 years of age who do not have any established coronary heart disease and stroke were included in the study. Respondents with any established CHD and stroke, seriously ill and bed ridden individuals were excluded from the study. Sample size was calculated by using the formula for estimation of proportion for one sample situation to detect prevalence of moderate to high CVD risk (Total CVD risk of 19.64%), as determined by a previous study conducted in South India [13], the minimum sample size required was 268 with allowable error of 5%, confidence interval of 95% and with an addition of 10% of the sample to account for the design effect; however a total of 275 respondents participated in the study. Written informed consent was obtained from the participants and data was collected using WHO HEARTS risk - based CVD Management tools (Non-Laboratory-based) for the South Asian region. The predictor variables for the risk prediction were - Age, Gender, Smoking, Blood pressure, Coexistence of diabetes, and BMI. In addition, a semi-structured interview schedule was used to collect socio-demographic details, and other NCD risk related details.

Operational Definitions

Hypertension: Any person having SBP>140 mmHg and/or DBP>90 mmHg as recommended by Joint National Committee-VII[15].

Diabetics: Any person having RBS ≥ 200mg/dl.

Smokers: All current smokers and those who smoked any tobacco product on a regular basis for at least the previous 01year before the assessment [16].

Alcohol users: Alcohol use referred to the intake of any form of alcohol in the past 12 months [16].

Out of 99 revenue villages in the South Andaman District, 11 villages were selected in consultation with the Gram Panchayats, and in these villages, consecutive house to house visits were carried out by front line health functionaries, and adults aged ≥40 years who were willing to provide informed consent and participate in the study from those localities were mobilized for the study, a team of trained experts conducted interviews and recorded necessary information at a central location in these villages. Respondents with any established CHD and stroke, seriously ill and bed ridden individuals were excluded from the study. Ethical approval was taken from Institutional Human Ethics Committee of ICMR - Regional Medical Research Centre, Port Blair.

The participants were interviewed and Physical measurements were recorded. Weight was recorded using a digital weighing scale with 180 kg capacity and with accuracy to 100 gm, and height was measured using a Stadiometer. Blood pressure was recorded using Omron HEM-7120 Automatic Blood Pressure Monitor with two different sized cuffs - one medium and one large size. Accu-Chek active blood glucose meter kit was used to measure blood glucose.

Data was analyzed using SPSS software version 28.0, appropriate statistical tests were used and Non-Laboratory-based CVD - risk prediction charts was used to identify risk for different risk levels. A "P" value of less than 0.05 was considered as statistically significant.

Results

A total of 275 respondents participated in the study (Women 53.82%, Men 46.18%); mean age was 56.38 years (Men: 58.16 years, and Women: 54.86 years) with a range of 40 -88 years. Sociodemographic profile of the respondents are shown in Table 1.

Characteristics	Respondents	Frequency	Percentage
Gender	Male	127	46.18%
	Female	148	53.82%
Age group	40 - 49 years	90	32.73%
	50 - 59 years	70	25.45%
	60 - 69 years	78	28.36%
	>= 70 years	37	13.45%
Religion	Hindu	208	75.64%
	Muslim	22	8.00%
	Christian	45	16.36%

Educational status	No formal education	75	27.27%
	Primary education	110	40.00%
	Secondary/High school education	70	25.45%
	College/University/PG Education	20	7.27%
Caste background	General	194	70.55%
	Backward caste	80	29.09%
	Refused	1	0.36%
Marital status	Never married	8	2.91%
	Currently married	225	81.82%
	Separated	8	2.91%
	Widowed	34	12.36%
Type of family	Nuclear	155	56.36%
	Joint	120	43.64%
Job status	Government employee	25	9.09%
	Non - Government employee	59	21.45%
	Self - employed	50	18.18%
	Non - paid	1	0.36%
	Home maker	99	36.00%
	Retired	35	12.73%
	Unemployed (Able to work)	1	0.36%
	Unemployed (Unable to work)	5	1.82%
Socioeconomic status(As per modified BG Prasad's	>= 7863	23	8.36%
	3931 - 7862	29	10.55%
	2359 - 3930	37	13.45%
	1179 - 2358	78	28.36%
	<1179	108	39.27%

Table 1: Sociodemographic profile of the respondents.

61.8%, 32.4% and 5.8% are having Low, Moderate and High CVD risk respectively in next - 10 years, distribution of CVD risk factors with various Sociodemographic factors is mentioned in Table 2. Men are having higher proportion of moderate and high risk CVD risk levels (P<0.001) while compared with women, There is a significant difference in the mean scores of CVD risk score between men and women, which is shown in Table 3.

Characteristics	Respondents	Low risk (<10%)	Moderate risk (10-20%)	High risk (>20%)	P Value
Gender	Men	59 (46.5%)	55 (43.3%)	13 (10.2%)	< 0.001
	Women	111 (75%)	34 (23%)	3 (2%)	
Age	40 - 49 years	88 (97.8%)	2 (2.2%)	0	< 0.001
	50 - 59 years	60 (85.7%)	10 (14.3%)	0	
	60 - 69 years	22 (28.2%)	53 (67.9%)	3 (3.8%)	
	>= 70 years	0	24 (64.9%)	13 (35.1%)	

Religion	Hindu	127 (61.1%)	68 (32.7%)	13 (6.3%)	0.98
	Muslim	14 (63.6%)	7 (31.8%)	1 (4.5%)	
	Christian	29 (64.4%)	14 (31.1%)	2 (4.4%)	
Education status	No formal education	31 (41.3%)	37 (49.3%)	7 (9.3%)	< 0.001
	Primary education	69 (62.7%)	34 (30.9%)	7 (6.4%)	
	Secondary/High school education	50 (71.4%)	18 (25.7%)	2 (2.9%)	
	College/University/PG Education	20 (100%)	0	0	
Caste background	General	128 (66%)	58 (29.9%)	8 (4.1%)	< 0.001
	OBC	42 (52.5%)	31 (38.8%)	7 (8.8%)	
	Refused	0	0	1 (100%)	
Marital status final	Never married	6 (75%)	2 (25%)	0	0.059
	Currently married	146 (64.9%)	68 (30.2%)	11 (4.9%)	
	Separated/Divorced/ Widowed	18 (42.9%)	19 (45.2%)	5 (11.9%)	
Type of family	Nuclear	102 (65.8%)	47 (30.3%)	6 (3.9%)	0.158
	Joint	68 (56.7%)	42 (35%)	10 (8.3%)	
Socioeconomic status	>= 7863	17 (73.9%)	4 (17.4%)	2 (8.7%)	0.629
	3931 - 7862	18 (62.1%)	10 (34.5%)	1 (3.4%)	
	2359 - 3930	21 (56.8%)	13 (35.1%)	3 (8.1%)	
	1179 - 2358	43 (55.1%)	29 (37.2%)	6 (7.7%)	
	<1179	71 (65.7%)	33 (30.6%)	4 (3.7%)	

Table 2: Sociodemographic status and CVD risk levels.

Male gender (P<0.001), being an elderly person (P<0.001), Illiteratehaving lower level of educational status (P<0.001), and belonging to a backward caste (P<0.001) are the factors associated with higher levels of CVD risk.

Distribution of CVD risk levels with various NCD risk factors are shown in Table 4.

(Except for the variables which are used in calculation of CVD risk levels)					
Factor	**Status**	**Low risk (<10%)**	**Moderate risk (10-20%)**	**High risk (>20%)**	**P Value**
Ever user of smokeless tobacco	Yes	82 (57.3%)	49 (34.3%)	12 (8.4%)	0.096
	No	88 (66.7%)	40 (30.3%)	4 (3%)	
Ever consumed alcohol	Yes	44 (51.8%)	33 (38.8%)	8 (9.4%)	0.042
	No	126 (66.3%)	56 (29.5%)	8 (4.2%)	

Salt consumption	Too much	39 (66.1%)	19 (32.2%)	1 (1.7%)	0.146
	Just the right amount	97 (65.1%)	41 (27.5%)	11 (7.4%)	
	Tool little	31 (52.5%)	24 (40.7%)	4 (6.8%)	
	Far too little	3 (37.5%)	5 (62.5%)	0	
Exercises for health reasons	Yes	54 (56.8%)	31 (32.6%)	10 (10.5%)	0.047
	No	1 1 6 (64.4%)	58 (32.2%)	6 (3.3%)	
Overall Hypertensive	Yes	79 (47.3%)	73 (43.7%)	15 (9%)	< 0.001
	No	91 (84.3%)	16 (14.8%)	1 (0.9%)	
Overall Diabetic	Yes	47 (51.1%)	36 (39.1%)	9 (9.8%)	0.016
	No	1 2 3 (67.2%)	53 (29%)	7 (3.8%)	
Days of consumption of fruits per week	< = 2 days per week	77 (60.6%)	42 (33.1%)	8 (6.3%)	0.01
	3 - 5 days per week	37 (50.7%)	28 (38.4%)	8 (11%)	
	> = 6 days per week	56 (74.7%)	19 (25.3%)	0	
Days of consumption of vegetables per week	< = 2 days per week	11 (68.8%)	4 (25%)	1 (6.3%)	0.493
	3 - 5 days per week	18 (48.6%)	16 (43.2%)	3 (8.1%)	
	> = 6 days per week	1 4 1 (63.5%)	69 (31.1%)	12 (5.4%)	
No. of days of physical activity per week	< = 2 days per week	1 1 9 (65.4%)	58 (31.9%)	5 (2.7%)	0.013
	3 - 5 days per week	13 (68.4%)	5 (26.3%)	1 (5.3%)	
	> = 6 days per week	38 (51.4%)	26 (35.1%)	10 (13.5%)	

Table 3: NCD Risk factors and CVD risk levels.

Since Age, sex, smoking, Systolic blood pressure, and [17]BMI are the predictors involved in calculation of CVD risk scores, there was no need to estimate relationship of these variables with CVD risk levels; therefore, except for these variables, bivariate analysis was conducted for other NCD risk factors; being an alcohol abuser ($P<0.05$), having diabetes ($P<0.05$), and insufficient intake of fruits ($P<0.05$) are the factors associated with higher levels of CVD risk.

Variable	Men		Women		Total	
	Mean	SD	Mean	SD	Mean	SD
CVD Risk score	11.17	7.35	6.76	4.91	8.8	6.53
Systolic BP	141.6	23.8	139.8	24.9	140.6	24.4
Diastolic BP	83.04	12	82.96	14.3	83	13.3
RBS	121.7	67.7	129.3	66.3	125.8	66.9
BMI	24.63	4.19	25.32	4.78	25	4.52

Table 4: Mean and standard deviation (SD) of different CVD risk factors among the study participants.

Interestingly, people who do exercise for health reasons and who do sufficient physical activity per week were having high CVD risk levels; it shows that once people are identified with higher CVD risk levels, they were advised to do physical exercises on a regular basis by the ongoing NCD risk prevention programs.

Discussion

In this study, we are reporting a higher proportions of moderate and high 10-year CVD risk levels at 32.4% and 5.8% respectively compared with previous reports. We found that factors including being an illiterate having lower level of educational status, and belonging to a backward caste, being an alcohol abuser, having diabetes and insufficient intake of fruits were found with higher levels of CVD risk, which are in consistent with the findings from the previous studies. A Study by Arun Gangadhar Ghorpade et al from a rural population in South India has concluded that 17% of the participants had moderate to high risk for the occurrence of cardiovascular events, and a higher proportion of CVD risk factors like smoking, alcohol, low High-Density Lipoprotein (HDL) cholesterol were found in 32%, 53%, 56.3%, and 61.5% of study participants, respectively, and that study has shown that Categorizing people as low (<10%)/moderate (10%-20%)/high (>20%) risk is one of the crucial steps to reduce the magnitude of fatal/non-fatal outcomes [11-13]. A Study from South India, by K Premanandh and R Shankar, has shown that Moderate and high CVD risk were 12.14% and 7.5% respectively in the study population and, 2.5% had very high risk (>40%). High risk alcohol drinkers (binge drinking) and abdominal obesity were significantly associated with higher CVD risk. Higher prevalence of behavioral risk factors was also reported in this study. And this study was concluded by recommending that Risk stratification and identification of individuals with a high risk for CHD could potentially benefit for intensive primary prevention efforts, and such stratifications are critically important in reducing the burden of CVDs in India.

CVD risk factors leads to overburdening of the public health infrastructure leading to increased suffering, need for medical care; escalating direct/indirect healthcare costs throughout the world [18, 19]. WHO data on increased CVDs in India is estimated to be one of the greatest of any country in the world [1], and is expected to be the largest cause of morbidity and mortality. In view of the causality of multiple factors in the etiology of CVDs, interplay of multiple risk factors needs to be considered while estimating the burden on population [1, 11, 13].

According to a study conducted in Nigeria utilizing the risk prediction chart, nearly one-sixth of the respondents had a high probability of having cardiovascular disease (CVD) within the next ten years. Systolic hypertension, visceral obesity, diabetes mellitus, smoking, increased total cholesterol, and physical inactivity were all related to a greater chance of developing CVDs according to the prevalence of CVD risk factors [20], and our results are in agreement with these findings. In a study conducted by Bernabe-Ortiz A et al.it was reported that Rurality and high altitude were characteristics that were independently linked to lower predicted CVD risk [21], but according to few published reports from South Andaman, it was reported that Rural population have higher risk of CVD risk factors compared to their counterparts [9,10].

In low and middle-income countries, using WHO/ISH charts as a screening tool to identify cardiovascular events is simple and affordable, and inexpensive screening tool for identifying cardiovascular events [11]. And WHO risk prediction charts can forecast next 10-year CVD risk in asymptomatic people in low-resource settings, aiding in the early detection and prevention of CVDs in areas with limited resources [22, 23], our study adds to the available evidences that WHO HEARTS Risk based CVD management tools are simple and easy to apply in rural settings and it provides predictions of

community risk for next 10 years for CVD events, and this helps to reduce risk factors, and helps to minimize morbidity and mortality due to CVDs, and these tools have management protocols to reduce community CVD risk levels [14]; therefore, further research and interventions using these tools can help us to reduce CVD risk levels.

Conclusion

32.4% and 5.8% of rural population in South Andaman Islands are at moderate and high level CVD risk respectively in next 10-years and these risk levels are high while compared with previous reports from other regions while using WHO risk prediction charts. Illiteracy/ lower level of educational status, belonging to backward castes; and being an alcoholic, having hypertension, diabetes, insufficient consumption of fruits are the factors which are associated with moderate to high risk levels of CVD risk and our public health efforts in these rural and remote Islands should be directed towards early diagnosis and efforts to bring down CVD risk levels among these groups. WHO HEARTS Risk-based CVD management tools are simple, useful to apply for risk stratification in rural and remote areas; and helps us to forecast next 10 years CVD risk levels among communities, and interventions with components on managing CVD risk factors focusing on the above stated associated factors are recommended to achieve community risk reduction in these Islands.

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Conflicts of interest

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