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APPLICATION OF THE QRISK HEART AGE CALCULATOR IN INDIAN CLINICAL SETTINGS

Cardiology

Dr. Krishna Kumar Dhoot	MBBS, MD, DNB, Director, Hrudaysparsh Heart Care Centre, Pune, India.
Dr. Sriniwas Kudva	MBBS, MD (General Medicine), Diplomate of National Board (Cardiology), Lilavati Hospital and Research Centre, Mumbai, India.
Dr. Abhay Suresh Jain	MBBS, DNB (General Surgery), MCh (Cardiovascular and Thoracic Surgery), Consultant Cardio Thoracic Vascular Surgery, Fortis, Mulund, India.
Dr. Ayan Kar	MBBS, DNB (General Medicine), DNB (Cardiology), Interventional Cardiologist, Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata, India.
Dr. Arindam Pande	MBBS, MD, DM, FICC, FSCAI, FESC, FACC, FRCP, Senior Consultant Cardiologist, Manipal E.M. Bypass Hospital, Kolkata, India.
Dr. Ankur Gupta	MBBS, MD, DM, FSCAI (USA), Senior Consultant Interventional Cardiologist, Paras Health, Panchkula, Haryana, India.
Dr. Vikas Singh	MD, DM (Cardiology), FACC, FSCAI, FAPSIC, FCSI, FICP, Senior Intervention Cardiologist, Daksh Heart Care and Mediversal Hospital, Patna, India.
Dr. Gautam Swaroop	MBBS (Gold Medalist, Chancellor's Medal), MD (Medicine), DM (Cardiology), FACC, FSCAI, FAPSIC, Interventional Cardiologist and Director, Cardiac Sciences at Tender Palm Super Specialty Hospital, Lucknow.
Dr. Rahul Patil	MBBS, MD (General Medicine), DM (Cardiology), Interventional Cardiologist, Internal Medicine, United Hospital, Bangalore, India.
Dr. Chetan Gharat*	MD, Medical Affairs, Lupin Digital Health Limited, Mumbai, Maharashtra, India. *Corresponding Author

ABSTRACT

Introduction: Heart age reflects the predicted age of a person's vascular system based on their cardiovascular (CV) risk factor profile, including the estimated 10-year risk of heart attack or stroke. This study aimed to evaluate heart age and CV risk using the QRISK3 calculator in an Indian setting. **Methods:** This retrospective cross-sectional study was conducted in India. The QRISK3-2018 calculator (https://www.qrisk.org/) was used to estimate 10-year cardiovascular disease (CVD) risk and heart age. Patients' variables, including gender, height, weight, systolic blood pressure (SBP), diabetes mellitus (DM), smoking status, atrial fibrillation (AF), and chronic kidney disease (CKD), were manually entered into the calculator. **Results:** A total of 4,663 records were reviewed, with QRISK3 scores calculated for 4,530 patients; 133 were excluded due to incomplete data. The majority is male (64.7%). The mean (standard deviation) age and heart age were 55.3 (12.6) years and 59.6 (13.1) years, respectively. The mean (standard deviation) SBP of patients was 120.5 (14.8) mmHg. Most patients (85.3%) were non-smokers, while 10.1% quit smoking and 4.5% were current smokers. The DM was present in 35.7%, CKD in 2.4%, and AF in 2.0% of patients. The median (range) of the QRISK score was 9.8 (0.10-50.00). A higher proportion of females (63.7%) were in the low-risk group compared to males (43.2%) [P<0.001]. The QRISK3 score was strongly correlated with age (r=0.893), heart age (r=0.978), and weakly with SBP (r=0.172) (P<0.001 for all). **Conclusion:** The QRISK score reported positive correlations with age, heart age, and a weak but significant correlation with SBP. Higher CV risk was more prevalent among males, smokers, and patients with diabetes, CKD, or AF. Risk distribution varied significantly by gender, smoking status, and comorbidities.

KEYWORDS

Cardiovascular Disease, Atrial Fibrillation, Chronic Kidney Disease, Systolic Blood Pressure.

INTRODUCTION

Cardiovascular diseases (CVDs) are among the leading causes of death worldwide [1]. They result primarily from atheromatous changes in the blood vessels supplying the heart, giving rise to a spectrum of clinical disorders ranging from asymptomatic atherosclerosis and stable angina to acute coronary syndrome, including unstable angina, non-ST-segment elevation myocardial infarction, and ST-segment elevation myocardial infarction [2].

The risk factors for CAD, a major type of CVD, are categorized into modifiable and non-modifiable types. Modifiable risk factors include physical inactivity, obesity, tobacco use, smoking, high-fat diet, hyperlipidemia, stress, hypertension, and diabetes mellitus (DM). Non-modifiable risk factors include age, gender, family history, socioeconomic status, and ethnicity [3]. According to the American Heart Association's Global Cardiovascular Disease Statistics report of South Asia, the age-standardized rate of CVD-related and all-cause disability-adjusted life years in India was 6,171 per 100,000 persons in 2021 [4]. This highlights the significant burden of CVD in the region.

Heart age is a concept that refers to the predicted age of a person's vascular system based on their CVD risk profile [5]. It is often used to estimate the risk of a heart attack or stroke over the next 5-10 years. Heart age calculators are frequently employed as motivational tools to enhance public awareness about CVD risk factors and encourage follow-up action [6].

One widely used tool for assessing CVD risk is the QRISK3 2018 algorithm. Developed in the United Kingdom by the QRISK algorithm development group, a collaboration of researchers, clinical experts, and the primary care sector. The QRISK3 is based on a large dataset of electronic health records from general practices. It calculates an individual's 10-year risk of developing CVD by incorporating over 50 variables, including traditional risk factors such as age, sex, total cholesterol, high-density lipoprotein cholesterol, systolic blood pressure (SBP), smoking status, and whether or not the individual has diabetes. The QRISK3 also includes factors such as ethnicity, family history of CVD, and the use of hypertensive medication, making it a comprehensive and personalized risk assessment tool [7].

The current study has evaluated the applicability and relevance of QRISK3-derived heart age in an Indian population, highlighting

potential implications for cardiovascular (CV) risk stratification and preventive healthcare planning.

METHODS

Study Design and Population

This was a retrospective, single-center, cross-sectional study conducted in India. Patients were adults aged ≥25 of Indian ethnicity with sufficient clinical data available to compute QRISK3 scores. Patients with missing data were excluded. Data was manually extracted from patient records.

Definitions

Heart age: Heart age is an estimate of the age of a healthy person with the same CV risk profile. It was automatically generated by the QRISK3 calculator alongside the 10-year risk [8].

QRISK3-2018 Calculator

QRisk scores and heart age were calculated using the QRISK3-2018 risk calculator (https://www.qrisk.org/). Patients were categorized, and QRISK was solely based on gender, height, weight, systolic blood pressure (SBP), presence or absence of diabetes mellitus (DM), current smoking status, history of atrial fibrillation (AF), and chronic kidney disease (CKD). These variables were manually entered into the QRISK3 online tool to estimate the 10-year CV risk (%) and the heart age. In this study, QRISK3 stratified patients into three risk categories based on their calculated 10-year CVD: low risk (<10%), moderate risk (10–20%), and high risk (>20%) [9].

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS), version 23.0. Descriptive statistics were used to summarize the study outcomes. Continuous variables were reported as mean and standard deviation (SD), while categorical variables were presented as numbers and percentages. The P<0.001 was considered statistically significant. Spearman's correlation coefficient (r) was calculated to see the relationship of QRISK with age, heart age, SBP, height, and weight.

RESULTS

Study Population and Demographics

A total of 4,663 patient records were collected for the study. However, the QRISK3 score was calculated for only 4,530 patients, as the data for the remaining 133 patients were incomplete and insufficient for accurate risk calculation. The majority of patients were male (64.7%). The mean (SD) age and heart age were 55.3 (12.6) years and 59.6 (13.1) years, respectively. The mean (SD) height was 164.1 (9.2) cm, and the mean (SD) weight was 70.9 (14.4) kg. Regarding smoking status, 85.3% patients had never smoked, 10.1% quit smoking, and 4.5% were current light smokers. Diabetes mellitus was present in 35.7% of patients. The AF and CKD were present in 2.0% and 2.4% of patients, respectively. The mean (SD) SBP of patients was 120.5 (14.8) mmHg. The median (range) of the QRISK3 score was 9.8 (0.10-50.00) [Table 1].

QRISK®3 Distribution

A higher proportion of females (63.7%) were in the low-risk group compared to males (43.2%), whereas a greater proportion of males fell into the moderate (30.4%) and high-risk (26.3%) groups compared to females (23.5% and 12.7%, respectively). This difference in QRISK score distribution between genders was statistically significant (P<0.001). The proportion of individuals in the high-risk group was highest among those who quit smoking (31.7%), compared to light smokers (21.7%) and non-smokers (20.3%). Conversely, the proportion of low-risk individuals was highest among never smokers (51.4%) and lowest among those who had quit smoking (44.0%). The QRISK score distribution varied significantly by smoking status (P<0.001). Among patients with diabetes, a considerable proportion were in the high-risk group (35.3%), with nearly equal distribution with the moderate risk (35.8%) group. In patients with CKD, the majority (63.6%) were classified as high-risk, while only 14.5% were in the low-risk group. Similarly, among those with AF, nearly half (47.8%) were in the high-risk group, whereas only 22.2% were categorized as low risk. The distribution of the QRISK score varied significantly among patients with diabetes, CKD, and AF (P<0.001 for all) [Table 2].

Statistical Analysis

A very strong positive correlation was observed between the QRISK score and age (r=0.893) as well as heart age (r=0.978), both of which were statistically significant (P<0.001). These findings indicate that CV risk increases markedly with both age and heart age. A weak but statistically significant positive correlation was also observed between QRISK score and SBP (r=0.172, P<0.001) [Figure 1].

DISCUSSION

The current study supports the existing evidence that South Asian patients have a heightened risk of developing CVD. Furthermore, among individuals with existing CVD, South Asian ethnicity may be associated with an increased risk of mortality compared to other ethnic groups [10].

In the MARK survey, it was hypothesized that the QRISK3 calculator would identify a high CVD risk in at least 50% of asymptomatic patients with T2DM [10]. The QRISK3 2018 is a CV risk prediction tool designed to estimate an individual's 10-year risk of developing CVD [7]. Developed in the UK, QRISK3 is considered more appropriate for assessing CV risk in Indian individuals. Notably, QRISK3 includes an option to specify "Indian" ethnicity, enhancing its relevance and accuracy for this population [11].

In the present study, the mean age was 55.29 years, which is comparable to findings from other studies reporting a mean age of approximately 60 years [7,12,13]. Additionally, 64.7% of participants were male, which is consistent with Chandrawanshi V. et al., who reported 62.6% male participation in their study [11]. The smoking patterns in the current study were also comparable to those reported by Ghosal S. et al., who found that 76.1% of patients had never smoked, 9.8% had quit, and 8.8% were current light smokers [10]. The median QRISK score range in the present study was 9.8%, whereas Ghosal et al. reported a higher median score of 20.6% [10].

Among male participants, 43.2% had a low QRISK score, 30.4% had a moderate score, and 26.3% had a high score. These findings suggest that over half of the male patients fall into the moderate-to-high-risk categories, highlighting the significant burden of CV risk in this population. In contrast, 63.7% of female patients had a low QRISK score, indicating a comparatively lower CV risk. Comorbidities were more prevalent among patients with high QRISK scores. Specifically, 35.8% of diabetic patients had a moderate QRISK score, while 35.3% had a high-risk score, suggesting a strong association between diabetes and elevated CV risk. Higher diabetes prevalence also corresponded with increased QRISK scores and higher heart age.

Among patients with CKD, 63.6% had a high QRISK score, while 47.8% of those with AF also fell into the high-risk score category. These results highlight the contribution of CKD and AF, both components of QRISK calculation, to elevated CV risk. A strong association exists between these comorbidities and elevated CV risk. Chronic kidney disease and AF are important risk factors that are part of the QRISK3 calculation. Their presence increases the chance of developing heart problems in the future. Finally, a positive correlation was observed between QRISK score and both age and SBP. As age and SBP increased, so did the QRISK score. Similar trends were reported by Chandrawanshi V. et al., who found a statistically significant positive correlation of age and SBP QRISK [11].

Strengths and Limitations

This study's strengths include a large sample size, use of the validated QRISK3 calculator, and a focus on an underrepresented Indian population. It provides valuable insights into heart age and CV risk distribution across key subgroups. However, the retrospective, single-center design, exclusion of incomplete records, and lack of further follow-up data limit the generalizability and ability to assess actual CV outcomes.

CONCLUSION

The QRISK3 effectively identified elevated CV risk and heart age in Indian patients. Higher risk was linked to age, male gender, smoking, and comorbidities such as diabetes, CKD, and AF. These findings support the use of QRISK3 for early risk stratification and prevention in high-risk groups.

Conflict of Interest: Chetan Gharat is an employee of Lupin Digital Health Ltd., Mumbai, Maharashtra, India. All other authors have no conflicts of interest to disclose.
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Table 1: Baseline Characteristics

Parameters	Number of patients (N=4664)
Gender [n=4663]	
Male	3016 (64.7)
Female	1647 (35.3)
Age (years), mean (SD) [n=4663]	55.3 (12.6)
Heart Age (years), mean (SD) [n=4528]	59.6 (13.1)
Height (cm), mean (SD) [n=3116]	164.1 (9.2)
Weight (kg), mean (SD) [n=3240]	70.9 (14.4)
Smoking status, [n=4663]	
Never	3978 (85.3)
Light	212 (4.5)
Quit	473 (10.1)
Atrial fibrillation, [n=4663]	
Present	93 (2.0)
Absent	4570 (98.0)
Chronic kidney disease, [n=4663]	
Present	112 (2.4)
Absent	4551 (97.6)
Diabetes, [n=4663]	
Present	1664 (35.7)
Absent	2999 (64.3)
Systolic blood pressure (mmHg), mean (SD) [n=2355]	120.5 (14.8)
QRISK score median (range) [n=4528]	9.8 (0.1-50.0)
Low risk	2289 (50.5)
Moderate risk	1267 (28.0)
High risk	974 (21.5)
Data presented as n (%), unless otherwise specified. SD, standard deviation. *N=4664, unless otherwise specified.	

Table 2: QRISK Score Comparison Between Categorical Variables

Parameters	QRISK score			P value
	Low risk (≤10)	Moderate risk (10-20)	High risk (>20)	
Gender	<0.001			
Male [n=2919]	1262 (43.2)	888 (30.4)	769 (26.3)	
Female [n=1611]	1027 (63.7)	379 (23.5)	205 (12.7)	
Smoking status				
Never [n=3859]	1984 (51.4)	1093(28.3)	782 (20.3)	<0.001
Light [n=207]	101 (48.8)	61 (29.5)	45 (21.7)	
Quit [n=464]	204 (44.0)	113 (24.4)	147 (31.7)	
Diabetes [n=1625]	471 (29.0)	581 (35.8)	573 (35.3)	<0.001
Chronic kidney disease [n=110]	16 (14.5)	24 (21.8)	70 (63.6)	<0.001
Atrial fibrillation [n=90]	20 (22.2)	27 (30.0)	43 (47.8)	<0.001

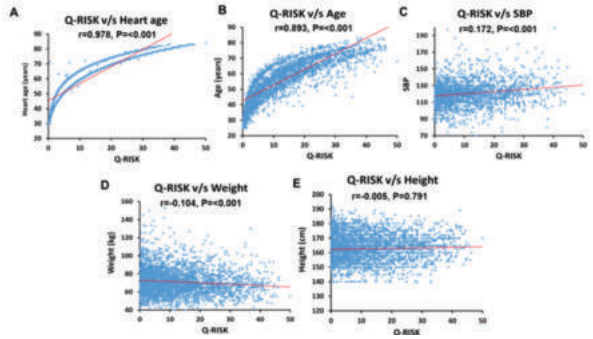

Figure 1: Correlation Between QRISK Score and Related Parameters a) QRISK vs Heart age, b) QRISK vs Age, c) QRISK vs SBP, d) QRISK vs Weight, e) QRISK vs Height

REFERENCES

1. WHO. CVD. Available on https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds). Last accessed on 08th January 2025.
2. Regmi, M., Siccardi, M. A. Coronary Artery Disease Prevention. 2023 Aug 7. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025.
3. Agrawal, V., Humaney, N., Kuthe, S., Agrawal, S., Agrawal, U. (2023). Estimation of cardiovascular disease risk through the QRISK3 algorithm in a tertiary care hospital, India. Journal of Cardiovascular Disease Research, 14(4).
4. AHA. Available on https://www.heart.org/-/media/phd-files-2/science-news/2/2021-heart-and-stroke-stat update/2021_heart_disease_and_stroke_statistics_update_fact_sheet_at_a_glance.pdf Last accessed on 08th January 2025.
5. Tabaei, B. P., Chamany, S., Perlman, S., Thorpe, L., Bartley, K., Wu, W. Y. (2019). Heart age, cardiovascular disease risk, and disparities by sex and race/ethnicity among New York City adults. Public health reports, 134(4), 404-416.
6. Bonner, C., Raffoul, N., Battaglia, T., Mitchell, J. A., Batcup, C., Stavreski, B. (2020). Experiences of a national web-based heart age calculator for cardiovascular disease prevention: user characteristics, heart age results, and behavior change survey. Journal of medical Internet research, 22(8), e19028.
7. Solanki, N. D., Pandya, T. R., Rathod, J., Rathod, V., Panchal, K., Rana, D. A. (2024). Comparison of American College of Cardiology/American Heart Association cardiovascular risk score, Framingham risk scores, European Society of Cardiology Cardiovascular Disease Risk Calculator, QRISK3-2018 risk calculator in patients presenting with first time with myocardial infarction: A step toward the development of Indian cardiac risk score. Apollo Medicine, 21(3), 218-223.
8. QRISK3-2018. Available on https://www.qrisk.org/. Last accessed on 30th July 2025.
9. Mu, X., Wu, A., Hu, H., Zhou, H., Yang, M. (2022). Assessment of QRISK3 as a predictor of cardiovascular disease events in type 2 diabetes mellitus. Frontiers in Endocrinology, 13, 1077632.
10. Ghosal, S., Sinha, B., Ved, J., Biswas, M. (2020). Quantitative measure of asymptomatic cardiovascular disease risk in Type 2 diabetes: evidence from Indian outpatient setting. Indian Heart Journal, 72(2), 119-122.
11. Chandrawanshi, V., Gaikwad, N. R., Keche, Y., Wasnik, P., Dhaneria, S. (2023). Ten-Year cardiovascular risk as predicted by the QRISK® 3 calculator in diabetic patients attending a tertiary care teaching hospital in Central India and its application to stratify statin over-users and under-users. Cureus, 15(10).
12. Garg, N., Muduli, S. K., Kapoor, A., Tewari, S., Kumar, S., Khanna, R., et al. (2017). Comparison of different cardiovascular risk score calculators for cardiovascular risk prediction and guideline recommended statin uses. Indian heart journal, 69(4), 458-463.
13. Hasabullah, M., Kahtani, F., Balkhoyor, T., Al-Harbi, L., Kinsara, A. J. (2020). A comparison of four cardiovascular risk assessment instruments in Saudi patients. Cureus, 12(2).