ORIGINAL ARTICLE

Assessing the risk of diabetes among healthcare professionals in Mardan: a multicentre cross-sectional study using the QDiabetes® calculator

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Abstract

Objective: To evaluate the 10-year risk of developing type 2 diabetes mellitus among healthcare professionals using a risk calculator.

Method: The cross-sectional study was conducted at four public hospitals in Mardan, Pakistan, from August 2023 to January 2024, and comprised permanently employed healthcare professionals, including doctors, nurses and paramedics, of either gender aged 25-60 years. Data was collected using a modified QDiabetes questionnaire, and biochemical tests were performed. The risk of developing type 2 diabetes mellitus was calculated using QDiabetes risk calculator. Data was analysed using SPSS 22.

Results: Of the 232 subjects with mean age 35.3±8.7 years, 145(62.5%) were males and 87(37.5%) were females. The overall mean body mass index was 25.4±4.5kg/m^2. The mean QDiabetes score was 5.5±8.3%, with 167(72%) having low risk, 16(6.9%) being borderline, 35(15%) having intermediate and 14(6%) having high risk. Higher score was associated with being male, married, paramedic and having a higher body mass index ($p<0.05$). Age ($R=0.59$, $p<0.001$) and body mass index ($R=0.64$, $p<0.001$) showed moderate positive correlations with the risk score, while systolic blood pressure ($R=0.28$, $p<0.001$) and triglyceride level ($R=0.14$, $p=0.03$) had weaker associations.

Conclusion: Healthcare workers were found to be at a borderline risk of developing type 2 diabetes mellitus, with paramedics exhibiting a higher risk compared to doctors and nurses. Age and body mass index were significant predictors of the risk, while systolic blood pressure and triglyceride levels had weaker associations.

Key Words: Diabetes risk, Type 2 diabetes mellitus, Healthcare professionals, QDiabetes risk calculator, Risk factors.
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Introduction

Diabetes mellitus (DM) is recognised as a major public health issue worldwide[1], which is marked by elevated glucose levels.[2] Currently, DM is viewed as a global epidemic[3], and, according to the World Health Organisation (WHO), it is one of the four priority non-communicable diseases (NCDs).[4] Worldwide, DM prevalence is rising at an unprecedented rate. Sedentary lifestyles and obesity are the main causes of this dramatic rise.[5] Due to their hectic lifestyles and lack of time for physical activity, young people and children are developing DM at a young age.[2] DM can occur in people of all ages, genders and races, and is influenced by factors such as dietary habits, genetic makeup, and environmental conditions.[6]

In 2024, an estimated 589 million adults having age 20–79 years were living with diabetes, representing a global prevalence of 11.1%, projected to rise to 853 million (13%) by 2050, with almost 81% of cases are in the low and middle-income countries[7].

In the South-East Asia region, the number of adults with diabetes is projected to increase from 106.9 million in 2024 to 184.5 million by 2050 (73% increase), with 13.2% prevalence, 42.7% undiagnosed, and 27.8% of pregnancies affected by hyperglycaemia[8].

In Pakistan, 34.5 million people (1 in 3 adults) currently have diabetes, giving the country the highest prevalence globally in percentage terms and accounting for >40% of cases in the Eastern Mediterranean Region[9]. The number of adults with diabetes in Pakistan is projected to rise from 34.5 million in 2024 to 70.2 million by 2050, ranking the country fourth globally in total number of adults with diabetes[10].

In the prevention of type 2 DM (T2DM) and its complications, it is necessary to identify individuals with undiagnosed DM. The American Diabetes Association recommends that individuals aged 45 years or higher should be screened for T2DM every three years, more specifically those having a body mass index (BMI) of

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25kg/m^2 or higher should be screened.[11] Recently, various risk assessment scores and tools have been developed to estimate the DM risk in healthy individuals. These risk assessment scores and tools are recommended by the current practice guidelines for the prevention of DM, and are used in prevention programmes in several Western countries.[12] The QDiabetes risk calculator is a reliable tool used to assess the absolute risk of T2DM in individuals aged 25-84 years. It incorporates both established and novel risk factors.[13]

Despite the increasing prevalence of diabetes in Pakistan, there is a significant lack of targeted risk assessment and prevention strategies among healthcare workers (HCWs), who are pivotal in patient education and management. This deficiency in risk assessment and the absence of subsequent interventions may contribute to a growing DM burden among HCWs, who are already under considerable work-related stress and have limited opportunities for self-care.

The current study was planned to evaluate the 10-year T2DM risk among HCWs using a risk calculator.

Subjects and Methods

The multi-centre, cross-sectional study was conducted at four public hospitals in Mardan, Pakistan, from August 2023 to January 2024. After approval from the ethics review committee of the Advanced Studies and Research Board (ASRB) of Medical Teaching Institution (MTI) Bacha Khan Medical College (BKMC), Mardan, the sample size was calculated using OpenEpi calculator (www.openepi.com)[14] based on the formula: n=[DEFF*Np(1-p)]/[(d2/Z21-α/2*(N-1)+p*(1-p)]. The sample was raised using proportionate stratified sampling technique from among HCWs associated with Mardan Medical Complex (MMC), District Headquarters Hospital (DHQ) Mardan, Tehsil Headquarters Hospital (THQ) Takhtabhai, and Type-D Hospital Katlang. Those included were permanently employed HCWs, including doctors, nurses and paramedics, of either gender aged 25-60 years. Those excluded were individuals with a known T2DM diagnosis. The participants were asked if they had high blood sugar levels or were taking medications or following a specific diet for T2DM management. Written informed consent was obtained from all the participants prior to data collection.

Data was collected using a proforma adapted from the QDiabetes risk calculator[15], and included demographic variables, diabetes risk factors and physiological measures. Additionally, biochemical tests were conducted at the MMC laboratory for high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides (TG), total cholesterol (TC), urea and creatinine.

Data was analysed using SPSS 22 and Microsoft Excel 365. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Differences between risk-based groups were assessed using independent samples t-tests and one-way analysis of variance (ANOVA). Pearson correlation and linear regression models were utilised to investigate relationships and associations among variables. P<0.05 was considered statistically significant.

Results

Of the 232 subjects with mean age 35.3±8.7 years, 145(62.5%) were males and 87(37.5%) were females. The overall mean BMI was 25.4±4.5kg/m^2. There were 61(26.3%) doctors, 91(39.2%) nurses and 80(34.5%) paramedics. Most participants were married 163(70.3%).

Table-1: Baseline characteristics of the participants.

Baseline Characteristics	Summary
Total (N)	232
Age (mean ± SD)	35.3 ± 8.7
Gender	
Male	145 (62.5 %)
Female	87 (37.5 %)
Health Care Workers	
Doctors	61 (26.3 %)
Nurses	91 (39.2 %)
Paramedics	80 (34.5 %)
Hospitals	
Mardan Medical Complex	120 (51.7 %)
DHQ Mardan	76 (32.8 %)
THQ Takhtabhai	24 (10.3 %)
Type D Hospital Katlang	12 (5.2 %)
Marital Status	
Single	65 (28 %)
Married	163 (70.3 %)
Widowed	4 (1.7 %)
Height	168.4 ± 10.4cm
Weight	71.6 ± 13.3kg
BMI	25.4 ± 4.5kg/m^2

DHQ: District headquarters, THQ: Tehsil headquarters, SD: Standard deviation, BMI: Body mass index.

The mean height was 168.4±10.4cm, and mean weight was 71.6±13.3kg. There were 209(90.1%) non-smokers (Table 1).

Physical activity level was moderate 100(43.1%) cases. Mean systolic blood pressure (SBP) was 122.5±13.1mmHg, mean diastolic blood pressure (DBP) was 79.3±7.6mmHg, mean TC was 181.6±32.3mg/dl,

Table-2: Biophysiological measures and risk factors

Bio physiological measures	Summary
Total (N)	232
BMI (kg/m2) Categories	
<18.5	08 (3.4 %)
18.5 to 24.9	108 (46.6 %)
25.0 to 29.9	81 (34.9 %)
30.0 to 40.0	35 (15.1 %)
Systolic BP (mmHg)	122.5 ± 13.1
Diastolic BP (mmHg)	79.3 ± 7.6
Total Cholesterol Level (mg/dl)	181.6 ± 32.3
LDL Level (mg/dl)	107.1 ± 27.7
Triglyceride Level (mg/dl)	180.6 ± 82.9
HDL Level (mg/dl)	47.1 ± 12.3
Cholesterol/HDL Ratio	4.1 ± 1.4

BMI: Body mass index, BP: Blood pressure, HDL: High-density lipoprotein, LDL: Low-density lipoprotein.

nurses even though the overall majority of paramedics was in the low-risk category (Figure 1).

Significant differences in QDiabetes scores were observed with respect to gender, marital status, BMI and the heath facility the subjects were associated with, while no significant differences were noted based on smoking status or physical activity levels (Table 4).

There was a moderate positive correlation between age and the risk score (R=0.59, p<0.001). BMI exhibited a strong positive correlation (R=0.64, p<0.001). SBP showed a weaker but significant positive correlation (R=0.28, p<0.001). TG levels had a weak positive correlation with the risk score (R=0.14, p=0.03).

Linear regression analyses Showed that age was associated with an unstandardised coefficient of 0.56

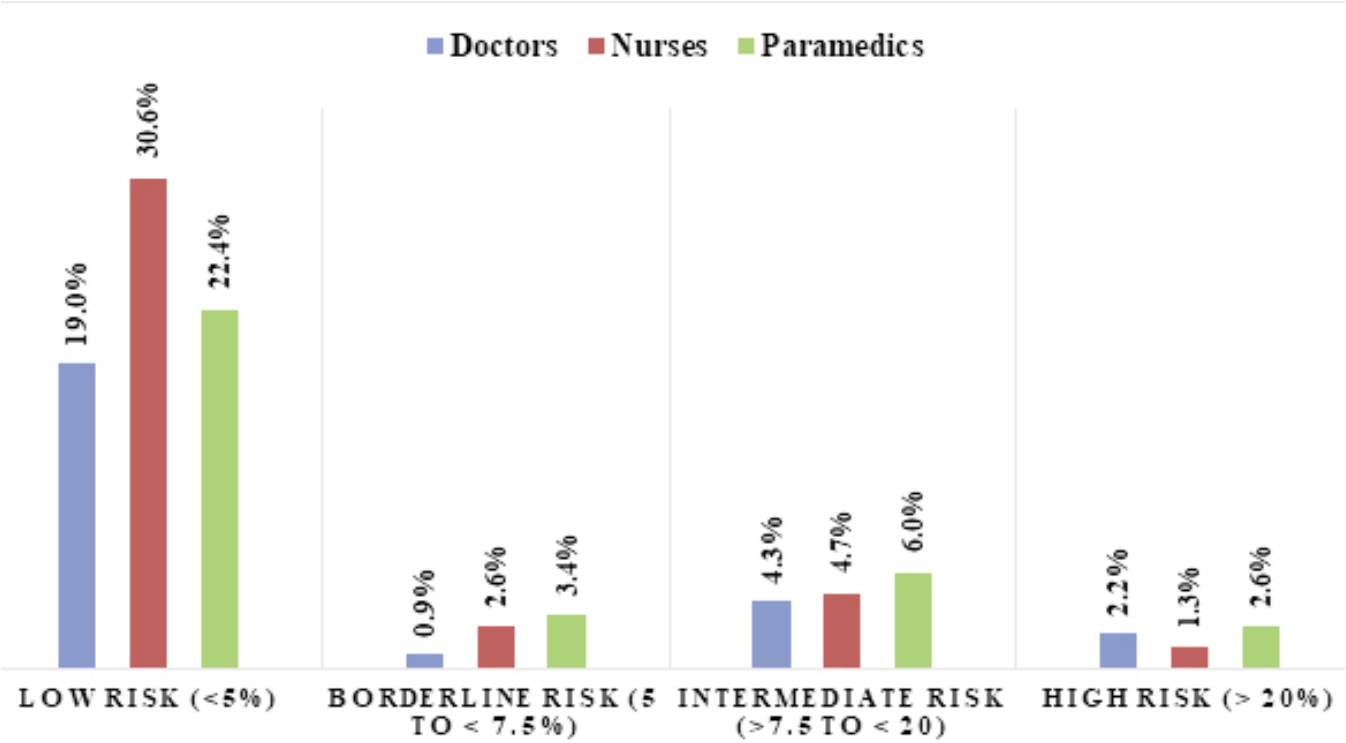

Figure-1: Diabetes risk among healthcare workers.

mean HDL was 47.1±12.3mg/dl, mean LDL was 107.1±27.7mg/dl, mean TG was 180.6±82.9 mg/dl, and mean TC/HDL ratio was 4.1±1.4 (Table 2).

The mean QDiabetes score was 5.5%±8.3 (range: 0.1-58.9%), with 167(72%) having low risk, 16(6.9%) being borderline, 35(15%) having intermediate and 14(6%) having high risk (Table 3). The risk of developing T2DM was higher in paramedics compared to doctors and

Table-3: Risk of developing type 2 diabetes among the participants.

Risk of Diabetes	Participants		Total
	Male n=145	Female n=87	n=232
Low	98 (67.6%)	69 (79.3%)	167 (72%)
Borderline	11 (7.6%)	05 (5.7%)	16 (6.9%)
Intermediate	25 (17.2%)	10 (11.5%)	35 (15.1%)
High	11 (7.6%)	03 (3.4%)	14 (6.0%)

Low: <5%, Borderline: 5-7.5%, Intermediate: >7.5-20%, High: >20%.

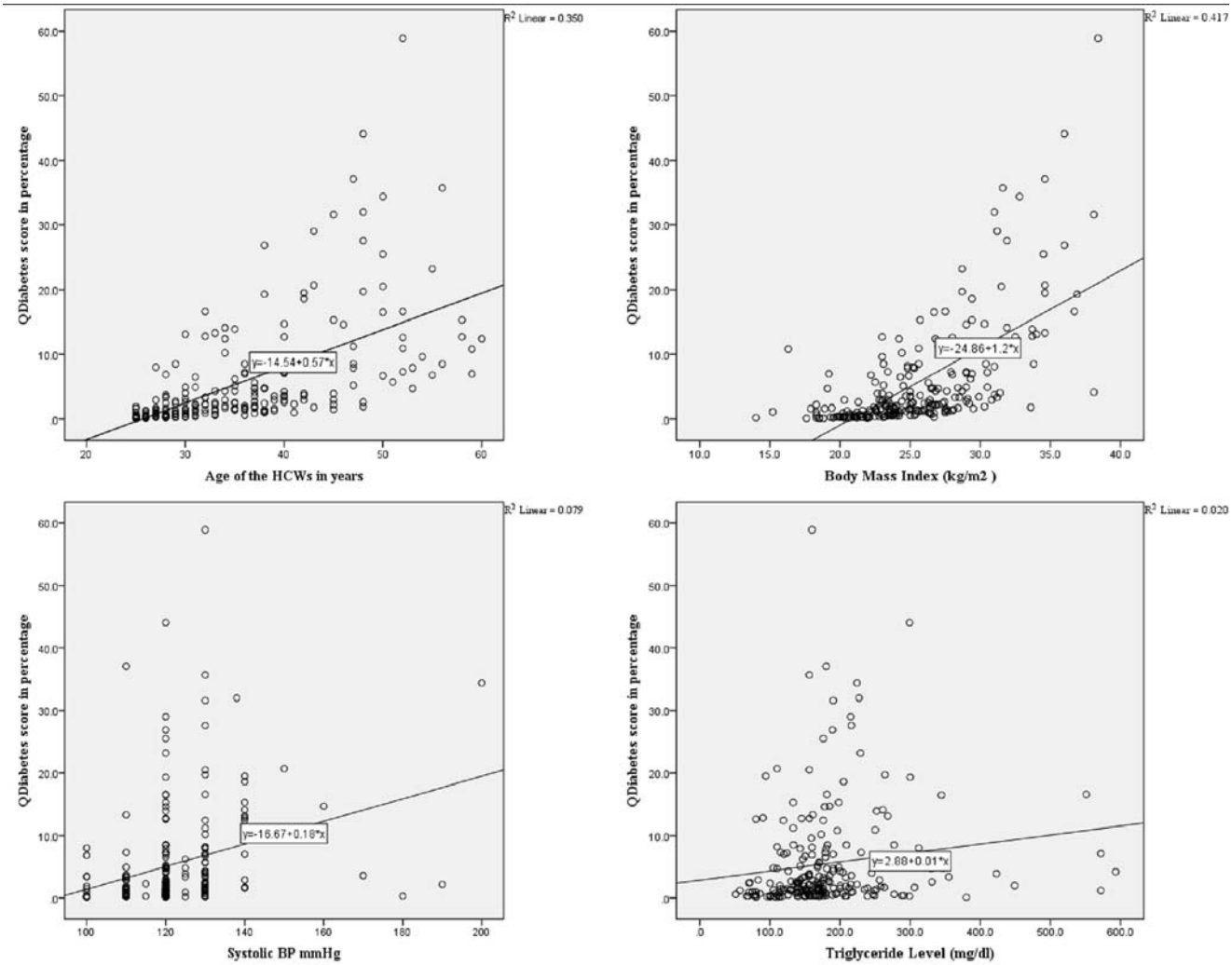

Figure-2: Scatterplot analysis of age, body mas sindex (BMI), systolic blood pressure (SBP), and triglycerides with QDiabetes risk score.

(95% confidence interval [CI]: 0.46-0.66; F=123.7[p<0.001), indicating that each additional year of age contributed to a 0.56% increase in the risk, explaining 35% of the variance (R^2=0.35). BMI exerted a more pronounced effect, with a coefficient of 1.19 (95% CI: 1.01-1.38; F=164.4; p<0.001), where each unit increase in BMI resulted in a 1.19% rise in the risk score, accounting for 41% of the variance (R^2=0.41). SBP contributed a coefficient of 0.18 (95% CI: 0.11-0.26; F=19.8; p<0.001), corresponding to a 0.18% increase in the risk score per mmHg increase in BP, explaining 8% of the variance (R^2=0.08). TG levels, with a coefficient of 0.02 (95% CI: 0.001-0.03; F=4.8; p=0.03), accounted for a 0.02% increase in the risk score per mg/dl increase in TG, explaining 2% of the variance (R^2=0.02) (Table 5, Figure 2).

Table-4: Distribution of mean QDiabetes across variables.

Variables	N	QDiabetes Score Mean ± SD	P-value
Gender			0.008
Male	145	6.6 ± 9.36	
Female	87	3.6 ± 5.97	
Marital Status			< 0.001
Single	65	1.8 ± 3.51	
Married	163	6.7 ± 8.97	
Widowed	4	15.7 ± 16.13	
Hospitals			< 0.001
MMC	120	3.1 ± 4.83	
DHQ Mardan	76	7.1 ± 10.20	
THQ Takhtabhai	24	8.3 ± 8.23	
Type D Hospital Katlang	12	14.4 ± 13.43	

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Health Care Workers			0.04
Doctor	61	6.1 ± 8.54	
Nurse	91	3.8 ± 5.94	
Paramedic	80	6.8 ± 10.17	
Body Mass Index			< 0.001
Underweight	8	2.0 ± 3.61	
Normal	108	2.1 ± 2.69	
Overweight	81	4.9 ± 5.07	
Obese	35	18.1 ± 13.63	
Smoking			0.87
Non-smoker	209	5.4 ± 8.48	
Ex-smoker	9	5.5 ± 6.32	
Light smoker	13	7.1 ± 8.26	
Moderate smoker	01	1.6	
Physical activity			0.56
Sedentary lifestyle	61	6.4 ± 8.36	
Moderate Activity	100	4.9 ± 8.06	
Active	71	5.3 ± 8.82	

* Underweight <18.5, Normal: 18.5 to 24.9, Overweight:25.0 to 29.9, Obese:30.0 to 40.0
MMC: Mardan Medical Complex, DHQ: District headquarters, THQ: Tehsil headquarters, SD: Standard deviation.

Table-5: Summary of correlation and regression analysis with QDiabetes score as the dependent variable.

Dependent Variable		QDiabetes Risk Score (%)				
Independent Variable	**Mean (SD)**	**R**	**R2**	**F**	**B (95% CI)**	**p-value**
Age (years)	35.3 (8.7)	0.59	0.35	123.7	0.56 (0.46 to 0.66)	<0.001
BMI 9kg/m2)	25.4 (4.5)	0.64	0.41	164.4	1.19 (1.01 to 1.38)	<0.001
Systolic BP (mmHg)	122.5 (13)	0.28	0.08	19.8	0.18 (0.11 to 0.26)	<0.001
Triglyceride Level	180.6 (82.9)	0.14	0.02	4.8	0.02 (0.001 to 0.03)	0.03

BMI: Body mass index, BP: Blood pressure, SD: Standard deviation, CI: Confidence interval.

Discussion

The current study revealed that the overall risk in the target population was borderline, with certain subgroups exhibiting a higher risk profile. The findings align with those of an earlier study.[1]

In the current study, the majority of participants were young, aged <40 years, which aligns with the age distribution reported earlier.[1] Additionally, the study employed proportionate sampling techniques, resulting in a participant distribution of 26.3% doctors, 39.2% nurses and 34.5% paramedics. This distribution is similar to that reported by a study[15], which had 24.4% doctors, 45.6% nurses and 30% other HCWs. However, in terms of gender distribution, the current sample of 62.5% males and 37.5% females is in contrast to the 33.4% male and 66.4% female distribution in an earlier study.[15]

In this study we reported that male is at higher risk of developing diabetes however Busari et al[1] reported that the risk of developing type 2 diabetes was higher in females than in males.

In the current study, 72% participants were at mild risk, 6.9% at borderline risk, 15.1% at intermediate risk, and 6% at high risk. This contrasts with findings from Busari et al.[1], who reported 56% participants at mild risk, 28% at slightly elevated risk, 8% at moderate risk, and 6% at high risk. Additionally, Agu et al.[16] observed a different risk distribution among local government workers, with 23.1% having low risk, 47.6% slightly elevated risk, 20.3% moderately elevated risk, and 9% having high risk.

The risk stratification in the current study revealed that paramedics, compared to doctors and nurses, had a higher QDiabetes score, which may be attributed to their working conditions, lifestyle, or socioeconomic factors. This is consistent with a previous study[17] that have shown occupational differences in diabetes risk, particularly in lower socioeconomic job roles. Moreover, the current data suggested that the risk was higher among HCWs employed at Type-D Hospital Katlang, which may reflect regional differences in lifestyle, healthcare access, or other socio-environmental factors. The significant association between higher BMI and increased QDiabetes scores reinforces the need for weight management interventions as a key strategy in diabetes prevention.

The current findings indicated that HCWs, particularly males, were at increased risk of developing T2DM, whereas Busari et al.[1] reported that the risk was higher in females. This is probably due to the difference in study settings and timeline. Regarding the BMI of the participants, the current study found a positive association in line with Agu et al.[16]

The strengths of the current study include the use of a valid risk assessment tool. Besides, the study employed a proportionate stratified sampling technique and included a multicentre approach, enhancing the representativeness and generalisability of the findings across different healthcare settings.

However, the current study has potential limitations as it relied on self-reported data for certain variables, such as smoking status and physical activity levels, which may have introduced reporting bias. Additionally, the study excluded participants on the basis of self-reported diabetes diagnosis without checking their glycated haemoglobin (HbA1c) levels.

The findings underscore the importance of targetted

preventive measures and lifestyle modifications, particularly for high-risk individuals, such as paramedics and those with a high BMI. Tailored interventions for these groups is recommended. Additionally, further research should investigate the underlying causes of these risk patterns to develop more effective and customised prevention strategies.

Conclusion

There was a borderline overall risk of developing T2DM among HCWs in Mardan, with varying risk profiles across different subgroups. Key risk factors included age and BMI, while SBP and TG showed a weaker association. Male gender and marital status were also found linked to higher risk scores.

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AUTHOR'S CONTRIBUTION:
SAU: Concept, design, data analysis, drafting and final approval.
HA: Design, data interpretation, drafting and final approval.
SA & SH: Data acquisition, revision and final approval.
SLAS: Design, data analysis, revision and final approval.