Original Article

Comparative Profiling of QRISK3 and ASCVD Risk Scores in Indian Patients with Acute Cardiovascular Disease: A Cross-Sectional Study

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Abstract

Background: Cardiovascular disease (CVD) is a major public health burden in India. However, the applicability of Western cardiovascular risk prediction models such as QRISK3 and ASCVD remains uncertain due to genetic, lifestyle, and socioeconomic differences. Comparative evaluation of these models in Indian patients with acute cardiovascular disease remains limited. The aim is to compare QRISK3 and ASCVD risk score distribution and resultant statin eligibility among Indian patients presenting with acute cardiovascular disease. **Material and Methods:** A cross-sectional observational study was conducted at ESICMC and PGIMSR, Bangalore, India, including 95 participants aged 30–79 years with acute CVD (acute coronary syndrome, cerebrovascular accident, or peripheral vascular disease). QRISK3 and ASCVD 10-year risk scores were calculated using standardized online tools. Demographic, clinical, and laboratory parameters were collected. Statistical analysis included descriptive statistics, Chi-square tests, and ANOVA using IBM SPSS version 29.0. **Results:** The mean age was 57.13 ± 10.14 years and 77.9% were male. QRISK3 classified 47.4% of participants as high risk (>20%), whereas ASCVD classified 36.8% as high risk. Smoking and BMI showed significant associations with QRISK3 risk categories, while diabetes mellitus was significantly associated with ASCVD risk categories. No significant association was observed between blood pressure categories and either risk score. Statin eligibility differed between the models, with 87.4% eligible using QRISK3 compared with 77.9% using ASCVD thresholds. **Conclusion:** QRISK3 and ASCVD demonstrate differing patterns of cardiovascular risk stratification and statin eligibility in Indian patients with acute cardiovascular disease. These findings highlight limitations of applying Western-derived risk prediction models to South Asian populations and emphasize the need for population-specific cardiovascular risk assessment tools. Further validation in larger prospective cohorts is warranted.

Keywords: Risk stratification; Statin eligibility; Smoking; Obesity; Diabetes mellitus.

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Introduction

Cardiovascular disease (CVD) is a leading cause of morbidity and mortality worldwide, with a disproportionately high and growing burden in South Asia.[1] In India, the age of onset of first myocardial infarction is approximately a decade earlier than in Western populations.[2] This epidemic contributed to 60% of the 18.6 million global cardiovascular deaths in 2019.[3] International guidelines recommend the use of risk prediction tools to identify high-risk individuals for preventive interventions.[4] The ASCVD (Atherosclerotic Cardiovascular Disease) Pooled Cohort Equations, recommended in the United States, were developed primarily from cohorts of non-Hispanic White and African American individuals.[5] Conversely, the United Kingdom recommends QRISK3, derived from a large, diverse community population, which includes additional variables such as severe mental illness and chronic kidney disease.[6]

The QRISK3 (QRESEARCH risk estimator Version 3) and ASCVD (Atherosclerotic Cardiovascular Disease) risk scores are two widely used tools to estimate the 10-year risk of cardiovascular events. QRISK3 is a model developed in the United Kingdom, which incorporates demographic, clinical, and lifestyle variables, including risk factors particularly relevant to modern populations, such as severe mental illness, migraine, and corticosteroid use. In contrast, the ASCVD risk score, introduced by the American College of Cardiology and the American Heart Association, is widely used in the United States and focuses on traditional risk factors such as age, blood pressure, smoking status, and lipid levels.[7-11] Despite their effectiveness in Western populations, the applicability of these models to the Indian population is uncertain due to significant differences in genetic, lifestyle, and socioeconomic factors.[12] Indian individuals often exhibit unique cardiovascular risk factors, such as an increased prevalence of metabolic syndrome and type 2 diabetes, even at lower BMI levels.[13] Additionally,

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the risk thresholds in QRISK3 and ASCVD models may not align with the Indian demographic, potentially leading to under- or over-estimation of cardiovascular risk.[14,15] Statin therapy is considered an important preventive measure and has been recommended for patients who are at high risk of Cardiovascular disease .In Indian clinical settings, the ASCVD score is commonly used to determine statin eligibility , yet a direct comparison with QRISK3 in patients presenting with acute CVD - a critical group for secondary prevention is lacking.[16] Recent large epidemiological studies have demonstrated that India bears a disproportionately high burden of cardiovascular disease compared with high-income countries, with earlier age of onset and higher cardiovascular mortality rates.[17-25] Indian populations exhibit a high prevalence of diabetes mellitus and metabolic syndrome, which substantially increase cardiovascular risk even at lower body mass index levels compared to Western populations.[18,22] South Asian populations demonstrate distinct cardiovascular risk profiles, including higher insulin resistance and atherogenic dyslipidemia, raising concerns regarding the accuracy of Western cardiovascular risk prediction models in this population.[19] Current international cholesterol management guidelines recommend statin therapy based on estimated cardiovascular risk, forming the basis for treatment thresholds used in ASCVD and QRISK3 risk assessment tools.[24]

These findings further support prior recommendations emphasizing the need for recalibration or development of cardiovascular risk prediction models tailored specifically to Indian and South Asian populations.[17,19]

Therefore, this cross-sectional study aims to compare the QRISK3 and ASCVD risk scores—tools designed for primary prevention—in terms of their distribution, associated risk factors, and implications for statin eligibility in an Indian cohort presenting with acute cardiovascular disease. This comparison may inform the pragmatic use of these tools in clinical settings and underscore the need for a validated, India-specific risk assessment model.

Materials and Methods

A hospital-based, cross-sectional observational study was conducted in the Department of General Medicine at ESICMC AND PGIMSR, Bangalore, India over a period of 12 months from [June, 2023] to [June, 2024]. The study was approved by the Institutional Ethics Committee (IECNo:532/L/11/12/Ethics/ESICMC&PGIMSR/eSTT.vOL IV/24-B/2024). Written informed consent was obtained from all participants prior to enrollment.

Inclusion Criteria: Patients aged 30–79 years admitted with a confirmed new diagnosis of acute cardiovascular disease, defined as acute coronary syndrome (diagnosed by clinical presentation, ECG changes, and troponin elevation), cerebrovascular accident (diagnosed by clinical assessment and neuroimaging), or peripheral vascular disease (diagnosed by clinical assessment and angiography/Doppler studies).

Exclusion Criteria: Pregnancy, advanced chronic kidney disease (stage 4 or 5), active malignancy, other severe comorbidities limiting life expectancy, or current use of lipid-modifying medications (e.g., statins).

Participants: A total of 95 participants were enrolled using a convenience sampling method.

Data Collection and Risk Score Calculation: Demographic data (age, gender), clinical parameters (blood pressure, body mass index, smoking status, personal history of hypertension, diabetes mellitus, atrial fibrillation, migraine, rheumatoid arthritis, severe mental illness, family history of premature CVD). The 10-year cardiovascular risk was calculated for each participant using the online QRISK®3 calculator (https://qrisk.org/three/) and the ASCVD Risk Estimator Plus (https://tools.acc.org/ascvd-risk-estimator-plus/). For analysis, QRISK3 scores were categorized as: low (<10%), intermediate (10-20%), and high (>20%) based on UK NICE guideline thresholds for statin consideration.[10] ASCVD scores were categorized as: low (<5%), borderline (5-<7.5%), intermediate (7.5-<20%), and high (≥20%) based on ACC/AHA guidelines.[5] Statin eligibility was defined as a score ≥10% for QRISK3,[10] and ≥7.5% for ASCVD.[5] It is acknowledged that the QRISK3 and ASCVD tools are designed and validated for primary prevention in individuals without established CVD. In this study, they were applied to a cohort with acute CVD to analyze the comparative distribution of calculated scores and their association with risk factors, rather than to validate their predictive accuracy for future events in this population

Study Design: Cross-Sectional Observation Study.

Statistical Analysis: Data were analyzed using IBM SPSS Statistics (Version 29.0). Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The Chi-square test was used to assess associations between categorical risk factors and risk score categories. Analysis of Variance (ANOVA) was used to compare means across groups, following confirmation of normality assumptions using the Shapiro-Wilk test. A p-value of <0.05 was considered statistically significant. This study is limited by the lack of model performance metrics (e.g., c-statistic, calibration) due to its cross-sectional design in an acute CVD cohort.

Results

A total of 95 patients with acute cardiovascular disease were included in the study. The study population consisted predominantly of middle-aged males presenting with a spectrum of acute atherosclerotic conditions.

Table 1: Distribution of different cardiovascular disease in the study population.

Diagnosis	total
Cerebrovascular accident	38
Acute coronary syndrome	42
Peripheral vascular disease	15

Acute coronary syndrome was the most common presentation , followed by cerebrovascular accident and

peripheral vascular disease as in [Table 1].

Table 2: Baseline Clinical and Laboratory Characteristics.

Study variables	Number of participants
	(N) %
Gender	
Male	74 (77.9%)
Female	21 (22.1%)
Risk factors	
Diabetes Mellitus	38 (40%)
Chronic kidney Disease stage 1-3	13 (13.7%)
Family history of cv event in first degree relative	22 (23.2%)
Hypertension	45 (47.4%)
Atrial fibrillation	08 (8.40%)
Migraine	14 (14.7%)
Rheumatoid arthritis	1 (1.05%)
Smoking	54 (56.8%)
	MEAN ± SD
Age	57.13 ± 10.14
Systolic blood Pressure (mm hg)	127.86 ± 22.04
Diastolic blood Pressure (mm hg)	81.68 ± 10.23
Total cholesterol (mg/dl)	177.78 ± 49.29
Low density Lipoprotein (ldl)	106.60 ± 33.9
High density Lipoprotein (hdl)	39.93 ± 12.08
Body mass index (kg/m²)	26.70 ± 3.42

[Table 2] summarizes the baseline clinical characteristics and cardiovascular risk profile of the study cohort. Traditional risk factors such as hypertension, diabetes mellitus, and smoking were common, and the overall profile reflected a predominantly overweight population with dyslipidemia features consistent with increased cardiometabolic risk.

Table 3: Distribution of QRISK3 Scores

QRISK3 SCORE	Frequency(N) Percentage (%)
Low (<10%)	12 (12.6%)
Intermediate (10-20%)	38 (40%)
High (>20%)	45 (47.4%)
Total	95(100%)

[Table 3] shows the distribution of QRISK3 risk categories in the study cohort, with a substantial proportion classified into higher-risk groups.

Table 4: Distribution of ASCVD Risk Scores

ASCVD score	Frequency (n) Percentage (%)
Low (<5%)	11 (11.60%)
Border line (5-10%)	10 (10.50%)
Intermediate (10-20%)	39 (41.10%)
High (>20%)	35 (36.80%)
Total	95 (100%)

[Table 4] depicts the distribution of ASCVD risk categories in the cohort, with a considerable proportion falling into the intermediate to high-risk groups.

Table 5: Association Between QRISK3 Risk Score and Diabetes Mellitus

QRISK3 Category	Type 2 DM – No (n)	Type 2 DM – Yes (n)
Low	11	1
Intermediate	21	18
High	25	19
Total	57	38

Table 6: Association Between ASCVD Risk Score and Diabetes Mellitus

ASCVD Category	Type 2 DM – No (n)	Type 2 DM – Yes (n)
Low	11	0
Borderline	6	4
Intermediate	23	16
High	17	18
Total	57	38

A statistically significant association was observed between ASCVD risk categories and diabetes mellitus (χ^2 = 9.26, p = 0.026). In contrast, the association between QRISK3 risk categories and diabetes mellitus was borderline significant (χ^2 = 5.97, p = 0.051), suggesting a weaker relationship between diabetes and QRISK3 risk stratification in the study population [Table 5-6].

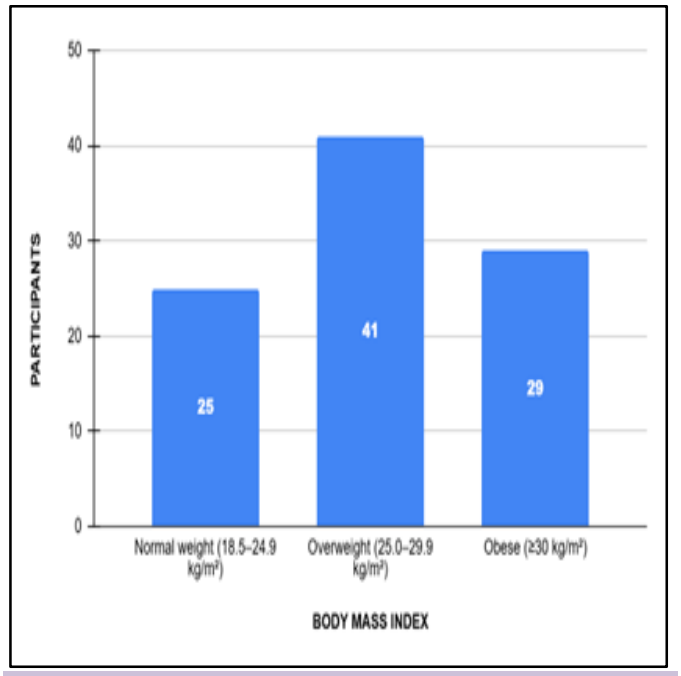

Figure 1: Distribution of Body Mass Index (BMI) Categories Among Study Participants

The majority of study participants were either overweight or obese, indicating a high prevalence of increased body mass index among patients with acute cardiovascular disease. This finding highlights the important contribution of excess body weight as a cardiovascular risk factor in the study population. [Figure 1]

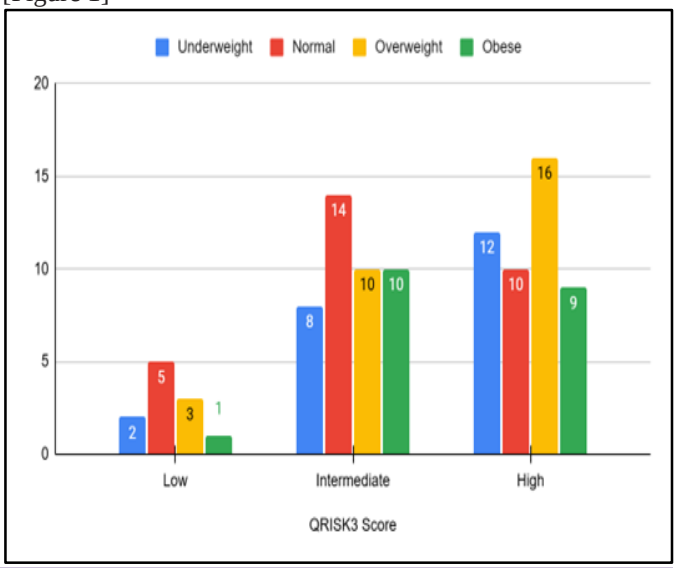

Figure 2: Table showing distribution of BMI and QRISK3 scores. (Low <10%, Intermediate 10-20% and High risk >20%)

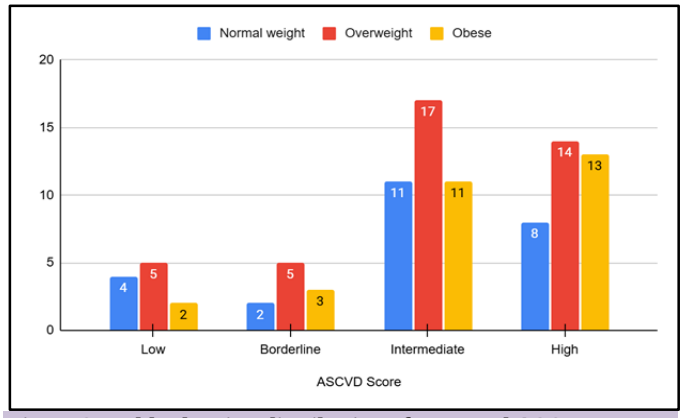

Figure 3: Table showing distribution of BMI and ASCVD scores. (Low <10%, Intermediate 10-20% and High risk >20%)

Mean BMI of the study population was 26.70 ± 3.42 kg/m². Higher BMI categories were more frequently observed in intermediate and high QRISK3 risk groups. Chi-square analysis showed a statistically significant association between BMI and QRISK3 risk categories (χ^2 = 7.20, p = 0.027). However, the association between BMI and ASCVD risk categories was not statistically significant (χ^2 = 1.98, p = 0.140). [Figure 2,3]

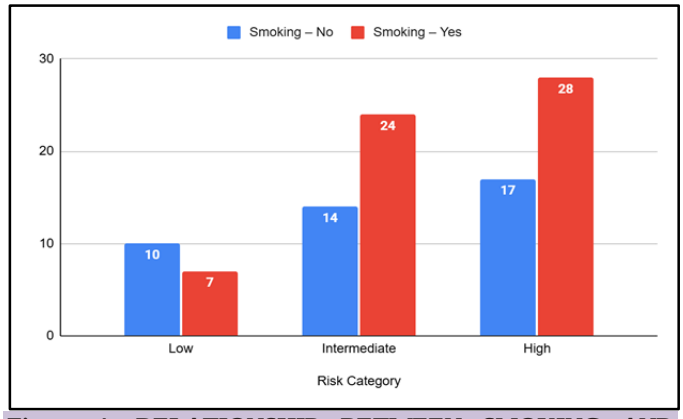

Figure 4: RELATIONSHIP BETWEEN SMOKING AND QRISK3

(Low <10%, Intermediate 10-20% and High risk >20%)
With a χ^2 = 6.51; p-value: 0.0109 (statistically significant), Smoking is associated with higher QRISK3 scores.

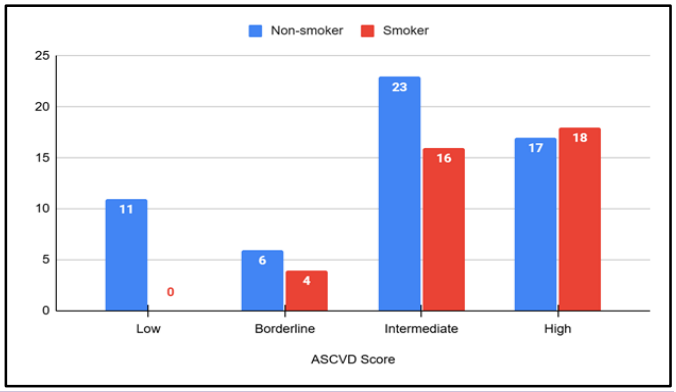

Figure 5: Relationship Between SMOKING and ASCVD (Low <5%, Borderline 5-7.4%, Intermediate 7.5-20%, High >20%).

With a χ^2 = 2.10; p-value: 0.161 (statistically insignificant), smoking does not appear to have a statistically significant relationship with ASCVD score.
Smoking was associated with higher QRISK3 scores whereas no significant association was observed with ASCVD scores.

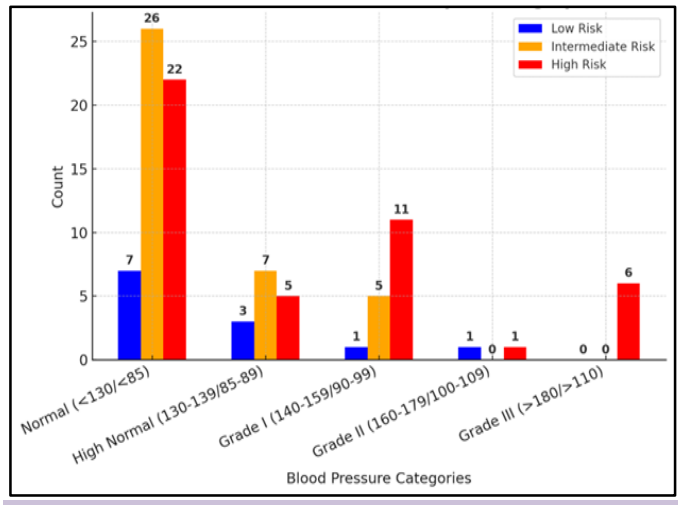

Figure 6: Distribution of QRISK3 Risk Categories According to Blood Pressure Categories.

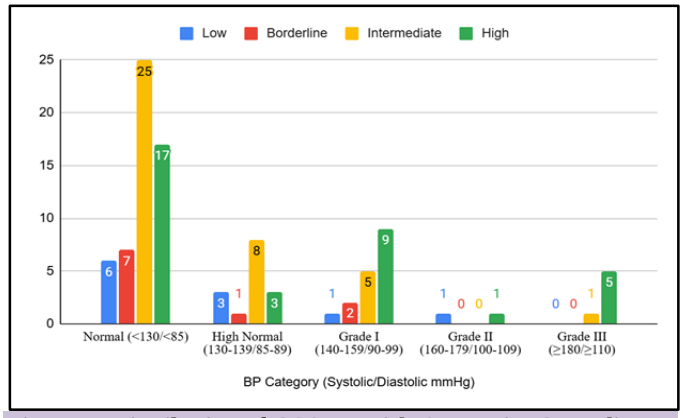

Figure 7: Distribution of ASCVD Risk Categories According to Blood Pressure categories.

QRISK3 and ASCVD risk categories were compared across blood pressure groups. Higher BP categories showed more participants in intermediate and high-risk groups. However, the association was not statistically significant for QRISK3 (χ^2, p = 0.066). Similarly, no significant association was observed for ASCVD risk categories (χ^2, p = 0.213). Overall, BP categories did not show a statistically significant relationship with either risk score. [Figure 6,7].

Table 7: Statin Eligibility Among Participants of ASCVD and QRISK3 Scores

Risk Tool	Statin eligibility threshold	Eligible (n)	Eligible (%)
QRISK3	≥10%	83	87.40%
ASCVD	≥7.5%	74	77.90%

Based on guideline-recommended thresholds, 83 (87.4%) participants were eligible for for statin therapy according to QRISK3 criteria. In contrast, 74 (77.9%) patients categorized as intermediate or high risk by ASCVD were eligible for statin therapy, indicating a substantially higher statin eligibility rate when QRISK3 criteria were applied [Table 7]

Discussion

QRISK3 classified a higher proportion of participants as high risk compared to ASCVD. QRISK3 risk categories showed statistically significant associations with smoking and obesity, with a borderline association with diabetes mellitus, whereas ASCVD demonstrated a strong association with increasing age and a statistically significant association with diabetes mellitus. These findings suggest that QRISK3 may better reflect the contribution of lifestyle and metabolic risk factors, while ASCVD appears to be more strongly influenced by age and diabetes-related risk in this cohort.
In the present study, the mean age of participants was 57.13 ± 10.14 years, with a marked male predominance (77.9%). Acute coronary syndrome was the most common presentation, followed by cerebrovascular accident and peripheral vascular disease. These findings are consistent with previous Indian epidemiological studies that report earlier onset of cardiovascular disease and higher prevalence among males compared to Western populations.[9,13,23] Prabhakaran et al,[9] and Gupta et al,[23] have highlighted the disproportionately higher burden of CVD in Indian men, often presenting nearly a decade earlier than Western cohorts. Similarly, the INTERHEART study demonstrated a high contribution of modifiable risk factors in South Asians at younger ages,[15] supporting the demographic pattern observed in our cohort.
In our study, traditional cardiovascular risk factors such as hypertension (47.4%), diabetes mellitus (40%), and smoking (56.8%) were highly prevalent. QRISK3 risk categories showed significant associations with smoking (χ^2 = 6.51, p = 0.011) and obesity (χ^2 = 7.20, p = 0.027), while the with QRISK3 (χ^2 = 8.82, p = 0.066) than with ASCVD (χ^2 = 5.80, p = 0.213), although these relationships were not statistically significant. These findings suggest that QRISK3 may better capture lifestyle and metabolic risk factors, whereas ASCVD appears to be more strongly influenced by age and diabetes-related cardiovascular risk. These observations are consistent with previous studies indicating that South Asian populations exhibit higher metabolic risk even at lower body mass index levels.[14,21] Misra and Shrivastava,[14] described the characteristic pattern of atherogenic dyslipidemia and central obesity in South Asians, which may influence cardiovascular risk prediction differently across models. Furthermore, Joshi et al,[13] demonstrated that diabetes is a major contributor to early myocardial infarction in South Asians, supporting the associations observed in both QRISK3 and ASCVD categories in our study.
Regarding risk stratification patterns, QRISK3 classified 47.4% of participants as high risk (>20%), whereas ASCVD classified 36.8% as high risk. QRISK3 identified a larger proportion of patients as eligible for statin therapy (87.4%)

compared to ASCVD (77.9%), even with lower statin initiation thresholds (≥7.5%). Similar discrepancies between risk prediction models have been reported in comparative studies evaluating pooled cohort equations and QRISK3 in diverse populations.[19,22] Patel et al,[22] questioned the calibration of Western-derived models in South Asians, suggesting possible over- or underestimation of cardiovascular risk. Additionally, WHO risk chart revisions,[16] emphasize the importance of regional calibration, further supporting the variation observed between ASCVD and QRISK3 classifications in our study.

Limitations: A major limitation of the present study is the application of primary prevention risk calculators to a secondary prevention population. Both ASCVD and QRISK3 were developed and validated in individuals without established cardiovascular disease.[5,6] Therefore, our findings should be interpreted as a comparative assessment of risk score distribution rather than validation of predictive accuracy. Given the earlier age of onset, higher prevalence of diabetes, and distinct metabolic characteristics in Indian populations,[9,14] there is a compelling need for recalibration or development of an indigenous cardiovascular risk prediction model tailored to South Asian populations.

Conclusion

QRISK3 and ASCVD risk prediction models demonstrated different patterns of cardiovascular risk stratification in Indian patients with acute cardiovascular disease. QRISK3 showed stronger associations with lifestyle and metabolic risk factors such as smoking and obesity, whereas ASCVD risk categories were more strongly associated with diabetes mellitus and age. Differences in statin eligibility were also observed between the two models. These findings highlight the limitations of applying Western-derived cardiovascular risk prediction tools directly to South Asian populations. The results underscore the need for recalibration or development of population-specific cardiovascular risk prediction models for the Indian population to improve risk assessment and guide preventive therapy.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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