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"Assessment of 10 year and lifelong cardiovascular risk using ASCVD risk calculator in health care workers of rural field practice area – A cross sectional study"

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Abstract:

Background: In the current century, India is facing a triple burden of disease. Though certain deadly and threatening communicable diseases are on decline, there is equal and greater share of NCD on the rise. In view of this increasing health hazard globally, WHO has included a separate goal (3.4) for Non-communicable diseases in Sustainable Development Goals.

Objectives: To assess the short time (10 years) and lifelong (30 years) Cardio-vascular risk among rural healthcare workers.

Methodology: We conducted a Cross-sectional study among grassroot healthcare workers. A total 77 workers found eligible and 71 participated in the study. WHO STEPS questionnaire was used to collect socio-demographic, behavioral and biochemical data. Blood sugar was estimated using Random blood sugar analysis, Plasma lipid profile using Cobas analyzer.

Results: Majority of the participants were female (93%) and were in the age group of 20-59 (98.6%). Around 67% were either overweight or obese, 13%; 12% had history of hypertension and diabetes respectively. Nearly 60% have their Blood pressure elevated. History of cervical cancer screening had been done at-least once in only 13% of participants. Though 10-year risk was low in 90% of participants in 40-59 age group, lifelong risk was high in 58% of the participants. In addition, we used Framingham score to quantify risk for the participants.

Conclusion: Lifetime cardiovascular risk increases significantly with increase in age and rise in blood pressure.

Keywords: Cardiovascular risk, Health-care workers, ASCVD, Non-Communicable diseases.

INTRODUCTION:

For many years, infectious diseases were the leading cause of mortality, especially in resource limited healthcare settings. However, in the past few decades due to rapid urbanization and globalization coupled with increased life expectancy, and adoption of harmful lifestyle behaviours, Non-Communicable Diseases (NCDs), especially Cardio-vascular disease (CVD)

has replaced Communicable disease as one of the leading causes of morbidity and early death, substantially overburdening the public health infrastructure, and in turn escalating direct/indirect healthcare costs globally.[1]

Cardiovascular disease (CVD) is a broad term encompassing coronary heart disease (CHD), heart failure, ischemic stroke, peripheral vascular disorder and atherosclerosis of the aorta and its branches. The modifiable risk factors for CVD includes other individual non-communicable disease conditions such as, dyslipidaemia, type 2 diabetes (T2DM), increased blood pressure (BP), obesity, and smoking, and found to be responsible for more than 50% of cardiovascular mortality. Interpretation of data from 52 countries, the INTERHEART study found that nine changeable factors (i.e., tobacco, dyslipidaemia, hypertension (HTN), diabetes, central obesity, psychosocial factors, daily intake of fruits and vegetables, regular alcohol consumption, and frequent physical exercise) attributed to more than 90% of the risk of new-onset myocardial ischemia.[2]

Atherosclerosis has been proved to be the prime root cause of future cardiovascular events that accounts to considerable number of morbidity and mortality worldwide, and will continue to remain as the major cause of mortality by 2030.[3]

Atherosclerotic cardiovascular disease (ASCVD) events, particularly ischemic coronary heart disease, has been found to be increasingly associated with people of South Asian ethnicity, compared to most other racial/ethnic groups.[4] Regional and national differences exist both in incidence and mortality of ASCVD, because of the differences in the prevalence of risk factors and people's access to high-quality health services.[3]

Global burden figures from 2019 suggest that the prevalence of age standardized years of life lost due to cardiovascular diseases is at least two times higher in South Asia as compared to Western Europe and Australia. T2DM is a major player with more than 70% of patients with T2DM dying due to ASCVD.[5]

One strategy put forth to reduce the high CVD risk of South Asians is to screen and treat modifiable CVD risk factors.[4] Risk calculation for CVD is vital in order to predict the future impact of ASCVD and enables to promote adherence to healthy lifestyle measures and therapies. Among various risk calculation tools, The Framingham Risk Assessment is an easy and validated method for identifying persons at risk for ASCVD.[2] The other CVD risk estimator tool that have been developed and validated is 2013 American Heart Association/American College of Cardiology Pooled Risk Calculator for estimating 10-year and lifetime risk of atherosclerotic cardiovascular disease (ASCVD). Lifetime ASCVD risk estimation, measures the cumulative risk of developing the disease during the remainder of an individual's lifespan, capable of providing a more comprehensive assessment of future ASCVD risk compared with shorter-term i.e., 10-year risk estimates, which is very much applicable especially in younger population for whom 10- year ASCVD risk is nearly always low.[6]

Interplay between various factors such as genetic, socio-economic, individual, physician-related, environmental, and healthcare delivery system-related factors are responsible for development of ASCVD.[1]

Community-based risk stratification studies for CVD are not done in Indian settings, hence we tried to explore the prevalence of various modifiable or changeable factors and to stratify individuals as low, moderate and high risk with help of ASCVD risk calculator.

CONCEPTUAL FRAMEWORK:

The aim of the study is to determine the prevalence of cardiovascular risk factors among healthcare workers. Through our study we tried to analyse the relationship between presence of certain noncommunicable diseases (like diabetes and hypertension) and cardiovascular risk scores, so as to understand their role in cardiovascular risk prediction. In addition, we intend to find out, whether increasing age is a risk for development of cardiovascular risk event that has been reported by previous studies.

METHODOLOGY:

A Healthcare based cross-sectional study was conducted between November 2022 to April 2023 among healthcare workers in a rural field practice area.

Study population:

Of the 92 healthcare workers and field staffs working under the field practice area 86 have been found eligible for study and 71 consented for the study. The eligibility criteria to participate in study includes; Age group between 20-79; Free from any cardiovascular disease, and without on any cardiac medication. Healthcare workers and field staffs includes Medical Officer, Community Health Officers, Lady Health Visitor, Staff Nurses, Public Health Care Officers, Senior Health Assistant, Junior Health Assistant, Health Inspecting Officers, Anganwadi teachers, Accredited Social Health Activists, Pharmacist, Lab technicians and Group D workers.

Clinical measurements:

WHO STEPS Instrument version 3.2 was used to collect information about Socio-demographic data, behavioural measurements, physical measurements, and biochemical measurements. Random blood sugar was tested using glucometer, by drawing capillary blood. Blood samples were collected from the participants to analyse lipid levels using Cobas C 501 analyser.

Baseline incidence of NCD was evaluated by acquiring history of known HTN, DM, dyslipidaemia, coronary artery disease requiring medication and verifying absence of transient ischemic attack/stroke.

Risk factor definitions:

DM: Random plasma glucose ≥200mg/dL or use of antihyperglycemic medications

Hypercholesterolemia/ Dyslipidaemia: total cholesterol ≥200mg/ dL, triglyceride ≥150 mg/dl, low-density lipoprotein cholesterol ≥130mg/dL, or high-density lipoprotein cholesterol <40mg/dL for males and <50mg/dl for females, (for persons with and without DM).[7]

HTN: systolic blood pressure (BP) ≥130mm Hg, diastolic BP ≥80mm Hg, or use of an antihypertensive medication.[8]

Obesity: Body mass index (BMI) ≥22.9 kg/m^2.

Smokers: lifetime use of any form of tobacco products.

Alcohol: lifetime use of any form of alcohol.

Cardiovascular risk Stratification:

The 10-year risk scores were calculated using FRS, and ACC/AHA ASCVD risk calculators, while lifetime scores were calculated for each participant using ACC/AHA ASCVD tool. Using the new pooled cohort equations, the cohort was stratified into 3 groups, namely, 18 to 39 years, 40 to 59 years, and 60 to 79 years. Participants in age groups of 40 to 59 and 60 to 79 years were further stratified as per their 10-year predicted risk for ASCVD events using an online risk calculator - ASCVD Risk estimator plus, into four risk groups: low risk [<5%], borderline risk [5%–<7.5%], intermediate risk [>7.5%–<20%] and high risk [>20%].[3]

Based on lifetime risk scores, subjects in the age groups of 18 to 39 and 40 to 59 years were stratified into low (<39%) and high (≥39%) risk subgroups. For participants in age group 40 to 59 years, the application of the ASCVD risk calculator estimates both the 10 -year immediate as well as the lifetime CVD risk.[9]

Statistical analysis:

Continuous variables are discussed in frequency and percentages'. Categorical variables were presented in mean and standard deviation. Pearson x^2 test was used to evaluate significant associations. The risk factors were identified as independent categorical variables with age-stratified ASCVD 10-year and lifetime risk score groups as outcome variable. P<0.05 was taken as statistically significant.

Informed consent & Ethics approval:

All patients gave written and signed informed consent and the protocol approval was obtained for this observational study from the Institutional Ethics Committee (IEC). Ref No: MDC/JNMCIEC/255.

RESULTS:

Of the 71 participants, 66 were females and 5 were males. Majority were in the age group of 20 to 59 (98.6%). 93% of the study population were married and around 95% were Hindus. 66 (93%) had at-least secondary school education. Socio-demographic distribution of study participants are detailed in table 1.

Table 1. Sociodemographic characteristics of study participants.

Characteristics	Frequency (N = 71)	Percentage (%)
Sex		
Male	5	7.0
Female	66	93.0
Age (in years)		
20-39	37	52.1
40-59	33	46.5
60-79	1	1.4
Marital status		
Single	5	7.0
Married	66	93.0
Religion		
Hindu	67	94.4
Muslim	3	4.2
Christian	1	1.4
Education		
Less than primary school	3	4.2
Primary school	2	2.8
Secondary school	39	54.9
High school	14	19.7
College/university	11	15.5
Post-graduate degree	2	2.8

In our study, 12.7% and 11.3% had self-reported hypertension and diabetes respectively. Age-wise distribution of NCD prevalence indicated that. Among the various NCDs, dyslipidaemia was frequently reported (%). Of the 71 study participants, only 19 (26.8%) had optimal BMI (18.5 – 22.9). Based on waist-hip ratio 7 (9.9%) participants were on high-risk level.

Table 2. Clinical and Social risk factors for cardiovascular events among participants.

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Characteristics	Frequency (N = 71)	Percentage (%)
Clinical features		
BMI Categories		
Underweight	4	5.6
Normal	19	26.8
Overweight	16	22.5
Pre-obese	24	33.8
Obese	8	11.3
WHR		
Excellent	2	2.8
Good	17	23.9
Average	17	23.9
At-risk	28	39.4
High risk	7	9.9
History of Hypertension		
Present	9	12.7
Absent	62	87.3
History of Diabetes		
Present	8	11.3
Absent	63	88.7
Blood pressure		
Normal	30	42.3
Elevated	15	21.1
High blood pressure stage 1	14	19.7
High blood pressure stage 2	12	16.9
Hypertensive crisis	0	0
Blood sugar		
Normal	52	73.2
Borderline	6	8.4
Elevated	13	18.3
Social factors		
Tobacco		
Yes	5	7.0

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No	66	93.0
History of Alcohol intake		
Present	2	2.8
Absent	69	97.2
Cervical Cancer screening		
Yes	9	12.7
No	57	80.3
Not applicable (Male)	5	7.0

Based on American Heart Association (AHA) classification of hypertension, 26 (36.6%) were suffering from stage 1 or stage 2 hypertension compared to the self-reported history of hypertension among participants i.e., 12.7%. Out of 66 female participants only 9 (12.7%) underwent cervical screening at-least once in their lifetime. The major risk factors of cardiovascular disease such as tobacco and alcohol intake were significantly lower among the study participants as many of them were female participants. Isolated hypertriglyceridemia was seen in 51 (71.8%) participants, while dyslipidaemia was observed in only one female participant. Through our study it was found that only 2 diabetics had their blood sugar controlled, while identifying 8 new onset diabetes along with 5 borderline patients among participants.

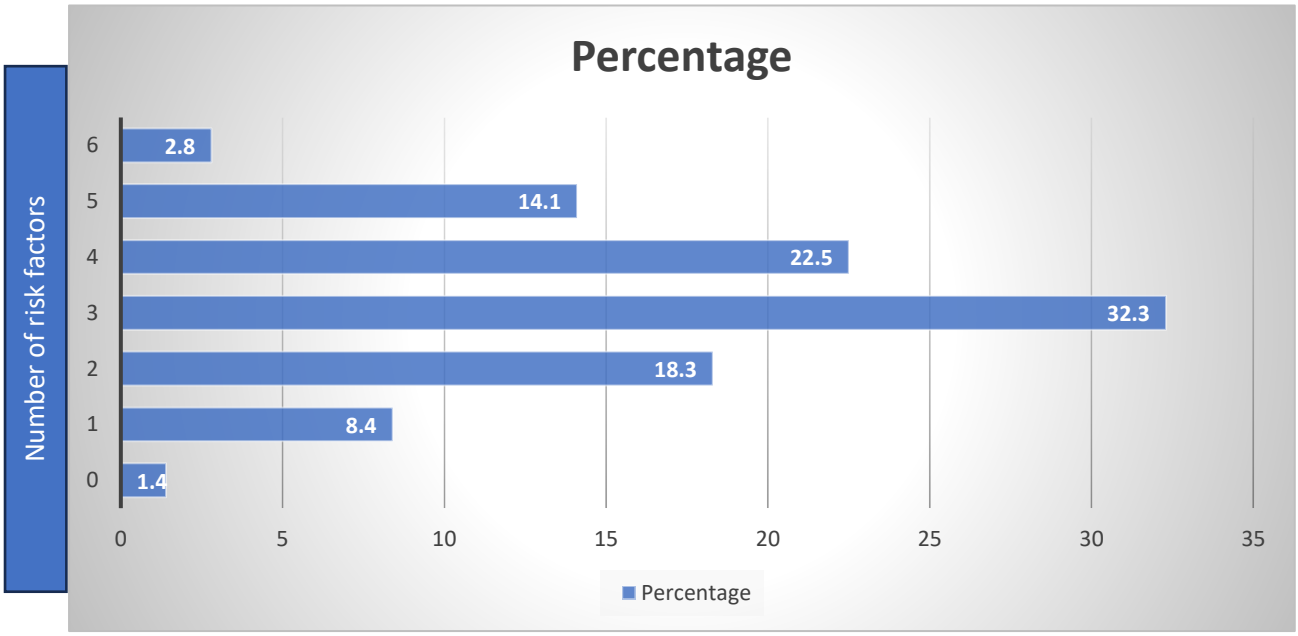

Figure 1. Prevalence of risk factors among study participants (abnormal total cholesterol, HDL, LDL, TG, systolic and diastolic BP, FBS, BMI, as well as a history of smoking) among study participants.

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Table 3. Age and sex stratified distribution of atherosclerotic cardiovascular disease (ASCVD) scores and Framingham risk scores.

Age	**Sex**	**ASCVD risk scores**				**Framingham scores**		
		10-year risk		**Lifetime risk**		**<10% (Low)**	**10-20% (Moderate)**	**>20% (High)**
		<5% (Low)	5%-20% (Moderate)	<39% (Low)	>39% (High)			
20-39 (n=37)	Females	0	0	30 (88.2)	4 (11.8)	34 (100)	0	0
	Males	0	0	2 (66.7)	1 (33.3)	2 (66.7)	1 (33.3)	0
40-59 (n=33)	Females	28 (90.3)	3 (9.7)	13 (41.9)	18 (58.1)	23 (74.2)	8 (25.8)	0
	Males	1 (50)	1 (50)	0	2 (100)	2 (100)	0	0
60-79 (n=1)	Females	0	1 (100)	0	0	0	0	1 (100)
	Males	0	0	0	0	0	0	0

Table 3. shows the baseline 10-year and lifelong risk of developing a CVD event based on 2013 AHA/ACC pooled ASCVD risk calculator. It estimates the risk of developing a hard event in the age group of 20-79 years. Framingham cardiovascular risk calculator was also used to estimate low, moderate, and high risk.

Of the total study participants, 10-year risk was estimated for 34 (47.8%) in the age-group of 40-79. Majority of them (85.3%) had low 10-year risk (<5%) and no one had high risk (>20%). Lifelong risk estimates showed 45 had low risk (<39%), while 25 had high risk (>39%) of developing a cardiac event in their lifetime. High lifetime risk was more for participants in the age-group of 40-59.

Using FRS tool (Framingham risk scoring tool), it was found that 9 (12.7%) had moderate risk (10%-20%) and only one who was above the age of 60 had high risk (>20%).

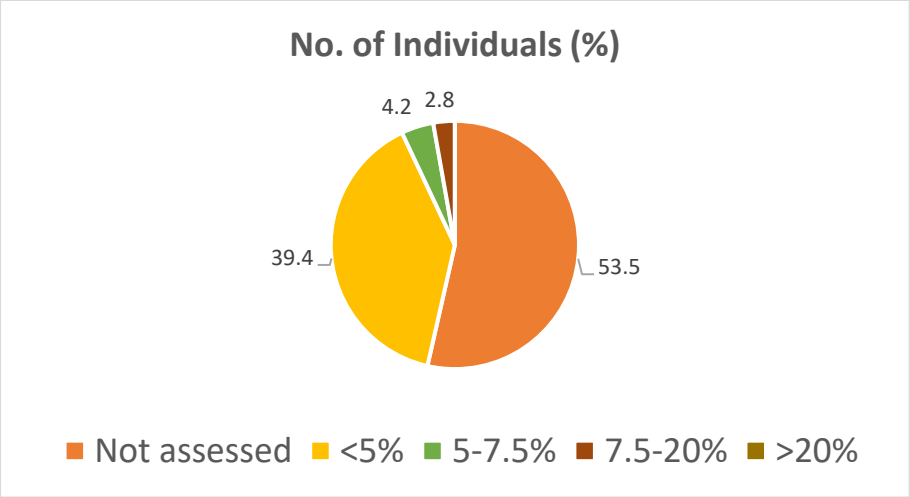

Figure 2. 10-year risk of cardiovascular events among study participants.

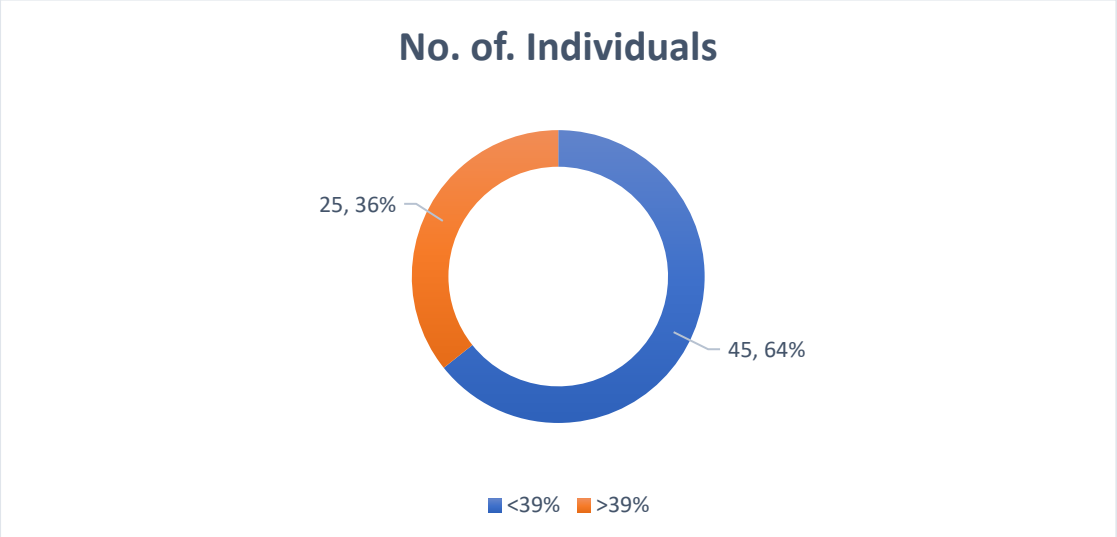

Figure 3. lifelong risk of cardiovascular event among study participants.

Table 4. Anthropometric measures, Clinical features, and Biochemical findings among participants.

Characteristics	**Mean (SD)**	**Range**
BMI (in Kg/m2)	24.83 ± 4.25	36.5-15.83
Waist to hip ratio	0.85 ± 0.04	0.96-0.73

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SBP	118.42 ± 14.55	160-90
DBP	78.73 ± 9.85	100-60
HDL	30.23 ± 7.83	57-20
LDL	64.37 ± 22.13	133-29
TC	143.48 ± 24.20	211-100
TG	213.51 ± 90.31	426-58
RBS	122.76 ± 44.62	327-73

Table 5. Relationship between risk of Cardio-Vascular event (Lifelong), Sociodemographic features and history of medical conditions.

Characteristics	**Lifetime risk of CV event**		**X^2**	**P Value**
	Low risk	**High risk**		
Sex				
Male	2	3	1.478	0.246
Female	43	22		
Age				
20-39	32	5	88.08	0.001
40-59	13	20		
60-79	NA	NA		
Marital status				
Single	5	0		

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Married	40	25	3.108	0.211
History of Hypertension	2	6	12.54	0.002
History of Diabetes	1	7	10.81	0.004
BMI (>25)	16	15	9.304	0.317

The study clearly showed risk of having a lifetime cardiac event significantly increased with increase in age (p value <0.05). The participants with the history of diabetes and hypertension also had significant association with risk of development of cardiovascular event (p value of 0.004 & 0.002) respectively.

DISCUSSION:

SDG goal 3-target 3.4 focuses on reducing one-third premature mortality due to NCDs by 2030 through prevention and treatment. It is an extension of global voluntary NCD mortality target, where it aims for 25% relative reduction in premature mortality from CVD, Cancer and Diabetes.

It has been well documented that the eventual outcome of myocardial infarction/stoke/death rarely precipitates because of single potential risk factor, but more often because of combined effect several risk factors.[1]

There is a strong relationship between prevalence of CVD risk factors and lifestyle. Smoking, for example, demonstrates a dose effect and undesirable interaction with other risk factors (e.g., lipids, diabetes). Smoking and smokeless tobacco (e.g., chewing tobacco) increase the risk of developing ASCVD and mortality.[3] Since our study participants were predominantly females, smoking was not reported significantly, and those who had history of consumption among females, were in the form of smokeless tobacco. But even chewable tobacco increases the risk of developing ASCVD.

It was evident from our study that 23% were overweight, while 45% were either pre-obese or obese. In a study done by Qasem Surrati et al. they concluded 34% & 45% were overweight and obese respectively.[2]

In our study, the prevalence of hypertension was found to be around 37% when quantified using the new AHA guidelines. Majority of them were unaware of their status. Similarly, a study done in Nigeria found that 20% of the study population were unaware of their elevated blood pressure status.[10] There is sufficient evidence that hypertension is closely associated with further cardiovascular complications. Therefore, screening for early diagnosis of this silent killer is a crucial element in designing an effective program to control this modifiable risk factor.[3]

Prevalence of diabetes in our study based on blood glucose estimation was found to be around 5.6%, comparable with the results of study done in Saudi Arabia (7.2%) & Kuwaitis (6.6%). Patients with T2DM have 2–4 times increase in the risk of incident CHD and ischemic stroke and 1.5 to 3.6-fold increase in mortality.[2]

It was found that increase in age was significantly associated increase in lifelong cardiovascular risk event. Both literature as well as previous studies shows that increasing age as an important risk factor for CVD.[2]

In our current study, among the participants aged 40 years and above i.e., 34 participants, 12% of the subjects showed moderate risk (5% - 20%) of 10-year cardiovascular event. However, our study did not show any participants with high risk (>20%) at the time of the study. These results were also similar to that of the results from the study conducted in Nigeria[10] & Saudi Arabia[2], where 10% & 13.5% had intermediate or moderate risk of CVD in 10 years. Prevalence of high total CVD risk has been estimated to be less than 10% in people aged 40 or over in several LMIC countries including China 1.1%, Cuba 2.8%, Iran 1.7%, Georgia 9.6%, Nigeria 5.0%, Pakistan 10.0% and Sri Lanka, 2.2%.[2] Therefore, it is not surprising that none of our study participants had a high risk of 10-year CV event in the population.

In one cross-sectional study conducted by Khursheed Hassan et al., with 9885 participants (40–79 years old), the results indicated that 69.3% of all participants had an ASCVD risk score <7.5%.[11] It is comparable with our study were 87% of participants in 40-79 years age group had risk <5%.

In a study done among sedentary workers in an Indian city, the major risk factors for CHD were elevated triglycerides, hypertension, and high levels of serum total cholesterol.[1] When compared the same to our study subjects, majority of them had high triglyceride level, as well as elevated blood pressure leading on to an increased risk towards a cardiac hard event.

We used ASCVD risk estimator plus tool to characterize “at-risk” individuals from apparently asymptomatic population and categorize the risk into short term and long term for developing CVDs. The key initiative in developing an effective primary prevention program in a resource-limited setting like ours is to first identify the target population most likely to benefit from these interventions.[9] The WHO has recommended that in low resource settings, measures like individual counselling should be made available based on extent of cardiovascular risk.[1] In addition, we also used FRS for risk stratification of the study subjects.

Although currently used ASCVD risk estimator developed by AHA/ACC are simple and useful tool to predict the CVD risk in an individual and incorporates more information than the WHO/IHA risk charts, it is much more suited tool to estimate risk for whites and African-American. It does not take into consideration of other risk factors such as obesity and high salt intake to predict CVD risk, which are more applicable to the Indian population. Therefore, it is important to develop a comprehensive risk prediction chart for Asian population including these risk factors.

As this study was done only on healthcare workers of a single rural PHC with 71 individuals, with such a sample size it is difficult to draw any significant conclusions. Although, our

findings from the study provides useful insights on the importance of assessing CVD risk, the results cannot be generalized to all populations.

IMPLICATIONS FOR PRACTICE:

It has been well established from earlier studies that risk of cardiovascular disease increases with age, and with presence of diabetes mellitus and hypertension. Our study further adds evidence to the existing literature and in addition it identifies the risk among healthcare workers. Health education to create awareness about cardiovascular risk among these workers using their own risk scores will help them to understand better on the importance of screening the risk factors at young age and application of preventive measures, and disseminate the information to general population.

CONFLICT OF INTEREST:

None

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